Warwick District Council
Annual Status Report 2019

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2019 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

September 2019

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Executive Summary: Air Quality in Our Area

Air Quality in Warwick District Council

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Warwick District is situated in the West Midlands, within the county of Warwickshire. To the south lies Stratford-on-Avon, to the east, Rugby, and to the north are Coventry and Solihull. The main towns in the district are Warwick, Leamington Spa and Kenilworth, and there are also a number of villages scattered throughout the rural parts of the district. The main air quality issues identified are for Nitrogen Dioxide (NO_2) emitted from road traffic, particularly at congested town centre locations within Warwick, Leamington Spa and Kenilworth.

There are currently five Air Quality Management Areas (AQMAs) declared in the district, located within Warwick, Leamington Spa and Kenilworth. A detailed breakdown of the AQMAs, along with maps of the areas, can be found here: https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=296. The current Air Quality Action Plan (AQAP), which encompasses all five AQMAs, was updated in 2015. Air pollution in 2018 has improved at all monitoring locations compared to 2017. Warwick District Council is actively working to improve air quality in the district, through the implementation of the Action Plan, as well as implementation of the Local Transport Plan, the publication in January 2019 of the Air Quality Supplementary Planning Document[4], and continuing to work in partnership with Planning and Public Health colleagues.

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013
[4] https://www.warwickdc.gov.uk/downloads/file/5043/air_quality_spd

Actions to Improve Air Quality

Warwick District Council are in the process of implementing a number of key measures in order to address the air quality issues in the AQMAs and on a higher level across the council jurisdiction. One of these measures is the creation and improvement of key corridors that connect boroughs within Warwick District. The development of the A452 'Europa Way', a sustainable 'spine' linking Leamington Spa and Warwick, commenced works in May 2018 and this will continue throughout 2019[5]. 'Europa Way' has a number of features that will improve local air quality including; park and ride facilities, segregated bicycle lanes, new pedestrian routes as well as general traffic optimisation and junction improvement. Detail around these plans can be found on the Warwick District Council website.[6]

Other measures that have been implemented in 2018 include: a number of pedestrian and cycle improvements across the District including Priory Road, Emscote Road and Northgate; promotion of the Active Travel website[7] to encourage active travel and working pattern changes; 2500 park and ride spaces have been commissioned in 2018 as part of the Europa Way development. Studies undertaken in 2018 have confirmed the feasibility of a number of measures outlined in the AQAP; examples include, identifying 8 Euro 4 buses that are eligible for retrofitting in order to improve their sustainability and minimise pollution and submission of an Ultra-low Emission Bus Scheme grant bid to develop an electric bus route through the Leamington Spa AQMA.

The measures being implemented through the planning regime have continued to move forward. Planning applications are routinely being reviewed and assessed by the Environmental Health team and air quality assessments requested where relevant. Mitigation, based on the Air quality and planning supplementary planning document is also routinely requested. In addition, an air quality assessment of the impacts of Local Plan development has been undertaken, which goes some way to assessing the potential cumulative impact of development outlined in the Local Plan.

[5] https://www.warwickshire.gov.uk/major-transport-construction-projects/a452-europa-way-corridor/5?documentId=656&categoryId=20024
[6] WDC 2017 https://www.warwickdc.gov.uk/download/downloads/id/2234/in03_-_draft_infrastructure_delivery_plan_appendix_a_-_transport_corridor_strategies.pdf
[7] https://www.warwickshire.gov.uk/activetravel

Conclusions and Priorities

All 2018 monitoring locations within Warwick District Council reported a lower level of pollutant concentrations than the previous year. There were five monitored exceedances of the NO_2 annual mean objective, this is 13 less than experienced in 2017.

Four diffusion tubes that exceeded in 2018 are located in designated AQMAs, one within Warwick, and three within Leamington Spa. This figure fell to three exceedances when distance correction was applied to estimate concentrations at locations of relevant exposure.

There was one monitoring station that exceeded the NO_2 annual mean objective and was not within an AQMA; located at Castle Hill (W67), an area where Warwick District Council have installed three more monitoring stations in response to previous exceedances (W69, W70 & W71). The new 2018 locations reported no exceedances, however W69 reported a concentration within 10% of the AQO (39.9µg/m^3 before distance correction, and 36.5 µg/m^3 following distance correction to relevant exposure).

Warwick District Council do not propose any changes to the existing AQMAs for this reporting year, however plans to incorporate the Castle Hill area into the AQMA are to be reviewed following consideration of the results from the three additional monitoring locations. Similarly, the monitoring station located on Tachbrook Road, Leamington Spa will continue to be monitored for exceedances to ascertain if the Leamington Spa AQMA boundary will be adjusted. There is no intention currently to revoke either of the Kenilworth AQMAs.

Following a decrease in the trend of NO_2 concentrations in 2018, Warwick District Council will continue to implement measures outlined in the AQAP. Future ASRs will continue to review the effectiveness of these measures.

Local Engagement and How to get Involved

All Warwick District Council residents can help to improve air quality in the borough by choosing sustainable travel alternatives such as walking, cycling or using public transport. Warwickshire and Coventry have an ongoing carsharing programme, available online at https://carsharewarwickshire.liftshare.com/.

All enquiries pertaining to air quality should be directed to the Environmental Protection Division, either by email (ehpollution@warwickdc.gov.uk) or by phone (01926 456725).

An air pollution page is available on the Council website, found here https://www.warwickdc.gov.uk/info/20505/air_pollution, all statutory reports and up to date information is uploaded to, and presented within this page.

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1 Local Air Quality Management

This report provides an overview of air quality in Warwick District Council during 2018. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Warwick District Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Appendix E: Summary of Air Quality Objectives in England.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Warwick District Council can be found in Table 2.1, and a copy of the maps submitted with the AQMA declarations are provided in Appendix D: Maps of Monitoring Locations and AQMAs.

Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are also available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=296. Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides a map of air quality monitoring locations in relation to the AQMAs in which they are located.

Four of the five exceedances from 2018 were located in the existing AQMAs, one in Warwick and three in Leamington Spa. After distance correction, this figure reduced down to three exceedances within the AQMAs. Following distance correction, there were no reported exceedances of the NO_2 annual mean objective outside of the current designated AQMAs.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan		
						At Declaration (µg/m^3)	Now (µg/m^3)	Name	Date of Publication	Link
Warwick Coventry Road	Mar-11	NO_2 Annual Mean	Warwick	The area covers the east side of Coventry Road from the junction with St. Johns / Coten End, incorporating 2-4 Coventry Road and Montgomery Court, properties fronting on to Coventry Road only.	NO	50.8	46.4	Air Quality Action Plan: Warwick District Council	June 1st 2015	http://www.warwickdc.gov.uk/download/downloads/id/517/air_quality_action_plan
Warwick Road (Kenilworth) AQMA	Nov-08	NO_2 Annual Mean	Kenilworth	An area encompassing all properties along Warwick Road, Kenilworth between the junctions with Station Road and Waverley Road.	NO	48.1	37.3	Air Quality Action Plan: Warwick District Council	June 1st 2015	http://www.warwickdc.gov.uk/download/downloads/id/517/air_quality_action_plan
New Street Kenilworth AQMA	Nov-08	NO_2 Annual Mean	Kenilworth	An area encompassing all properties fronting New Street, Kenilworth from the junction with Bridge Street/Fieldgate Lane up to and including No. 17 New Street.	NO	39.8	34.38	Air Quality Action Plan: Warwick District Council	June 1st 2015	http://www.warwickdc.gov.uk/download/downloads/id/517/air_quality_action_plan

Leamington Spa AQMA	Dec-04 Amended 2014	NO_2 Annual Mean	Leamington Spa	An area of South Town, Leamington Spa, centred on High Street, Clemens Street and Bath Street.	NO	52.9	55.4	Air Quality Action Plan: Warwick District Council	June 1st 2015	http://www.warwickdc.gov.uk/download/downloads/id/517/air_quality_action_plan
Warwick AQMA	Dec-04 Amended 2008	NO_2 Annual and 1-Hour Mean	Warwick	An area in the centre of Warwick, encompassing properties along High Street, Jury Street, Bowling Green Street, Theatre Street, Northgate, The Butts, Smith Street, Church St and part of Saltisford, and also including a number of nearby properties. This AQMA is now declared for both annual and hourly mean nitrogen dioxide objectives.	NO	58.3	50.2	Air Quality Action Plan: Warwick District Council	June 1st 2015	http://www.warwickdc.gov.uk/download/downloads/id/517/air_quality_action_plan

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

2.2 Progress and Impact of Measures to address Air Quality in Warwick District Council

Warwick District Council has taken forward a number of direct measures during the current reporting year of 2018 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.

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

- Major route improvements commenced in 2018;
- The Low Emission Strategy Guidance has now been superseded by an Air Quality Supplementary Planning Document which was adopted by WDC in January 2019;
- Funding has been secured for 50 personal air quality monitors in order to assess travel behaviours and promote air quality awareness;
- 20mph Zones within AQMAs;
- Creation of active travel campaign website and on-going promotion campaign (Choose how you move); and
- Installation of new diffusion tubes in Castle Hill area, two further tubes have also been added to the network for the purpose of investigating any temporary air quality concerns, these have been deployed in Dale Street, Leamington since July 2018.

Warwick District Council expects the following measures to be completed over the course of the next reporting year:

- Additional electric vehicles to be incorporated into WDC fleet;
- Northgate, Warwick improvement works to be completed in August 2019; and
- Emscote Road cycleway to be developed into 2019.

Warwick District Council's priorities for the coming year are continuing the on-going improvements of the Europa Way corridor which includes a high standard, dedicated cycle route on a section of the highway.

The principal challenge facing Warwick District Council with the implementation of current and future measures is predominantly sourcing funding for some of the

schemes and measures outlined in Table 2.2. An initial electric bus funding bid was submitted in 2018 but was unsuccessful, other funding options are currently being explored.

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Table 2.2 - Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Area wide improvements to walking and cycling infrastructure	Promoting Travel Alternatives	Promotion of Cycling and Promotion of Walking	WCC	Mainly as part of key transport corridor proposals. Also a review of cycling infrastructure across the district underway (and how that fits in with new developments)	Ongoing	n/a	n/a	1. Europa Way Corridor Improvements to commence in May 2018. 2. Shared use cycle path created on Priory Road, Warwick. 3. Traffic model being developed for a two way cycle link proposal between Leamington Spa and Warwick along Emscote Road. 4. Pedestrian and cycle improvements at Northgate, Warwick to improve pedestrian routes between Warwick railway station and town centre. 5. Bicycle hire/share scheme to be explored that could serve Leamington Spa railway station, Warwick Technology Park, and Heathcote Industrial Estate.	Ongoing implementation of schemes	Europa Way corridor improvements commenced in 2018 and are ongoing Funding has been secured for the Emscote Road cycleway and development work will continue during 2019/20. Northgate, Warwick improvement works are underway and due to complete by the end of August 2019. WDC are now taking forward discussions regarding setting up a bike share scheme in Warwick District and a steering group has been established.
2	Smarter Choices and Travel Planning programme	Promoting Travel Alternatives	School Travel Plans and Workplace Travel Planning	WCC	Mainly as part of key transport corridor proposals	Ongoing	n/a	n/a	1. Engaging with large employers at Warwick Technology Park in relation to active travel and changes to working patterns/hours being discussed. 2. Active travel website is	Ongoing implementation of schemes	A lift share scheme introduced by local employer Wolseley has proved to be successful, with significant uptake by employees. WCC have since taken this example of a successful scheme to

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
									operational and being maintained.		the Coventry and Warwickshire LEP and are in the process of promoting the concept to other local companies.
3	Targeted bus stop infrastructure upgrades on key public transport corridors	Transport Planning and Infrastructure	Bus Route Improvements	WCC	Bus priority measure implemented as part of key transport corridor proposals	Ongoing	n/a	n/a	Feasibility work undertaken on some corridors	Ongoing implementation of schemes	WCC are working with local bus operator, Stagecoach, to map the X17 bus route and look at what could be done to speed up the movement of buses in certain areas. Traffic signalling changes could improve traffic flows and reduce periods when buses are stationary. If successful other routes will also be examined.
4	Improving infrastructure to improve walking and cycling signage	Promoting Travel Alternatives	Promotion of Cycling and Promotion of Walking	WCC	Walking and cycling implemented part of key transport corridor proposals	Ongoing	n/a	n/a	1. New signage nodes installed in Leamington Spa town centre and railway station in May 2018 showing walking routes/times. Signages nodes at Warwick and Warwick Parkway railway stations proposed for June 2018. 2. Bike hire/share scheme being explored to serve Leamington Railway station and large employment sites such as Warwick Technology Park and Heathcote Industrial Estate.	Ongoing implementation of schemes	1. Signage nodes at Warwick and Warwick Parkway railway stations are now in place. 2. A bike share scheme is currently being explored by WDC.

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
5	Hearts and Minds campaign to encourage modal shift away from private car use	Public Information	Other	WCC	Ongoing	Ongoing	n/a	n/a	1. Mini campaigns undertaken such as 'Choose how you move'. 2. Warwickshire Public Health bid for personal air quality monitors to support health campaign in 2017 was unsuccessful. Alternative funding for 50 personal monitors is being sought to run event/campaign on personal exposure to air pollution.	Ongoing campaigns	1. The Choose How You Move (CHYM) Active Travel campaign is continuing. The campaign has also been expanded in Leamington Spa where WDC, in partnership with WCC, have set up a rewards programme using the 'BetterPoints' app. The scheme encourages walking, cycling and use of public transport in Leamington by allowing users to log their green travel in return for BetterPoints that are then redeemable on the high street. Further details can be found at https://www.warwickdc.gov.uk/news/article/296/choose_how_you_move_in_leamington_spa 2. Warwickshire Public Health have secured funding for 50 personal air quality monitors and an initial project is underway looking at air quality awareness and impact on travel behaviours. It's expected that the monitors will later be used for further projects across Warwickshire.

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
6	Further consideration of Park and Ride	Alternatives to private vehicle use	Bus based Park and Ride	WCC	Currently in planning phase	Ongoing	n/a	n/a	1. Park and Ride facilities outlined in key transport corridor proposals. 2. 500 space park and ride scheme at Europa Way has been committed and is required to be developed prior to occupation of residential development along this corridor. 3. A park and ride at Blackdown (North of Leamington Spa) is included in local plan and on Community Infrastructure Levy (CIL) list. 4. Warwickshire County Council commissioning works to explore park and ride facilities to the North and South of Leamington Spa.	Unknown at this time	WCC have completed an initial piece of work to look at locating a park and ride site to the north of Warwick, they are also continuing to investigate additional sites and are working with WDC to see how these may fit into the wider parking strategy for the District.
8	Publicising CarShare Coventry and Warwickshire	Alternatives to private vehicle use	Car and lift sharing schemes	WCC	Ongoing	Ongoing	n/a	n/a	1. Active Travel website publicising car sharing opportunities. 2. Signage in Leamington Spa and Warwick being explored to further promote scheme.	Ongoing	Following the success of the Wolseley car share scheme WCC have presented to the Cov and Warks LEP with a view to expanding the scheme to other local employers.
9	Supporting future opportunities for funding for Low Emission Vehicles, in	Promoting Low Emission Transport	n/a	WDC / WCC	2016	Ongoing (depending on opportunities)	n/a	n/a	WCC currently developing an Electric Vehicle Charging Strategy	Ongoing implementation	A bid has been submitted to Olev for 44 charge points across Warwickshire, including sites in Warwick District. WCC

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	particular for vehicle charging infrastructure										are going out to tender at the end of summer 2019 for a supplier to provide the charging infrastructure. WCC are also moving over to electric vehicles for their pool fleet of four vehicles, this will be implemented by September 2019.
10	Use of the planning system to ensure a more widespread infrastructure for low emission vehicles	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	WDC	2013	2014 (for adoption of guidance)	n/a	n/a	Implementation of Low Emission Strategy Guidance to install EV infrastructure. Low emission strategy guidance currently being reviewed/updated and consideration to make this into a Supplementary Planning Guidance document. EV infrastructure is routinely being sought and implemented as part of the planning process.	Ongoing implementation	The Low Emission Strategy Guidance has now been superseded by an Air Quality Supplementary Planning Document which was adopted by WDC in January 2019. The new SPD was written jointly on behalf of WDC and neighbouring councils at Stratford DC, Coventry City, Rugby BC and Nuneaton and Bedworth BC. EV infrastructure continues to be sought and implemented as part of the planning process.
11	Moving the Warwick DC fleet to electric vehicles where practicable	Promoting Low Emission Transport	Public Vehicle procurement	WDC	2015	2016	n/a	n/a	Five vehicles ordered as pool vehicles	Vehicles in place as of 2016. Ongoing commitment where feasible	A further electric vehicle has been added to the WDC fleet bringing the total number of vehicles to 6. Options for adding a further two vehicles are also being considered.

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
12	Strive to set up an Ecostars scheme in Warwick District Council whereby fleet operators can join for free and strive to reduce their environmental impacts.	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	WDC	2016	2017 onwards	n/a	n/a	Not taken forward yet – no grant funding available	Subject to grant funding	No Update
13	Working with Warwickshire County Council and bus operators to encourage lower emission buses (either retrofitting existing buses, or use of alternative fuels).	Vehicle fleet efficiency	Promoting Low Emission Public Transport	WCC	2016	2017 onwards	n/a	n/a	1. Meetings held with bus providers in the Warwick district. Obtained details on composition of vehicle fleet and have identified eight Euro 4 buses that are eligible for retrofitting. 2. Initial discussions with local bus providers and bus manufacturers on possibility of trialling an electric bus route through the Leamington Spa AQMA. Expression of interest has been submitted for funding. Full bid to be submitted in 2018.	Subject to grant funding	An initial electric bus funding bid was submitted in 2018 but was unsuccessful, other funding options are currently being explored.
14	Ensuring that the electric taxi within Warwick District Council is utilised to promote Low Emission Vehicles to commercial	Promoting Low Emission Transport	Taxi emission incentive	WDC	n/a	n/a	n/a	n/a	Not feasible as taxi is privately owned	n/a	No update

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	operators and the public.										
15	Promotion of electric vehicles through the Warwickshire Drive Electric Website. http://www.warwickshire.gov.uk/driveelectric	Promoting Low Emission Transport	Other	WCC	2016	Ongoing	n/a	n/a	Website is updated and maintained.	Ongoing implementation	Ongoing. WDC website includes links to maps showing the locations of EV charging points in the District https://www.warwickdc.gov.uk/info/20535/car_parks/320/electric_charging_points
16	Use the taxi and private hire licensing system to try and reduce emissions from taxis and private hire vehicles.	Promoting Low Emission Transport	Taxi emission incentive	WDC	n/a	n/a	n/a	n/a	Preliminary review of WDC licensed taxi fleet completed in November 2017. Explored possibility of a county-wide taxi euro emission licensing policy through the Coventry and Warwickshire Air Quality Alliance, however, limited interest from neighbouring local authorities.	To be confirmed	An electric taxi project is currently being investigated which could help encourage local taxi drivers to move over to electric vehicles.
17	Investigation with procurement colleagues to produce a sustainable procurement guide to ensure transport emissions are as low as possible	Policy Guidance and Development Control	Sustainable Procurement Guidance	WDC (Procurement)	2016	2016-17	n/a	n/a	No progress made to date	2018	On going
18	Ensuring that the Warwick Low Emission	Policy Guidance and	Air Quality Planning	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	1. Good progress in implementing mitigation through	Ongoing	WDC's Low Emission Strategy Guidance has been superseded by

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	Strategy Guidance for Developers is kept up to date, and implemented	Development Control	and Policy Guidance						development control. 2. Existing Low Emission Strategy currently being revised and exploring possibility of making the strategy a Supplementary Planning Document.		an Air Quality SPD which is now being implemented. The SPD makes similar requirements of developers to those made under the previous guidance but with some changes. Additional trigger criteria have been added for major developments which must now be considered when determining the classification of a proposed development, and therefore the level of assessment and mitigation required. Also, a requirement for construction emission control measures, including non-road mobile machinery (NRMM) controls, is now included where type 2 mitigation is necessary.
19	Working with planning policy colleagues to ensure that the Local Plan fully addresses air quality issues with appropriate policies included	Policy Guidance and Development Control	Other policy	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	Planning policy relevant to air quality included in new Local Plan	n/a	On going
20	Working with planning colleagues and	Policy Guidance and	Other policy	WCC Public Health	n/a	Ongoing	n/a	n/a	5 minute walkable neighbourhoods have been investigate	Ongoing encouragement of active travel	On going

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	developers to ensure that new developments are based around the 'five-minute walkable neighbourhood', thereby encouraging active travel as the preferred methods of transport to access local facilities	Development Control							within work undertaken by WYG on how developments should look		
21	Ensure that green infrastructure is integrated into all residential and commercial developments, in line with the National Planning Policy Framework (NPPF)	Policy Guidance and Development Control	Other policy	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	NPPF followed for new development. Green infrastructure included where relevant	Ongoing	On going
22	Ensuring that planning applications with potential air quality impacts are fully assessed for their impacts, at relevant locations using appropriate methodologies	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	Air quality assessments asked for on a regular basis and mitigation sought where necessary	Ongoing	WDC website includes links to maps showing the locations of EV charging points in the District https://www.warwickdc.gov.uk/info/20535/car_parks/320/electric_charging_points.
23	Ensuring that where possible, cumulative impacts are	Policy Guidance and Develop	Air Quality Planning and	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	Ongoing work required where large areas of development are allocated in Local	Ongoing	On going

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	taken into account. Any committed developments should be included within a given air quality assessment	ment Control	Policy Guidance						Plan. Potential cumulative impacts raised at pre-application and outline planning application stages as necessary.		
24	Ensuring that appropriate mitigation is implemented where any relevant impacts are identified	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	WDC E,S, H and CP and Planning	n/a	Ongoing	n/a	n/a	Mitigation asked for on a regular basis as part of the Low Emission Strategy	Ongoing	Ongoing Mitigation is routinely asked for under the newly introduced Air Quality SPD which has replaced the Low Emission Strategy Guidance.
25	Junction improvements on key travel corridors in Warwick and Leamington Spa AQMAs are proposed which include junction/ highway modifications, improvements for walking and cycling and bus priority measures	Traffic Management	Strategic Highway Improvements	WCC (Transport)	2014-2016	Possible first corridor in place by 2020	n/a	n/a	Good progress on planning and starting to implement corridor proposals	Ongoing for different corridors, Europa Way to commence in May 2018.	Work on the Europa Way corridor has begun and is ongoing. A scheme to address air quality issues in the Bath Street area is being developed. Options include priority measures for buses, traffic management proposals to reduce queuing traffic in and around the Bath Street area, and improved connectivity for pedestrians and cyclists.
26	An investigation of 20 mph zones as part of the wider transport strategy, where this will smooth traffic flow	Traffic Management	Reduction of Speed Limits, 20 mph zones	WCC (Transport)	2015	n/a	n/a	n/a	Good progress	2022	No update

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
27	Targeted re-allocation of road space to prioritise and facilitate movement of pedestrians, cyclists, public transport and car share users	Traffic Management	Strategic Highway Improvements	WCC (Transport)	2014-2016	Ongoing	n/a	n/a	Good progress on planning and starting to implement corridor proposals	Ongoing for different corridors, Europa Way to commence in May 2018 but dependent on development funding. Shared use cycle link completed on Priory Road, Warwick which is to be expanded to Northgate, Eastgate, Westgate, St. Johns, and Emscote Road	Work on the Europa Way corridor has begun and is ongoing. Northgate works will be completed by end of summer 2019 and bids are being made to fund further stages of the planned Warwick town centre works which will act to make movement easier for pedestrians and cyclists. All of the remaining works planned for Warwick, including junction improvements at Eastgate and Westgate and the introduction of one-way routing in some areas, are expected to go ahead.
28	Manage deliveries across Warwick District Council to ensure that no additional congestion is caused by stationary delivery vehicles in busy locations	Traffic Management	Congestion Management	WCC (Transport)	2016	Not being taken forward at present	n/a	n/a	Will review at future Steering Group meetings	n/a	No update, on going
29	Re-investigate funding for a website to engage with the public on air quality, the health impacts of poor air quality, sustainable	Public Information	Via the internet	WCC Public Health	2016/17	Ongoing	n/a	n/a	Air quality information incorporated into Active Travel website. Further information about air quality and local AQMAs to be included. https://www.warwicks	Ongoing implementation	No update, on going

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	transport and strategies to improve air quality								hire.gov.uk/activetravel		
30	Working with planners and developers to embed Public Health's Evidence for Planning guidance, thereby encouraging any new developments to support access to active travel	Policy Guidance and Development Control	Other policy	WCC Public Health	n/a	Ongoing	n/a	n/a	The guidance document is used when responding to planning applications, pre-planning applications and local plan consultations on an ad-hoc basis.	Ongoing	No update, on going
31	Investigate implementing a campaign aimed at vulnerable members of the public (i.e. those with existing respiratory or cardio vascular conditions) in order that they could change behaviour to reduce exposure when pollution levels are high	Public Information	Via the internet	WCC Public Health	2015/16	Unlikely to implement a campaign aimed at vulnerable member of population	n/a	n/a	Instead will embed active travel in everything we do, aimed at whole population	Ongoing	Funding for personal air monitors now secured and an initial project is ongoing.
32	Continuation of monitoring within Warwick District Council, focussed on AQMAs, but also in other strategic locations	n/a	n/a	WDC E,S, H and CP.	n/a	Ongoing	n/a	n/a	Monitoring reported in this report	Ongoing	Three additional diffusion tubes have been installed in and around Castle Hill, Warwick to determine whether the current boundary of the Warwick AQMA should be adjusted.

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
											Two further tubes have also been added to the network for the purpose of investigating any temporary air quality concerns, these have been deployed in Dale Street, Leamington since July 2018.
33	Regular assessment of air quality against air quality objectives as specified by the LAQM process with reports to DDefra and the public	n/a	n/a	WDC E,S, H and CP.	n/a	Ongoing	n/a	n/a	Undertaken in this report	Ongoing	No Update
34	Review of measures set out in this Air Quality Action Plan on a regular basis to ensure they are up to date and being implemented	n/a	n/a	WDC E,S, H and CP	n/a	Ongoing	n/a	n/a	Undertaken in this report	Ongoing	No Update

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

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Whilst the current AQAP is focused on NO_2 reductions, the majority of the measures outlined in the AQAP will lead to improvements in $PM_{2.5}$ emissions. A large portion of $PM_{2.5}$ arises from transport, notable brake and tyre wear and so any measures that decrease overall vehicle trips will lead to decreased annual mean concentrations of $PM_{2.5}$. The council continue to monitor and review combustion emissions from industrial processes, and domestic appliances, and enforce statutory controls through the use of permitting etc.

The Department of Health's Public Health Outcomes Framework[8] have a number of public health indicators that are used to focus public health action, identify areas of health inequality and concern and monitor the differences in health impacts across regions in the UK. This framework includes an indicator "3.01- Fraction of Mortality Attributable to Particulate Air Pollution" which is calculated using background annual average $PM_{2.5}$ concentrations, modelled at a $1km^2$ resolution based on measured concentrations from the AURN. Warwickshire had a 5% fraction of mortality calculated, 0.1% higher than the West Midlands region and 0.1% lower than England as a whole.

Measures to improve air quality often have shared wins with other public health indicators, a good example being the encouragement of active travel and commuting leading to increased physical activity and increased wellbeing.

Monitoring of $PM_{2.5}$ is completed at two Automatic Urban and Rural Network (AURN) sites within the councils remit. AURN1 concentrations have mostly shown a steady decrease across a five year period, with a $0.9µg/m^3$ decrease in annual mean concentration in 2018 compared to 2017. The roadside AURN2 site has seen $PM_{2.5}$

[8] https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/3/gid/1000043/pat/6/par/E12000005/ati/101/are/E07000222/iid/30101/age/230/sex/4

concentrations incrementally increasing from 2016, with an increase in annual mean of 1µg/m^3 experienced between 2017 and 2018.

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

3.1 Summary of Monitoring Undertaken

Currently there is both automatic and non-automatic (passive) monitoring completed within Warwick District Council; the Council operate one automatic monitoring site and a network of 58 NO_2 diffusion tube monitoring sites. In addition there are two AURN automatic monitoring stations and one Non-Automatic Hydrocarbon Network monitoring site within Warwick District Council.

3.1.1 Automatic Monitoring Sites

Automatic monitoring was undertaken at three sites during 2018, two of which are part of the AURN and one is a Council operated monitoring site. Table A.2 presents details of the three automatic monitoring sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and the Quality Assurance/Quality Control (QA/QC) procedures that are in place are included in Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

National monitoring results are available through the Defra UK-AIR website at https://uk-air.defra.gov.uk/networks/.

3.1.2 Non-Automatic Monitoring Sites

Warwick District Council undertook non-automatic (passive) monitoring of NO_2 at 58 sites during 2018, two of which continue to be triplicate sites that are co-located with two of the automatic monitoring sites. The number of NO_2 non-automatic sites has increased by five sites when compared to the monitoring network within 2017, the new sites are W69, W70, W71, W72, and W73.

In addition to the council run NO_2 diffusion tube network, the Hamilton Terrace, Leamington Spa automatic monitoring site houses a Non-Automatic Hydrocarbon Network monitoring site. Benzene is monitored at this site in accordance with the relevant CEN benzene standard (EN 14662) on a 2-week changeover period.

Table A.2 presents the details of all the non-automatic monitoring 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.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in Appendix B: Full Monthly Diffusion Tube Results for 2018

All NO_2 monitoring sites within Warwick District Council’s jurisdiction have experienced a decrease with regard to their annual mean concentrations when comparing 2017 and 2018 concentrations. Within 2018, of the 58 non-automatic NO_2 monitoring sites, 14 sites monitored annual means greater than 36µg/m^3, and five of these monitored an annual mean in exceedance of the 40µg/m^3 annual mean objective.

Four of the five exceeding non-automatic monitoring sites were located within existing AQMAs-

- 1 in the Warwick AQMA
- 4 in Leamington Spa AQMA

The one site outside of an existing AQMA that exceeded the annual mean objective was W67 that is located on Castle Hill, a small section of road between the existing Warwick AQMA. Castle Hill has previously been flagged as a potential problem area due to W67 experiencing an exceedance of the annual mean objective for the previous five years. W67 monitored an exceedance last monitoring year, hence the deployment of further tubes in this area. After distance correction has been applied to the W67 concentration, the annual mean is predicted to be 39.8µg/m^3. W69 is a newly introduced site installed to monitor values around Castle Hill which also monitored an exceedance in the brief monitoring period last year; a value within 10% of the AQS

objective shows that this is still a problem area. Given the ongoing elevated results of diffusion tubes around the Castle Hill area WDC are currently reviewing the decision to undertake an amendment to the existing AQMA to fully capture this hot spot of pollution, detailed modelling may be required to finalise where this amendment will need to stretch to.

W14's concentration has fallen below the exceedance of 2017's reported value of 45.4µg/m^3 but is still within 10% of the AQS objective reporting a value of 36.6µg/m^3.

Table A.4 compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. For the previous five years there has not been an hourly mean concentration in excess of 200µg/m^3 reported at either of the three automatic monitoring sites.

3.2.2 Particulate Matter (PM_{10})

Table A.5 – PM10 Monitoring Results in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

There have been no monitored exceedances of the long term objective at either of the AURN sites within Warwick District Councils' jurisdiction. The urban background site concentration change is negligible and is well below the annual mean air quality objective. At AURN2, which is a roadside site, the annual mean concentration has decreased since last year, however due to an issue with the monitor the data capture was only 64.2%. The annualised annual mean concentration is 13.9µg/m^3.

Both AURN1 and AURN2 monitored a single hour exceeding the 50 µg/m^3 limit, well below the permitted 35 annual exceedances.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

$PM_{2.5}$ concentrations continue to fall at the urban background site (AURN1), dropping below 10µg/m^3 in 2018. However, the roadside site (AURN2) continues an upward trend in annual mean concentration increasing from 11µg/m^3 to 11.7µg/m^3 from 2017-2018; this is still well below the exceedance limit of 25µg/m^3.

3.2.4 Benzene (C_6H_6)

Whilst there is no obligation for Warwick to report on Benzene levels within the Council, in the interest of transparency, the monitored Benzene results from AURN1 have been presented in Appendix A: Monitoring Results

In addition to being part of the AURN, the AURN1 monitoring site is part of the Non-Automatic Hydrocarbon Network that monitors ambient benzene concentrations across the UK.

Benzene concentrations for 2018 at AURN1 have marginally decreased from 2017 and remain well below the annual average AQS objective of 5µg/m^3.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
AURN1	Hamilton Terrace, Leamington Spa	Urban Background	431943	265730	NO_2, O_3, PM_{10}, $PM_{2.5}$	NO	Chemiluminescence, Ultra-violet fluorescence (UVF), FDMS	9	50	4
AURN2	Rugby Road, Leamington Spa	Roadside	431271	266404	NO_2, PM_{10}, $PM_{2.5}$	NO	Chemiluminescence, FDMS	23	8	3.5
CM1	Pageant House, Warwick	Roadside	428263	264877	NO_2	YES	Chemiluminescence	13	2.8	2.4

Notes:

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

(2) N/A if not applicable.

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

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube collocated with a Continuous Analyser?	Height (m)
W1	Bath Street	Kerbside	431978	265280	NO_2	YES	Y	0.7	NO	2.7
W2	High Street	Roadside	432075	265234	NO_2	YES	Y	2.2	NO	2.7
W5	Hampton Street (3)	Roadside	427615	264563	NO_2	NO	Y	2	NO	1.5
W6-8 Leam Spa	Hamilton Terrace	Urban Background	431943	285730	NO_2	NO	N	n/a	YES	3.1
W10	Farley Street	Roadside	432560	265254	NO_2	NO	N	0.1	NO	2.9
W11	Clemens Street	Roadside	432051	265060	NO_2	YES	N	3.2	NO	2.9
W12	Spencer Street	Roadside	431866	265371	NO_2	YES	N(0.2)	5	NO	2.8
W13	Wise Street	Roadside	431900	265189	NO_2	YES	Y	1	NO	2.7
W14	Tachbrook Road	Roadside	431862	265169	NO_2	NO	N(0.6)	5.22	NO	2.8
W15	Old Warwick Road	Roadside	431849	265193	NO_2	YES	Y	2	NO	2.6
W16	Parade	Roadside	431951	265397	NO_2	NO	N(6.3)	7.5	NO	2.8
W17	Coventry Road (Woodville Road)	Kerbside	428704	265236	NO_2	NO	N	1	NO	1.5
W18	Coventry Road (Coachouse Mews)	Roadside	428735	265362	NO_2	NO	N	1.5	NO	1.5
W19	West Street Torry's	Roadside	427937	264586	NO_2	NO	N	3.2	NO	1.5
W23	Moorlands Road Jcn	Roadside	429078	271207	NO_2	NO	N	4.2	NO	1.5
W24	Waverley Road	Roadside	428974	271402	NO_2	YES	N	2.8	NO	4.5
W25	New Street No 1	Roadside	428707	272556	NO_2	YES	Y	0.4	NO	1.5
W26	New Street No 2	Roadside	428733	272578	NO_2	YES	Y	1.7	NO	1.5
W27	New Street No 3	Kerbside	428750	272612	NO_2	NO	N	1.1	NO	4.5

W28	Fieldgate Lane Jcn	Roadside	428652	272524	NO_2	YES	Y	0.7	NO	4.5
W30	The Square	Roadside	428714	271769	NO_2	NO	Y	3.4	NO	4.5
W31	Barrow Road	Kerbside	428816	271618	NO_2	YES	N(1.3)	1.4	NO	4.5
W32	Warwick Road	Roadside	428906	271497	NO_2	YES	Y	1.3	NO	1.5
W33-35 Pageant House	Pageant House	Roadside	428263	264877	NO_2	YES	Y	2.8	YES	1.5
W36	Jury Street	Roadside	428391	264966	NO_2	YES	N (1m)	2.1	NO	1.5
W37	High Street	Roadside	428132	264799	NO_2	YES	Y	2.9	NO	1.5
W38	West Street	Kerbside	427959	264624	NO_2	NO	N(3.6)	0.6	NO	1.5
W39	Crompton Street/ West Street	Roadside	427910	264541	NO_2	NO	Y	4.1	NO	1.5
W40	Bowling Green Street	Kerbside	427992	264695	NO_2	YES	Y	0.9	NO	1.5
W41	Friars Street	Roadside	427905	264682	NO_2	NO	N	1	NO	1.5
W42	Theatre Street	Roadside	427938	264947	NO_2	YES	Y	2.3	NO	4.5
W43	Saltisford/northgate	Roadside	428026	265158	NO_2	YES	Y	1.5	NO	2.5
W44	West Rock	Roadside	427930	265200	NO_2	YES	N	2.3	NO	2.6
W45	Albert Street/satilsford Junction	Roadside	427867	265275	NO_2	YES	Y	2.7	NO	2.5
W46	The Butts	Roadside	428240	265088	NO_2	YES	N(1.4)	1.6	NO	2.5
W48	Smith Street	Roadside	428522	265039	NO_2	YES	Y	2	NO	3
W49	Gerrard Street	Roadside	428501	264967	NO_2	NO	Y	1.8	NO	2.6
W50	St Nicholas' Church St 1.	Roadside	428600	264983	NO_2	YES	Y	1.7	NO	2.6
W51	St Mary's Churchyard	Urban Background	428270	264982	NO_2	NO	N	n/a	NO	2.7
W52	Coventry Road/crown Hotel	Kerbside	428710	265165	NO_2	YES	N (2m)	1	NO	2.5
W53	Coventry Road No 1 (Montgomery Court)	Roadside	428715	265202	NO_2	YES	Y	1.8	NO	2.4
W54	Coventry Road No 2 (28 Coventry Road)	Roadside	428715	265285	NO_2	NO	Y	1.9	NO	2.4

W55	Coventry Road No 3 (Great Western Arms)	Roadside	428710	265341	NO_2	NO	N	1.2	NO	2.5
W56	St Johns	Roadside	428619	265113	NO_2	NO	N	1.1	NO	2.5
W57	Coten End	Roadside	428748	265166	NO_2	NO	Y	3	NO	2.5
W58	Emscote Road	Roadside	429514	265469	NO_2	NO	N	3.8	NO	2.5
W59	Charles Street	Roadside	429501	265494	NO_2	NO	N(1.5)	2	NO	2.6
W60	Bridge Street	Roadside	430015	265718	NO_2	NO	N	2.4	NO	2.6
W61	Greville Road	Roadside	429974	265733	NO_2	NO	N	5.4	NO	2.5
W62	St Nicholas' Church St. 2	Roadside	428608	265042	NO_2	YES	Y	2.1	NO	3
W65	Hampton Street (2)	Roadside	427680	264607	NO_2	NO	Y	4.3	NO	2.5
W67	Castle Hill	Roadside	428477	264939	NO_2	NO	N (1.2m)	3.2	NO	2.5
W68	Birmingham Road	Roadside	432931	272790	NO_2	NO	Y	3.2	NO	2.4
W69	Castle Hill (2)	Roadside	428513	264921	NO_2	NO	N (1.5)	2.1	NO	2.5
W70	Mill Street	Roadside	428554	264870	NO_2	NO	N	3.1	NO	2.4
W71	Banbury Road	Roadside	428599	264857	NO_2	NO	N	2.1	NO	2.5
W72	Dale Street East	Roadside	431464	265903	NO_2	NO	N (2.9)	3.1	NO	2.5
W73	Dale Street West	Roadside	431480	265878	NO_2	NO	N (2.6)	0.3	NO	2.5
AURN1	Hamilton Terrace, Leamington Spa	Urban Background	431943	265730	C_6H_6	NO	9	50	NO	4

Notes:

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

(2) N/A if not applicable.

(3) AURN1 is part of the Non-Automatic Hydrocarbon Network that monitors benzene across the UK.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO_2 Annual Mean Concentration (µg/m³) [3]				
					2014	2015	2016	2017	2018
AURN1	Urban Background	Automatic	98.5	98.5	19.6	19.3	21.4	23.5	17.5
AURN2	Roadside	Automatic	93.1	93.1	21.1	20.2	20.4	17.3	17.0
CM1	Kerbside	Automatic	97.9	97.9	**40.1**	37.2	31.7	35.9	32.4
W1	Kerbside	Diffusion Tube	100.0	100.0	**40.0**	**43.4**	**47.3**	**61.2**	**42.3**
W2	Roadside	Diffusion Tube	91.7	91.7	32.6	38.2	**40.4**	**48.8**	36.0
W5	Roadside	Diffusion Tube	100.0	100.0	33.8	34.5	**40.4**	35.3	27.7
W6-8	Urban Background	Diffusion Tube	100.0	100.0	19.2	19.7	21.8	22.9	17.6
W10	Roadside	Diffusion Tube	100.0	100.0	24.0	24.3	26.5	28.9	22.8
W11	Roadside	Diffusion Tube	75.0	75.0	23.7	23.2	25.6	23.8	21.9
W12	Roadside	Diffusion Tube	100.0	100.0	33.7	33.3	36.6	**41.3**	31.4
W13	Roadside	Diffusion Tube	100.0	100.0	**47.0**	**48.6**	**50.4**	**55.4**	**46.4**
W14	Roadside	Diffusion Tube	100.0	100.0	34.5	38.1	39.6	**45.4**	36.6
W15	Roadside	Diffusion Tube	100.0	100.0	**41.0**	**43.9**	**45.0**	**52.0**	**40.9**
W16	Roadside	Diffusion Tube	91.7	91.7	28.5	30.7	32.6	37.6	27.8
W17	Kerbside	Diffusion Tube	83.3	83.3	29.1	27.7	29.4	31.2	26.1

W18	Roadside	Diffusion Tube	100.0	100.0	24.7	24.7	27.2	28.5	23.9
W19	Roadside	Diffusion Tube	100.0	100.0	31.0	28.4	33.3	35.0	27.3
W23	Roadside	Diffusion Tube	91.7	91.7	31.1	30.6	33.6	35.8	27.2
W24	Roadside	Diffusion Tube	100.0	100.0	29.7	28.2	30.4	30.7	25.3
W25	Roadside	Diffusion Tube	41.7	41.7	34.5	31.3	34.6	30.7	22.8
W26	Roadside	Diffusion Tube	91.7	91.7	25.7	24.4	29.0	30.3	23.6
W27	Kerbside	Diffusion Tube	91.7	91.7	22.5	21.6	26.1	26.5	21.0
W28	Roadside	Diffusion Tube	100.0	100.0	37.8	33.2	**40.0**	**44.0**	31.8
W30	Roadside	Diffusion Tube	91.7	91.7	26.1	24.0	27.3	29.0	22.6
W31	Kerbside	Diffusion Tube	100.0	100.0	37.6	35.2	37.1	**41.4**	32.0
W32	Roadside	Diffusion Tube	100.0	100.0	35.8	34.0	37.5	37.2	32.4
W33-35	Roadside	Diffusion Tube	91.7	91.7	**41.3**	**41.2**	**44.2**	**52.5**	37.4
W36	Roadside	Diffusion Tube	91.7	91.7	**43.6**	**42.2**	**46.3**	**49.5**	**40.3**
W37	Roadside	Diffusion Tube	100.0	100.0	34.6	37.5	**41.0**	**42.7**	33.6
W38	Kerbside	Diffusion Tube	91.7	91.7	34.5	34.0	37.4	39.6	31.8
W39	Roadside	Diffusion Tube	100.0	100.0	27.3	27.6	30.7	31.5	24.6
W40	Kerbside	Diffusion Tube	100.0	100.0	**40.0**	**40.7**	**42.9**	**47.6**	36.9
W41	Roadside	Diffusion Tube	100.0	100.0	25.4	22.6	26.7	27.6	23.2

W42	Roadside	Diffusion Tube	100.0	100.0	29.4	26.4	33.4	32.1	28.3
W43	Roadside	Diffusion Tube	100.0	100.0	**45.4**	**43.4**	**46.6**	**50.2**	38.5
W44	Roadside	Diffusion Tube	100.0	100.0	31.9	28.6	32.5	34.8	28.0
W45	Roadside	Diffusion Tube	100.0	100.0	27.8	27.2	29.6	31.2	25.9
W46	Roadside	Diffusion Tube	91.7	91.7	34.3	34.2	39.2	**40.0**	30.6
W48	Roadside	Diffusion Tube	83.3	83.3	33.8	32.7	36.0	39.7	32.9
W49	Roadside	Diffusion Tube	100.0	100.0	23.3	22.1	25.3	26.1	21.3
W50	Roadside	Diffusion Tube	100.0	100.0	28.7	27.9	30.5	32.5	25.4
W51	Urban Background	Diffusion Tube	100.0	100.0	18.2	17.4	20.2	21.4	16.2
W52	Kerbside	Diffusion Tube	100.0	100.0	39.4	38.1	**41.4**	**44.3**	37.4
W53	Roadside	Diffusion Tube	100.0	100.0	**41.0**	38.5	**44.0**	**46.4**	37.4
W54	Roadside	Diffusion Tube	100.0	100.0	32.9	31.0	34.8	37.3	29.4
W55	Roadside	Diffusion Tube	75.0	75.0	28.5	27.3	31.0	32.4	27.5
W56	Roadside	Diffusion Tube	91.7	91.7	22.7	21.3	23.7	26.3	19.1
W57	Roadside	Diffusion Tube	100.0	100.0	31.3	30.0	31.8	33.5	28.5
W58	Roadside	Diffusion Tube	83.3	83.3	31.3	29.9	31.0	34.4	26.9
W59	Roadside	Diffusion Tube	100.0	100.0	36.7	34.0	38.1	**41.6**	32.0
W60	Roadside	Diffusion Tube	100.0	100.0	28.9	27.8	31.6	32.3	26.5

W61	Roadside	Diffusion Tube	100.0	100.0	26.4	26.2	29.5	31.2	24.8
W62	Roadside	Diffusion Tube	100.0	100.0	**44.0**	**42.5**	**41.5**	**47.9**	39.3
W65	Roadside	Diffusion Tube	100.0	50.0	23.2	23.0	26.4	27.5	21.7
W67	Roadside	Diffusion Tube	100.0	100.0	**41.0**	**41.8**	**48.0**	**50.0**	**42.2**
W68	Roadside	Diffusion Tube	100.0	50.0	23.3	23.6	24.7	25.1	19.8
W69	Roadside	Diffusion Tube	100.0	58.3	-	-	-	-	39.9
W70	Roadside	Diffusion Tube	100.0	58.3	-	-	-	-	29.4
W71	Roadside	Diffusion Tube	100.0	58.3	-	-	-	-	33.4
W72	Roadside	Diffusion Tube	100.0	50.0	-	-	-	-	31.2
W73	Roadside	Diffusion Tube	100.0	50.0	-	-	-	-	27.5

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

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.**

(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%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Annual Mean NO_2 Concentrations: Leamington Spa

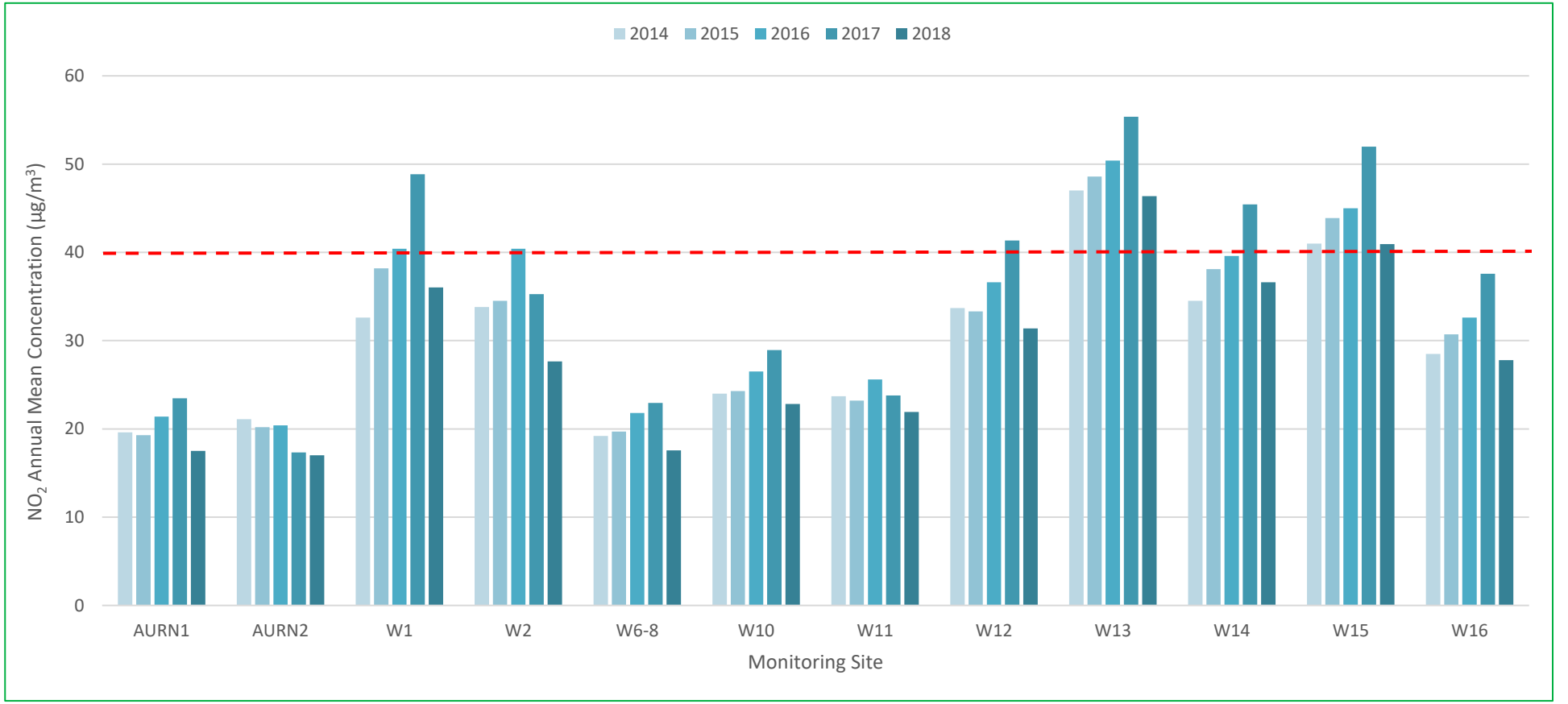


Figure A.2 – Annual Mean NO_2 Concentrations: Within Warwick AQMAs

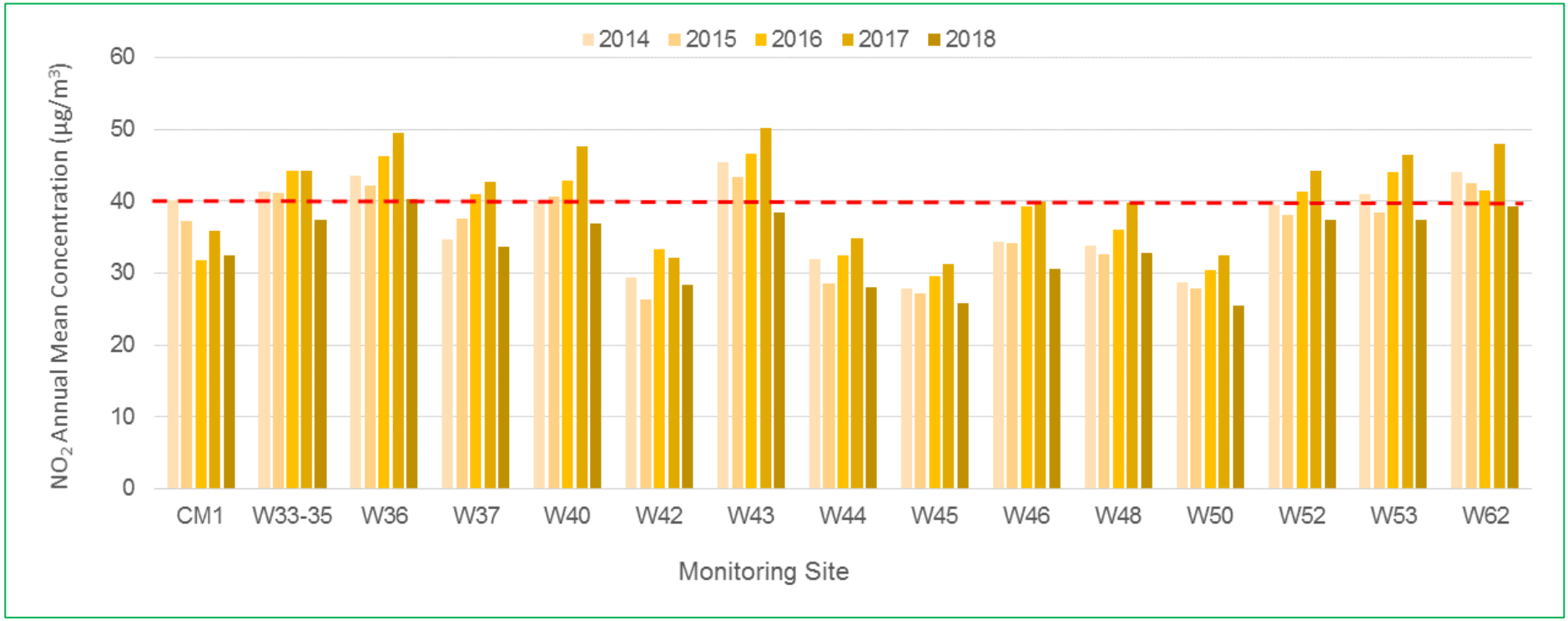


Figure A.3 –Annual Mean NO_2 Concentrations: Outside Warwick AQMAs

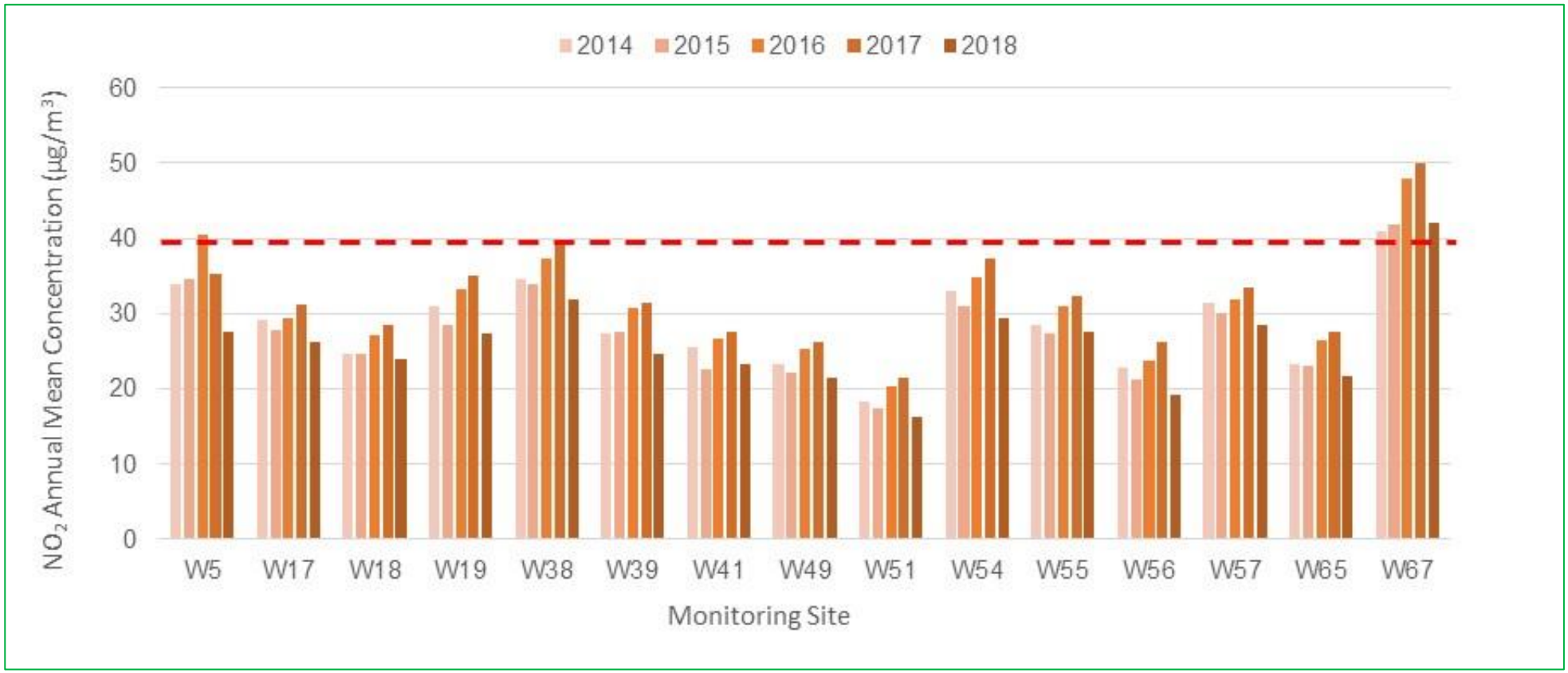


Figure A.4 –Annual Mean NO_2 Concentrations: Kenilworth and Stoneleigh

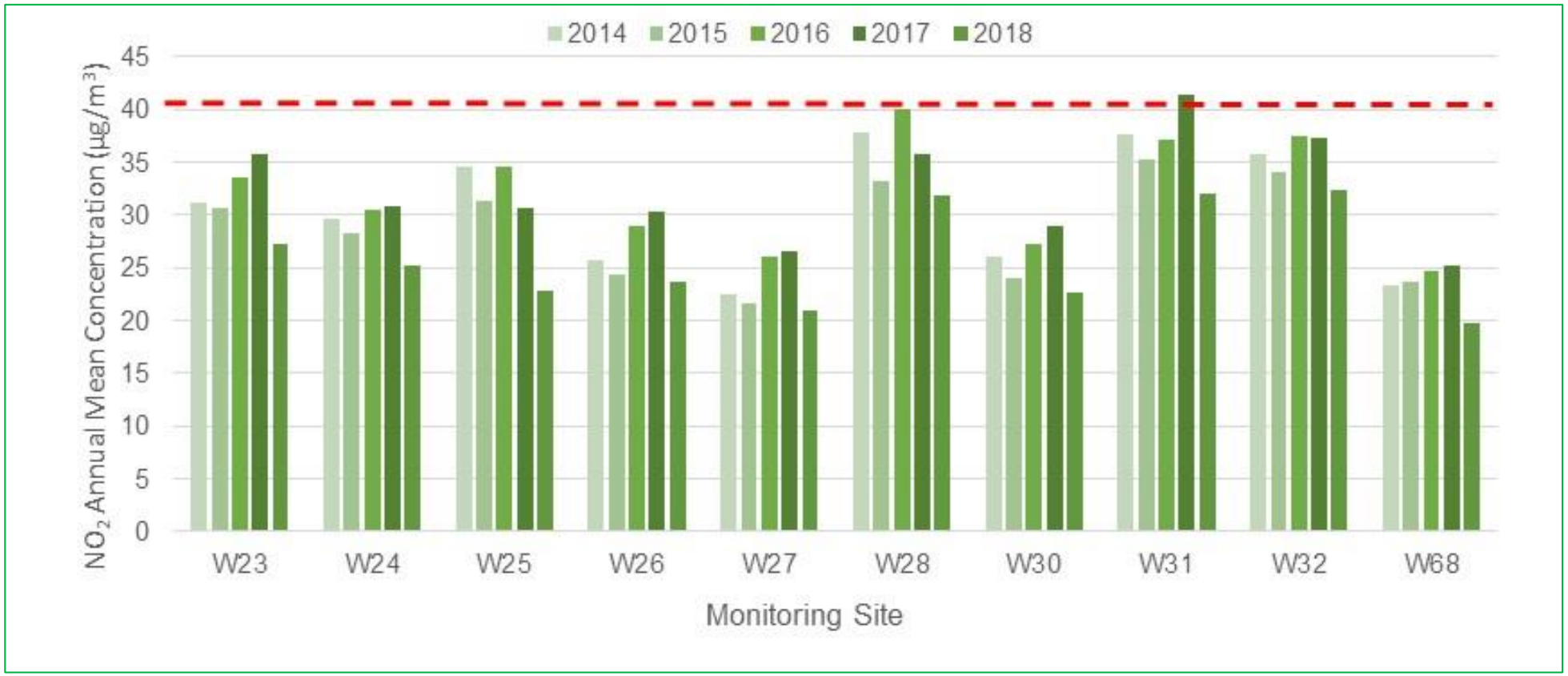


Figure A.5 – Annual Mean NO_2 Concentrations: Warwick, Emscote

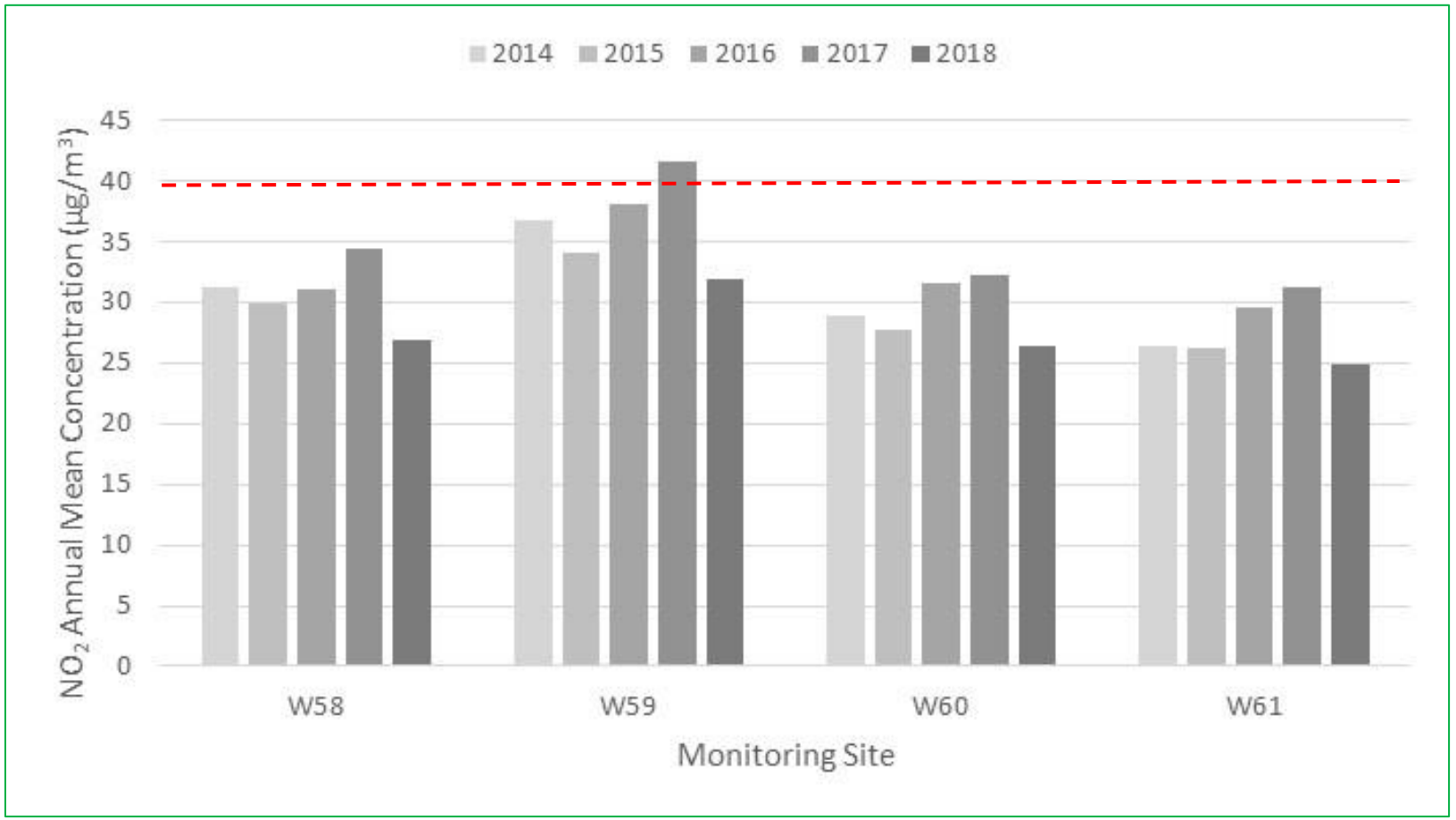


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2014	2015	2016	2017	2018
AURN1	UB	Automatic	98.5	98.5	**0(74)**	0	0	0	0
AURN2	RS	Automatic	99.3	99.3	0	0	0	0	0
CM1	RS	Automatic	93.1	93.1	0	0	0	0	0

Notes:

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

(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%).

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

Table A.5 – PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} Annual Mean Concentration (µg/m^3) (3)				
				2014	2015	2016	2017	2018
AURN1	Urban Background	94.9	94.9	15.9	15.3	15.4	13.9	14.0
AURN2	Roadside	64.2	64.2	14.7	15.3	15.7	17.3	13.9

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the PM_{10} annual mean objective of 40µg/m^3 are shown in **bold.**

(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%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.6 – Annual Mean PM_{10} Concentrations

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2014	2015	2016	2017	2018
AURN1	Urban Background	94.9	94.9	**3**	4	4	2	1
AURN2	Roadside	64.2	64.2	1 (30)	2	2	4	1 (23.6)

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(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%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Figure A.7 – Number of 24-Hour Mean PM_{10} Results >50µg/m^3

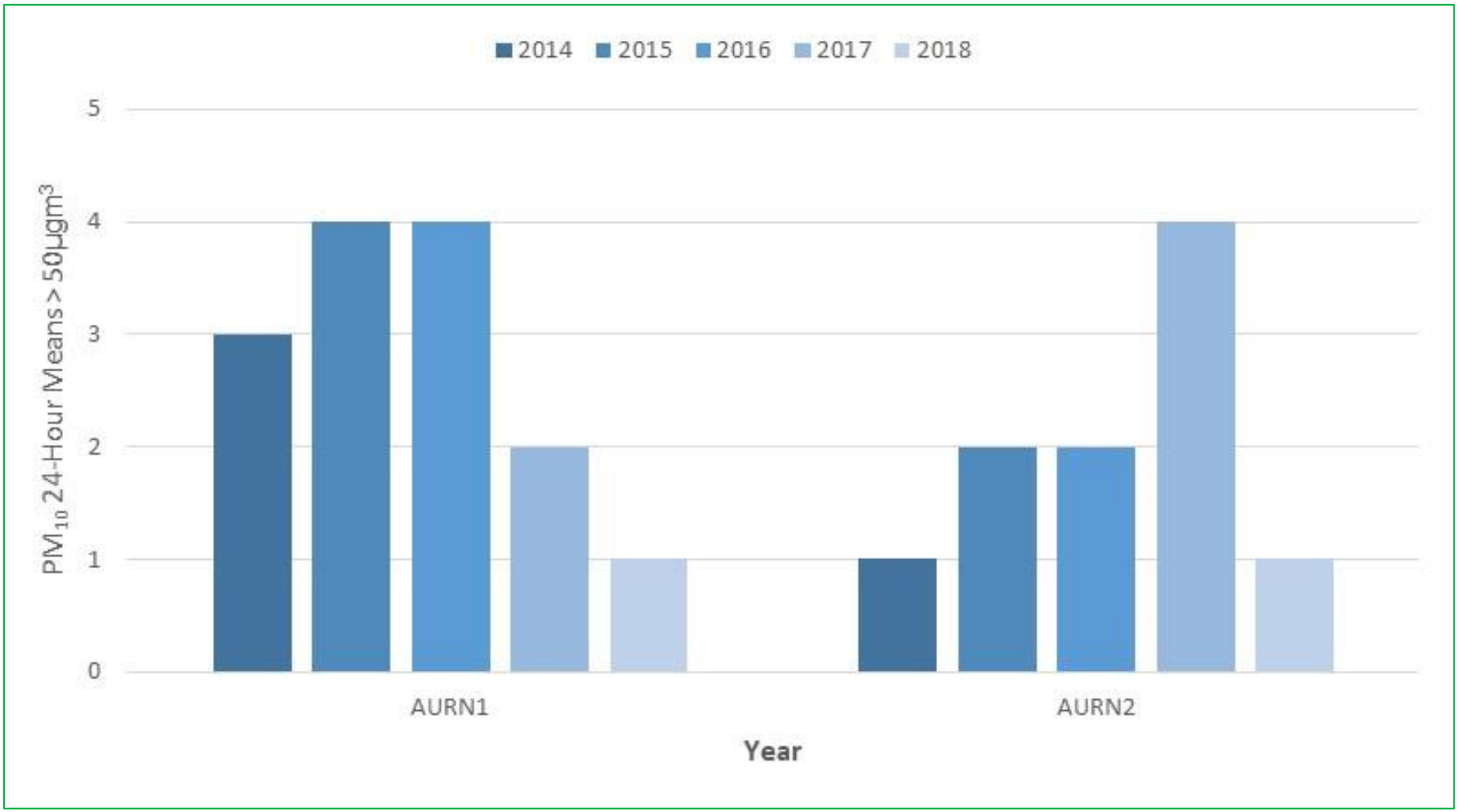


Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
				2014	2015	2016	2017	2018
AURN1	Urban Background	95.5	95.5	12.9	12.3	10.5	10.7	9.8
AURN2	Roadside	97.5	97.5	11.2	12.9	9.7	11	11.7

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

(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%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.8 – Annual Mean $PM_{2.5}$ Concentrations

Table A.8 – Benzene Monitoring Results

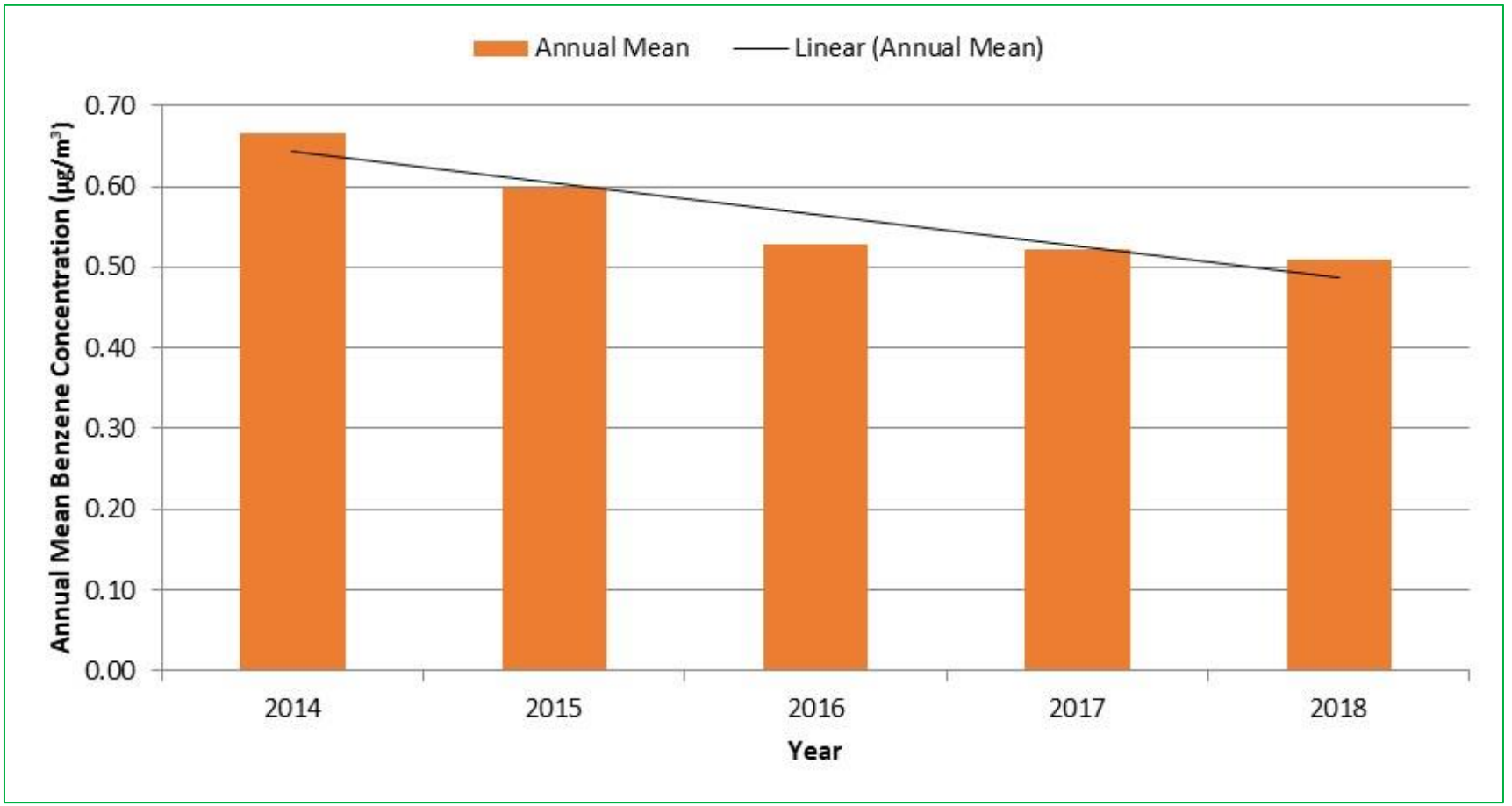
Site ID	Site Type	Monitoring Type	Valid Data Capture 2018 (%)	Benzene Annual Mean Concentration (µg/m^3) (3)				
				2014	2015	2016	2017	2018
AURN1	Urban Background	Non-automatic diffusion tube	96.2	0.67	0.60	0.53	0.52	0.51

Notes:

(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.9 – Annual Mean Benzene Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
													Jan		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.88) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
W1	58.0	43.7	45.4	51.8	40.8	38.0	57.2	47.2	52.2	54.4	46.2	42.4	**48.1**	**42.3**	
W2	45.6	38.5	35.9	39.4	39.3	38.0	45.5	40.1	42.2	45.0	41.0		**41.0**	36.0	
W5	38.5	31.1	34.8	27.1	30.4	28.3	32.5	30.9	33.7	29.9	28.6	31.3	31.4	27.7	
W6	27.3	25.0	23.7	17.7	12.4	12.1	15.1	16.8	18.3	24.0	24.8	24.7	20.2		
W7	26.3	23.2	24.8	18.5	11.0	12.9	14.8	15.5	19.0	37.6	21.1	26.5	20.9		
W8	29.7	24.2	21.8	18.7	13.9	13.8	14.4	16.5	16.2	23.4	16.6	16.6	18.8	17.6	
W10	36.4	28.5	28.5	24.9	20.9	20.5	21.3	20.6	23.3	26.7	28.6	31.2	26.0	22.8	
W11	24.6	30.7	28.2	24.3	22.0				21.2	27.2	17.6	28.3	24.9	21.9	
W12	45.1	41.0	41.7	36.1	31.2	26.4	33.9	32.0	34.8	34.3	33.1	38.5	35.7	31.4	
W13	60.9	55.1	52.7	56.7	43.1	50.6	55.6	46.3	47.8	55.2	51.9	56.5	**52.7**	**46.4**	
W14	47.4	43.0	42.1	39.9	38.3	39.7	43.8	44.5	44.5	43.1	31.8	41.2	**41.6**	36.6	36.1
W15	60.7	49.5	48.4	45.4	41.6	43.8	51.7	46.5	43.9	1.0	77.7	48.0	**46.5**	**40.9**	
W16	39.6	32.2	32.7	31.1	29.4	26.6	29.4	31.4	29.9	32.9	32.2		31.6	27.8	
W17	30.9	35.6	35.7	29.4	26.4		28.7	23.9	21.7	30.2		34.4	29.7	26.1	
W18	28.8	32.6	27.3	25.9	26.5	26.2	27.1	23.8	23.9	26.3	30.5	27.5	27.2	23.9	
W19	37.6	33.4	33.1	30.2	28.4	27.9	31.4	28.6	29.8	36.3	30.4	25.7	31.1	27.3	

W23	37.8	35.1	33.7	29.6		25.7	29.4	26.9	30.4	30.8	33.4	27.7	31.0	27.2	
W24	33.3	36.3	31.4	29.4	25.2	26.5	26.1	23.0	21.2	31.3	31.8	29.0	28.7	25.3	
W25								7.1	29.2	34.0	35.7	28.5	26.9	22.8	
W26	29.3	31.7	31.2	26.1		19.6	24.5	23.8	24.4	25.8	29.8	29.4	26.9	23.6	
W27	29.3	26.5	27.7	23.4	21.3	20.4	22.2	19.2	19.8	24.6		27.7	23.8	21.0	
W28	40.8	41.5	41.5	37.9	37.5	37.4	37.3	30.3	27.8	29.0	37.8	35.3	36.2	31.8	
W30	28.9	30.0	28.5		21.5	20.2	23.7	22.0	22.5	27.6	27.1	30.1	25.6	22.6	
W31	41.6	40.5	36.8	36.8	33.6	28.5	39.9	33.8	35.4	37.3	39.3	33.0	36.4	32.0	
W32	39.4	42.5	38.7	38.4	41.4	39.3	38.8	29.2	28.3	38.7	31.7	34.8	36.8	32.4	
W33		52.8	50.5	43.2	34.3	39.2	40.4	37.5	35.3	38.0	46.0	39.4	**41.5**		
W34		48.9	50.9	41.0		38.0	41.0	38.2	37.1	36.5	45.7	48.6	**42.6**		
W35	56.0	49.0	49.2	43.1	36.6	38.7	43.1	37.8	37.0	37.3	45.8	47.2	**43.4**	37.4	
W36	56.1	53.2	50.6	48.5	37.9	37.4	43.1	35.8		41.7	47.2	52.7	**45.8**	**40.3**	37.9
W37	43.5	42.6	42.3	34.5	36.3	39.1	40.8	33.4	33.9	41.2	33.2	37.6	38.2	33.6	
W38		37.3	35.1	36.3	34.1	35.0	38.4	34.4	37.4	40.4	32.9	35.6	36.1	31.8	
W39	31.8	27.6	30.5	28.1	25.9	24.7	24.8	25.7	27.3	32.0	25.1	31.9	28.0	24.6	
W40	51.4	50.3	43.7	40.9	36.1	35.3	44.4	40.3	42.1	38.5	38.5	41.4	**41.9**	36.9	
W41	31.0	31.7	30.8	24.1	22.4	21.6	23.5	22.0	21.7	28.7	30.0	28.3	26.3	23.2	
W42	36.4	38.6	35.0	32.7	29.7	26.6	33.1	28.8	25.0	36.2	36.1	27.8	32.2	28.3	
W43	43.7	42.4	40.5	42.9	45.7	40.9	53.7	41.0	45.3	45.1	42.3	41.2	**43.7**	38.5	
W44	34.9	34.1	35.4	30.7	23.5	25.9	31.1	29.0	30.1	35.9	36.2	34.8	31.8	28.0	
W45	36.0	32.7	30.5	24.1	26.5	25.2	28.0	25.5	26.2	31.1	35.2	31.9	29.4	25.9	
W46	32.4		35.5	35.6	34.7	33.5	36.5	30.2	32.1	40.4	43.1	28.8	34.8	30.6	
W48	43.0	39.6	39.1			26.7	32.0	31.4	30.6	35.4	52.6	43.2	37.4	32.9	
W49	30.9	28.4	25.6	23.8	19.7	18.3	19.3	20.7	20.9	25.6	27.3	30.3	24.2	21.3	
W50	34.4	30.6	33.6	31.2	28.7	25.7	27.2	22.9	25.3	26.9	31.9	28.4	28.9	25.4	
W51	23.1	21.5	21.8	17.1	15.9	14.3	15.9	14.9	15.4	20.6	18.2	21.7	18.4	16.2	

W52	44.7	40.9	44.8	38.8	44.9	46.9	46.9	38.6	36.4	42.5	42.6	42.1	**42.5**	37.4	33.0
W53	46.8	46.1	45.1	45.5	46.2	40.4	47.2	38.1	33.1	37.9	48.0	35.6	**42.5**	37.4	
W54	33.6	36.0	40.2	35.7	33.6	33.6	33.2	27.4	29.7	34.8	25.6	38.0	33.5	29.4	
W55		33.6	33.9	30.7	29.6	30.2	31.2	32.8			31.3	27.6	31.2	27.5	
W56	28.6	22.6	27.5	21.8	22.2		1.2	19.5	19.6	25.7	24.2	25.8	21.7	19.1	
W57	37.5	34.3	35.7	31.6	30.0	30.6	33.5	28.0	27.6	30.4	34.0	34.9	32.3	28.5	
W58	38.8	35.1	31.6			26.0	29.8	26.9	27.9	28.4	29.1	32.4	30.6	26.9	
W59	39.8	41.7	41.0	35.8	29.3	31.7	38.8	35.9	35.0	34.3	30.6	42.2	36.3	32.0	
W60	34.2	36.6	33.5	29.7	29.5	36.1	28.5	26.8	26.6	24.8	31.7	23.0	30.1	26.5	
W61	32.7	24.9	26.8	24.9	25.3	29.0	29.3	23.9	25.4	30.0	31.7	34.6	28.2	24.8	
W62	52.1	43.6	44.3	44.2	43.7	48.4	50.5	41.2	43.4	43.6	43.6	37.9	**44.7**	39.3	
W65	29.6	28.5	29.1	23.4	21.4	19.0							25.2	21.7	
W67	49.9	54.2	53.7	47.1	50.9	49.1	52.8	40.0	37.2	43.7	54.9	41.6	**47.9**	**42.2**	39.8
W68	30.5	29.0	21.5	20.8	19.1	16.6							22.9	19.8	
W69						46.5	48.8	39.4	36.3	41.7	40.6	41.8	**42.2**	39.9	36.5
W70						36.8	33.7	26.9	25.9	35.9	28.6	29.3	31.0	29.4	
W71						41.2	41.8	30.3	30.8	37.8	32.5	32.3	35.2	33.4	
W72							32.2	30.1	33.1	37.6	36.2	39.3	34.8	31.2	
W73							30.6	24.0	27.1	32.7	34.3	35.1	30.6	27.5	

☐ **Local bias adjustment factor used** ☒ **Annualisation has been conducted where data capture is <75%** ☒ **Where applicable, data has been distance corrected for relevant exposure**

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.**

Blank cells are where diffusion tubes were missing from their fixings.

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

Table B 2 – Benzene Monitoring Period Diffusion Tube Results

Site ID	Benzene Concentrations (µg/m^3)																									
	08/01/19 – 18/01/19	18/01/18 – 01/02/18	01/02/18 – 15/02/18	15/02/18 – 01/03/18	01/03/19 – 15/03/19	15/03/19 – 28/03/19	28/03/19 – 16/04/19	15/04/19 – 27/04/19	27/04/19 – 10/05/19	10/05/19 – 24/05/19	24/05/19 – 07/06/19	07/06/19 – 21/06/18	21/06/18 – 06/07/18	06/07/18 – 20/07/18	20/07/18 – 03/08/18	03/08/18 – 16/08/18	16/03/18 – 30/08/18	30/08/18 – 14/09/18	14/09/18 – 28/09/18	28/09/19 – 17/10/18	17/10/18 – 31/10/18	31/10/18 – 14/11/18	14/11/18 – 28/11/18	28/11/18 – 12/12/18	12/12/18 – 27/12/18	27/12/18 – 09/01/19	Annual Mean
AURN1	0.92	0.74	0.81	0.84	1.02	0.71	0.57	0.38	0.34	0.35	0.3	0.18	0.19	0.2	0.24		0.18	0.47	0.37	0.27	0.58	0.77	0.78	0.43	0.59	0.57	0.51

Notes:

Exceedances of the benzene annual mean objective of 5µg/m^3 are shown in **bold**.

Blank cells are where diffusion tubes were missing from their fixings.

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

QA/QC of automatic monitoring

All automatic monitoring sites in Warwick, other than Rugby Road, are calibrated by the Council's Local Site Operator (LSO). The QA/QC of the two Leamington Spa sites is undertaken through its status as part of the AURN and therefore conforms to AURN standards (undertaken by Ricardo-Energy and Environment). WeCare4Air is responsible for the servicing and call out contract for Hamilton Terrace and Jury Street and provides data management for Jury Street. The service contract for Rugby Road is arranged by Bureau Veritas and Defra and is provided by Enviro Technology Services.

QA/QC of diffusion tube monitoring

The diffusion tubes for the year 2018 were supplied and analysed by Staffordshire Scientific Services (SSS), the tubes were prepared using the 20% TEA in water preparation method. All results have been bias adjusted and annualised where required before being presented in Table A.3.

Staffordshire Scientific Services participates in the AIR-PT scheme which is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR-PT started in April 2014 and combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the AIR-PT scheme. Laboratory performance in AIR-PT is also assessed, by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Intercomparison Exercise carried out at Marylebone Road, central London. A laboratory is assessed and given a 'z' score. A score of 2 or less indicates satisfactory laboratory performance.

SSS's performance for 2018 is covered by rounds 19-30 of AIR PT. In all five of these rounds SSS scored 100%, this means the round rolling average is 100%, higher than

the 95% recommended. This means the laboratory has no systematic bias that we are aware of.

Diffusion Tube Bias Adjustment Factor

The diffusion tube data has been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentration and continuous monitoring, the latter assumed to be a more accurate method of monitoring. Defra LAQM.TG(16) 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.

With regard to the application of a bias adjustment factor for diffusion tubes, Defra LAQM.TG(16) and the LAQM Helpdesk recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites.

The national bias adjustment factor for SSS in 2018, obtained from the national bias adjustment spreadsheet (v03/18) is 0.87 (based on 12 studies), as presented in Figure C.1.

Figure C.1 – SSS 20% TEA in Water 2018 National Bias Adjustment Factor

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/19

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 2019

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: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List

If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List

If a year is not shown, we have no data[2]

Step 4:

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 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@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To update your selection, choose (All) from the pop-up list)	Year[2] (To update 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[4]	Bias Adjustment Factor (A) (Cm/Dm)
Staffordshire Scientific Services	20% TEA in water	2018	UC	Manchester City Council	12	37	35	5.0%	G	**0.95**
Staffordshire Scientific Services	20% TEA in water	2018	KS	Manchester City Council	12	61	62	-2.3%	G	**1.02**
Staffordshire Scientific Services	20% TEA in water	2018	SI	Manchester City Council	12	23	24	-4.7%	G	**1.05**
Staffordshire Scientific Services	20% TEA in water	2018	R	Bury Council	12	30	25	19.0%	G	**0.84**
Staffordshire Scientific Services	20% TEA in water	2018	KS	Marylebone Road Intercomparison	12	84	85	-0.7%	G	**1.01**
Staffordshire Scientific Services	20% TEA in water	2018	R	Salford City Council	11	44	40	10.5%	G	**0.91**
Staffordshire Scientific Services	20% TEA in water	2018	B	Salford City Council	9	18	14	24.6%	G	**0.80**
Staffordshire Scientific Services	20% TEA in water	2018	UB	Salford City Council	12	30	25	18.0%	G	**0.85**
Staffordshire Scientific Services	20% TEA in water	2018	R	stockport	12	43	37	15.6%	G	**0.87**
Staffordshire Scientific Services	20% TEA in water	2018	KS	Oldham Council	12	36	29	23.9%	G	**0.81**
Staffordshire Scientific Services	20% TEA in water	2018	R	Stoke-on-Trent City Council	10	57	56	2.7%	G	**0.97**
Staffordshire Scientific Services	20% TEA in water	2018	UB	Stoke-on-Trent City Council	11	28	23	19.1%	G	**0.84**
Staffordshire Scientific Services	20% TEA in water	2018	UB	Wigan Council	10	26	16	61.3%	G	**0.62**
Staffordshire Scientific Services	20% TEA in water	2018		**Overall Factor[3] (13 studies)**				**Use**		**0.87**

Bias adjustment factors are also available for two co-location studies completed at the automatic monitoring sites Hamilton Terrace in Leamington Spa and Pageant House

in Warwick. The calculation of the local bias adjustment factors are presented in Figure C.2 and Figure C 3.

Figure C.2 – Leamington Spa Hamilton Terrace Local Bias Adjustment

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03.01.18	31.01.18	27	26	30	28	1.7	6	4.3
2	31.01.18	28.02.18	25	23	24	24	0.9	4	2.2
3	28.02.18	29.03.18	24	25	22	23	1.5	6	3.8
4	29.03.18	02.05.18	18	19	19	18	0.5	3	1.3
5	02.05.18	06.06.18	12	11	14	12	1.5	12	3.6
6	06.06.18	04.07.18	12	13	14	13	0.9	7	2.1
7	04.07.18	01.08.18	15	15	14	15	0.4	2	0.9
8	01.08.18	05.09.18	17	16	17	16	0.7	4	1.7
9	05.09.18	03.10.18	18	19	16	18	1.5	8	3.6
10	03.10.18	31.10.18	24	38	23	28	8.0	28	19.9
11	31.10.18	05.12.18	25	21	17	21	4.1	20	10.2
12	05.12.18	09.01.19	25	27	17	23	5.3	23	13.1
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
26.3455	93.89881	Good	Good
25.2331	94.494048	Good	Good
23.5273	94.642857	Good	Good
15.6927	76.428571	Good	Good
9	61.190476	Good	r Data Capture
9	99.553571	Good	Good
11	99.255952	Good	Good
11	99.047619	Good	Good
14	99.107143	Good	Good
21	100	Poor Precision	Good
19.2718	97.619048	Poor Precision	Good
24.4137	92.738095	Poor Precision	Good
Overall survey -->		Poor	Good

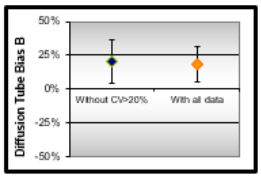
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Leam Spa

Precision 9 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 8 periods of data
Bias factor A 0.88 (0.77 - 1.02)
Bias B 14% (-2% - 30%)
Diffusion Tubes Mean: 19 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 17 µgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 17 (15 - 20) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 11 periods of data
Bias factor A 0.88 (0.79 - 1)
Bias B 13% (0% - 26%)
Diffusion Tubes Mean: 21 µgm^{-3}
Mean CV (Precision): 10 caution
Automatic Mean: 18 µgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 18 (16 - 21) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure C 3 – Jury St/Pageant House Warwick Local Bias Adjustment

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2018	31/01/2018			56.0				
2	31/01/2018	28/02/2018	52.8	48.9	49.0	50	2.2	4	5.5
3	28/02/2018	28/03/2018	50.5	50.9	49.2	50	0.9	2	2.2
4	28/03/2018	02/05/2018	43.2	41.0	43.1	42	1.2	3	3.1
5	02/05/2018	06/06/2018	34.3		36.6	35	1.6	5	14.6
6	06/06/2018	04/07/2018	39.2	38.0	38.7	39	0.6	2	1.5
7	04/07/2018	01/08/2018	40.4	41.0	43.1	42	1.4	3	3.5
8	01/08/2018	05/09/2018	37.5	38.2	37.8	38	0.4	1	0.9
9	05/09/2018	03/10/2018	35.3	37.1	37.0	36	1.0	3	2.5
10	03/10/2018	31/10/2018	38.0	36.5	37.3	37	0.8	2	1.9
11	31/10/2018	05/12/2018	46.0	45.7	45.8	46	0.2	0	0.4
12	05/12/2018	09/01/2019	39.4	48.6	47.2	45	5.0	11	12.3
13			41.5	42.6	43.4	42	0.9	2	2.4

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
55.3789	100		Good
48.9277	99.85119	Good	Good
28.0149	100	Good	Good
21.0831	100	Good	Good
20	100	Good	Good
17	100	Good	Good
18	100	Good	Good
19	100	Good	Good
22	100	Good	Good
28	99.553571	Good	Good
54.2408	100	Good	Good
59.016	75.833333	Good	Good
		Good	
Overall survey -->		Good	Good

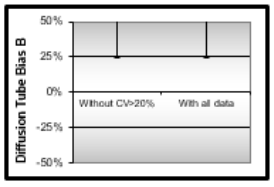
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Jury Street

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

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A 0.73 (0.57 - 0.99)
Bias B 38% (1% - 75%)
Diffusion Tubes Mean: 42 µgm^{-3}
Mean CV (Precision): 3
Automatic Mean: 30 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 31 (24 - 41) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 11 periods of data
Bias factor A 0.73 (0.57 - 0.99)
Bias B 38% (1% - 75%)
Diffusion Tubes Mean: 42 µgm^{-3}
Mean CV (Precision): 3
Automatic Mean: 30 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 31 (24 - 41) µgm^{-3}



Jaume Targa, for AEA

The Jury Street/Pageant House, Warwick local bias adjustment factor has not been used due to the relatively low adjustment factor calculated in comparison to

Leamington Spa, Hamilton Terrace. In the interest of being conservative the local bias adjustment factor (0.88) calculated from Leamington Spa Hamilton Terrace has been used to adjust the data, this has been chosen due to it being a slightly more conservative figure than the national adjustment figure (0.87) or the Jury Street/Pageant House, Warwick (0.73) in this instance.

Short to Long term data adjustment; Annualisation

In regards to the 2018 NO_2 diffusion tube data set, annualisation was required at eight diffusion tube locations and for both the PM_{10} and $PM_{2.5}$ monitoring data at the Rugby Road, Leamington Spa AURN2 monitoring station. Data capture at each of these monitoring sites during 2018 was below 75%, therefore annualisation has been completed in line with Box 7.9 and Box 7.10 of LAQM.TG(16).

In completing the annualisation process, data has been taken from a number of automatic monitoring sites that are part of the AURN. In line with LAQM.TG(16) the monitoring sites that have been used lie within a radius of approximately 50 miles of the sites to be annualised and have a data capture of 85% or above.

All monitoring stations that were used are background monitoring stations and as such are not influenced by local sources of air pollution such as road traffic emissions at roadside monitoring sites. The monitoring sites that were used to complete the required annualisation calculations are listed in Figure C.1.

The data has been adjusted to an annual mean, based on the ratio of concentrations during the monitoring period for that site to those over the 2017 calendar year at the nearest background automatic monitoring sites. Three AURN urban background monitoring sites were considered for annualisation; Leamington Spa, Birmingham Acocks Green, Coventry Allesley. The annualisation calculations are summarised below in Table C.2.

Table C.1 – AURN Monitoring Stations used for Annualisation

Pollutant	Background AURN Sites used for Annualisation
NO_2	• Hamilton Terrace, Leamington Spa – Urban Background • Birmingham Adcocks Green – Urban Background • Coventry Allesley – Urban Background

PM_{10}/$PM_{2.5}$	• Nottingham Centre – Urban Background • Oxford St Ebbes – Urban Background • Chesterfield Loundsley Green – Urban Background

NO_2 Fall-off with distance from the road

In line with LAQM.TG(16) distance correction has been applied to NO_2 monitoring sites that have recorded an annual mean concentration above the annual mean objective, or within 10% of the annual mean objective. Across 2018, 14 of Warwick's monitoring sites met this criteria., and five of these sites were not at locations of relevant exposure. Therefore these five sites have been distance adjusted due to them not being representative of an exceedance at their monitoring location.

In accordance with LAQM.TG(16) guidance the NO_2 Fall-Off with Distance Calculator (v4.2) has been used to derive the NO_2 concentration at a location of relevant exposure; the results of the calculations are presented in . The background concentrations used within the calculations have been taken from Defra 2018 (2017 base year) background maps that are available on the LAQM website.

Table C.2– Diffusion Tube Short Term to Long Term Monitoring Data Adjustment (2018)

Site ID	Unadjusted Diffusion Tube Mean (µg/m^3)	Annualisation Factor Birmingham Adcocks Green	Annualisation Factor Coventry Allesley	Annualisation Factor Hamilton Terrace, Leamington Spa	Average Annualisation Factor	Annualised & Bias Adjusted (0.88) Concentration (µg/m^3)
W25	26.9	0.985	0.922	0.983	0.964	22.8
W65	25.2	0.959	1.029	0.952	0.980	21.7
W68	22.9	0.959	1.029	0.952	0.980	19.8
W69	42.2	1.079	1.039	1.108	1.076	39.9
W70	31.0	1.079	1.039	1.108	1.076	29.4
W71	35.2	1.079	1.039	1.108	1.076	33.4
W72	34.8	1.042	0.974	1.044	1.020	31.2
W73	30.6	1.042	0.974	1.044	1.020	27.5

Table C.3 – PM_{10} Short Term to Long Term Monitoring Data Adjustment (2018)

Site ID	Unadjusted Monitored Mean (µg/m^3)	Annualisation Factor Chesterfield Loundsley Green	Annualisation Factor Oxford St Ebbes	Annualisation Factor Nottingham Centre	Average Annualisation Factor	Annualised Concentration (µg/m^3)
AURN2	13.8	1.042	1.008	0.965	1.005	13.9

Table C.4 – $PM_{2.5}$ Short Term to Long Term Monitoring Data Adjustment (2018)

Site ID	Unadjusted Monitored Mean (µg/m^3)	Annualisation Factor Chesterfield Loundsley Green	Annualisation Factor Oxford St Ebbes	Annualisation Factor Nottingham Centre	Average Annualisation Factor	Annualised Concentration (µg/m^3)
AURN2	11.7	1.062	1.056	1.024	1.066	12.3

Table C.5 – NO_2 Fall-Off with Distance Calculations

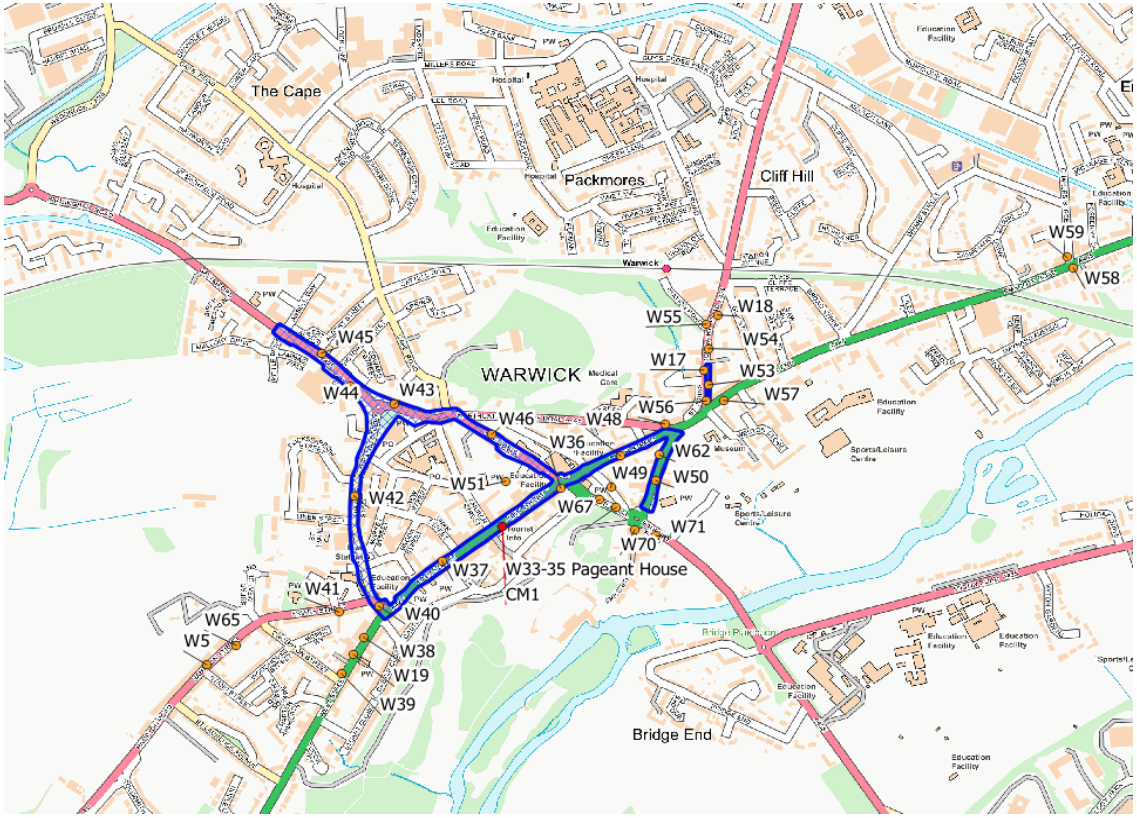
Site ID	Distance (m)		NO_2 Annual Mean Concentration ($\mu g/m^3$)			Comments
	Monitoring Site to Kerb	Receptor to Kerb	Background (1)	Monitoring at Site	Predicted at Receptor	
W14	5.2	5.8	20.1	36.6	36.1	Predicted concentration at Receptor within 10% the AQS objective.
W36	2.1	3.1	13.6	40.3	37.9	Predicted concentration at Receptor within 10% the AQS objective.
W52	1.0	3.0	17.3	37.4	33.0	-
W67	3.2	4.4	13.6	42.2	39.8	Predicted concentration at Receptor within 10% the AQS objective.
W69	2.1	3.6	13.6	39.8	36.5	Predicted concentration at Receptor within 10% the AQS objective.

Notes:

Background NO_2 concentrations have been taken from the 2018 Defra Background Maps.

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Air Quality Monitoring Locations: Warwick



Legend

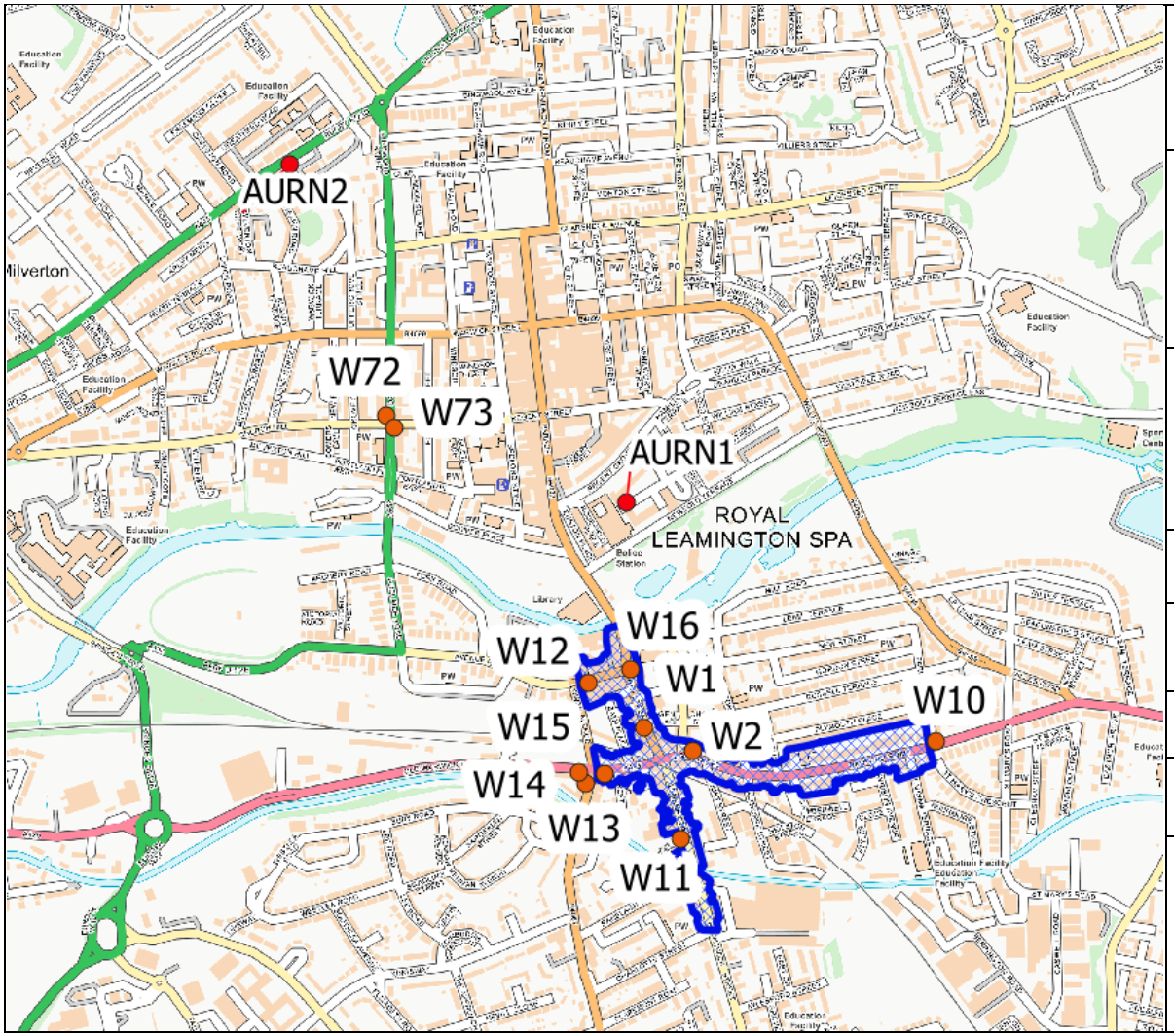
- Automatic Sites
- Diffusion Tubes
- Air Quality Management Areas

Contains Ordnance Survey Data Crown Copyright and Database Right [2019]

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	**Warwick**
Title	**Air Quality Monitoring Locations: Warwick**
By CR	**Approved** HS
Scale NTS	**Job Ref** 6454669
Date May 2019	**Figure No.** D.1

Figure D.2 – Air Quality Monitoring Locations: Leamington Spa Central



Legend

- Automatic Sites
- Diffusion Tubes
- Air Quality Management Areas

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Air Quality
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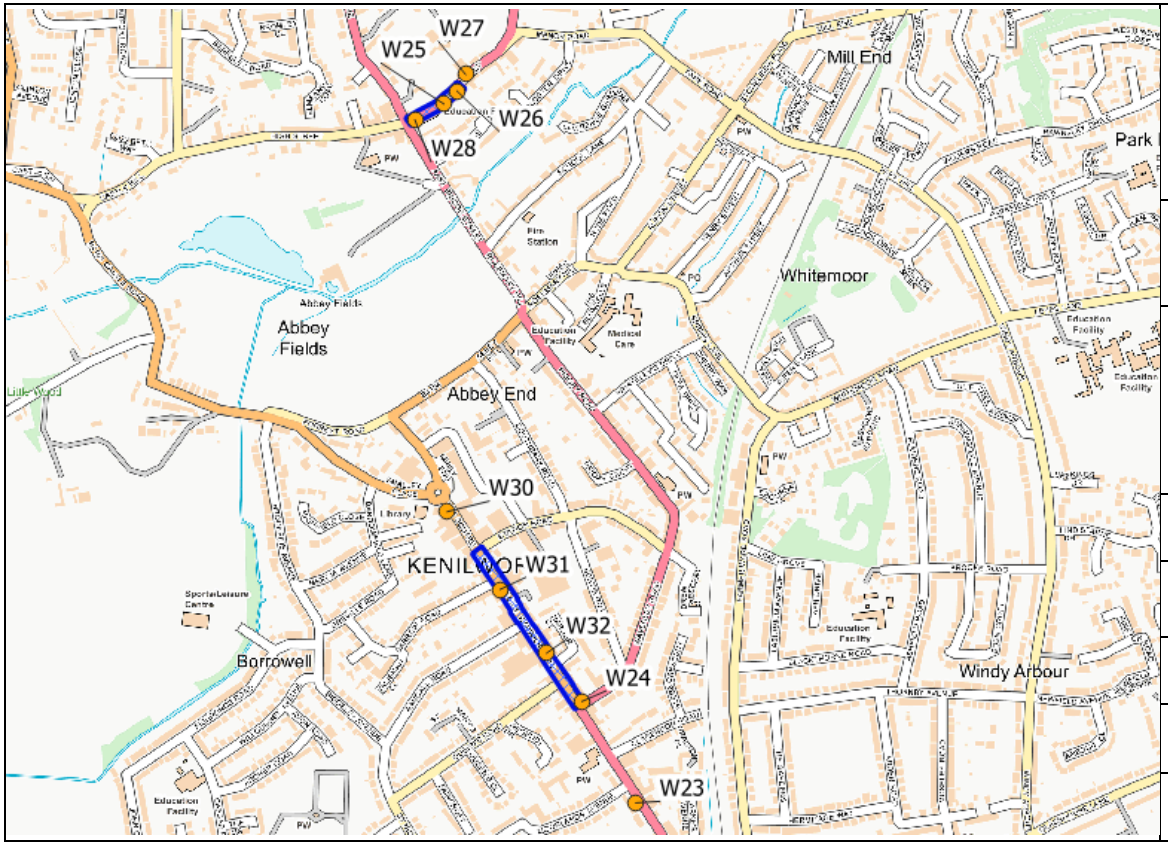
5th Floor
66 Prescot Street
London, E1 8HG

Location	**Leamington Spa**
Title	**Air Quality Monitoring Locations: Leamington Spa Centre**
By CR	**Approved** HS
Scale NTS	**Job Ref** 6454669
Date May 2019	**Figure No.** D.2

Figure D.3 – Air Quality Monitoring Locations: Kenilworth



Legend

- Automatic Sites
- Diffusion Tubes
- Air Quality Management Areas

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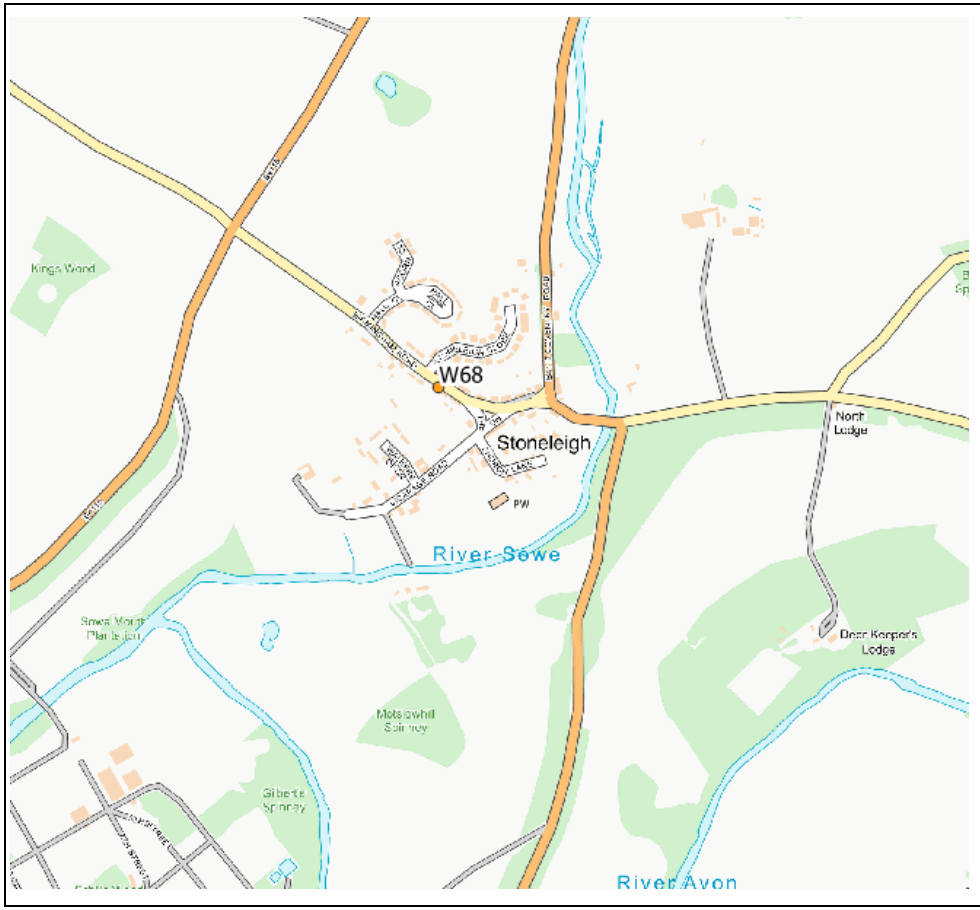
66 Prescot Street
London, E1 8HG

Location	
Kenilworth	
Title	
Air Quality Monitoring Locations : Kenilworth	
By	**Approved**
CR	HS
Scale	**Job Ref**
NTS	6454669
Date	**Figure No.**
May 2019	D.4

Figure D.4 – Air Quality Monitoring Locations: Stoneleigh



Legend

- Automatic Sites
- Diffusion Tubes
- Air Quality Management Areas

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Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	**Stoneleigh**
Title	**Air Quality Monitoring Locations: Stoneleigh**
By CR	**Approved** HS
Scale NTS	**Job Ref** 6454669
Date May 2019	**Figure No.** D.5

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[9]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[9] The units are in micrograms 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	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
UVF	Ultra-Violet Fluorescence
WDC	Warwick District Council

References

- Local Air Quality Management Technical Guidance LAQM.TG(16). February 2018. 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.PG(16). May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Warwick District Council Air Quality Action Plan, June 2015.
- Warwick District Council 2017 Annual Status Report.
- Warwick District Council 2018 Annual Status Report.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/19 published in March 2019.
- Defra Nitrogen Dioxide fall off with distance calculator, https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html
- Defra Background Maps (2017 based), https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
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- Non-Automatic Hydrocarbon Network, https://uk-air.defra.gov.uk/networks/network-info?view=nahc
- Warwick District Council Air Quality & Planning Supplementary Planning Document, January 2019.