

2017 Air Quality Annual Status Report (ASR)

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

June 2017

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Executive Summary: Air Quality in Our Area

Air Quality in Nottingham City

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].

The main air quality issues in Nottingham

Nottingham has two Air Quality Management Areas, both for nitrogen dioxide (NO2), where modelling predicted and/or monitoring demonstrated that the nitrogen dioxide annual mean objective of 40 ug/m3 was being, or was likely to be, exceeded by the 'due date' of 2005.

These two AQMAs were designated primarily due to nitrogen dioxide emissions from traffic, although NOx from gas fired boilers, (commercial and domestic heating and cooking) also contribute to ambient NO2 concentrations.

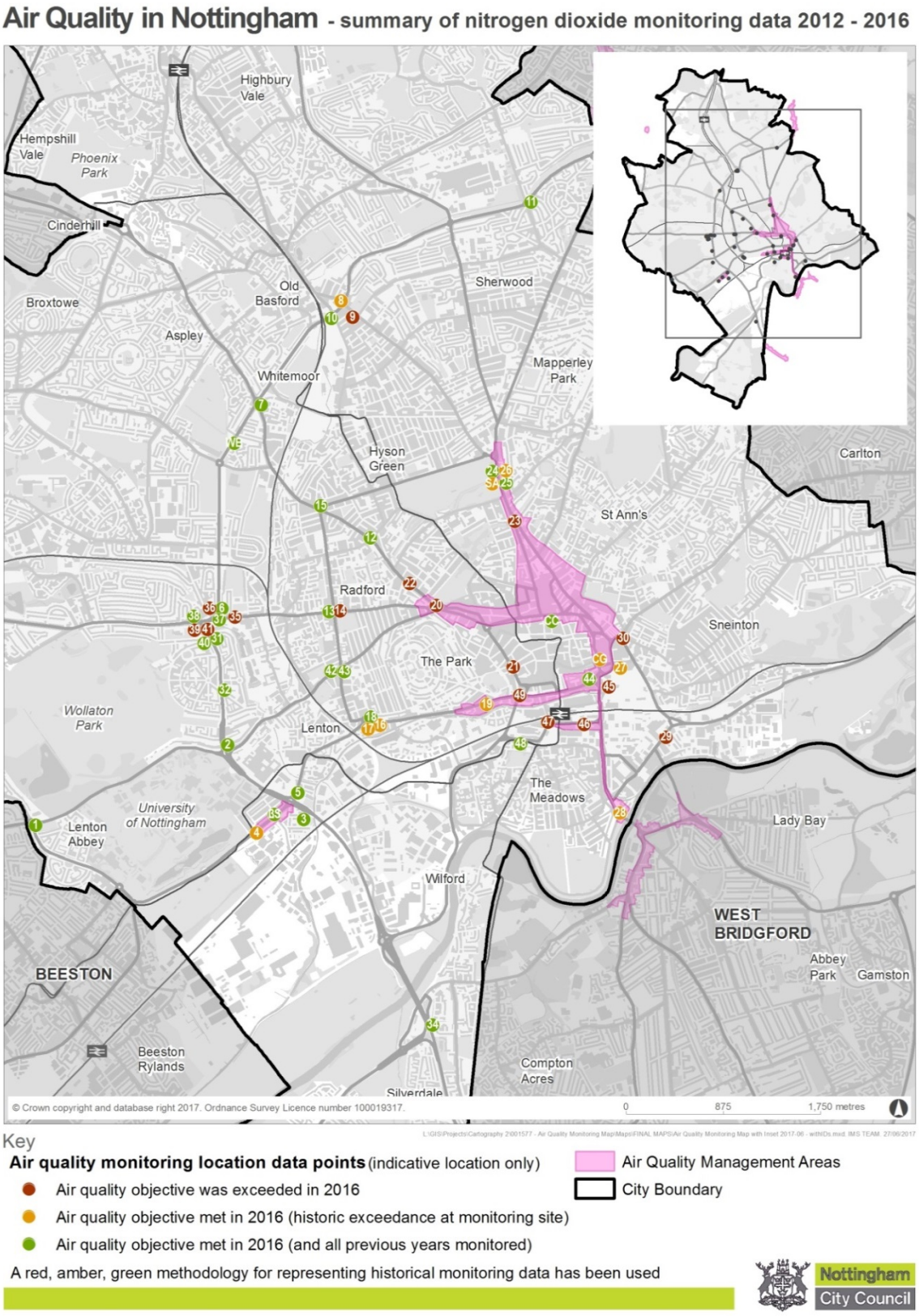
In 2015 air quality modelling, commissioned by DEFRA, identified Nottingham as one of 5 cities where it was predicted that the EU nitrogen dioxide annual mean limit value 40 µg/m^3 will not be met.

The modelling identified locations outside the existing AQMAs where the nitrogen dioxide concentrations might exceed the annual mean air quality objective and in response to this diffusion tube monitoring was commenced at 16 additional locations.

To assist with visualisation of the extent and range of the monitoring data Nottingham has incorporated monitoring locations, reporting period monitoring data (2012-2016), and Air Quality Management Area locations into one summary data map: Figure 1.

[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

Figure 1



Note monitoring location data points are only approximations to the actual monitoring locations as they have been sized/spaced to assist with legibility. Details of the monitoring locations and measured concentrations are in Table A.2 and B1 respectively.

Latest Monitoring

The Diffusion tube monitoring network was expanded in 2016. Data from the DT network shows previously unpredicted areas of exceedence of the NO2 annual mean AQOs outside the existing AQMAs (Fig 1 and Table A2).

Real time monitoring of nitrogen dioxide (NO_2) and particles (PM_{10}, $PM_{2.5}$) within the AQMA are presented below, in Figures 2 and 3 respectively, as annual means.

Figure 2

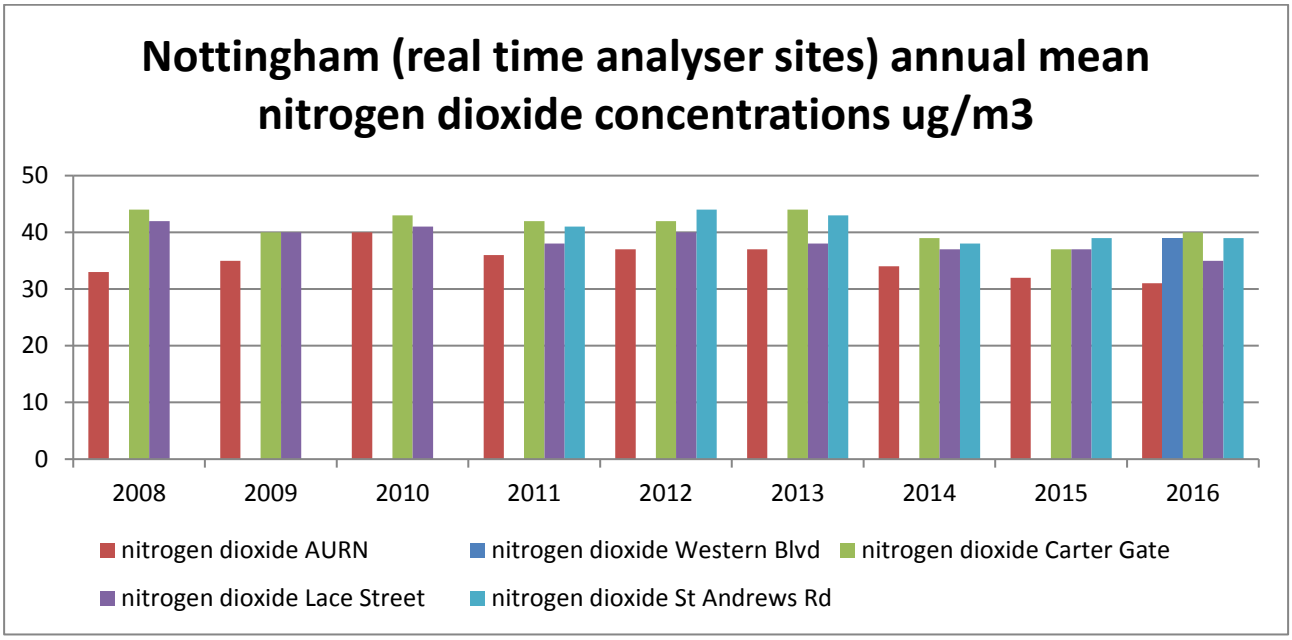
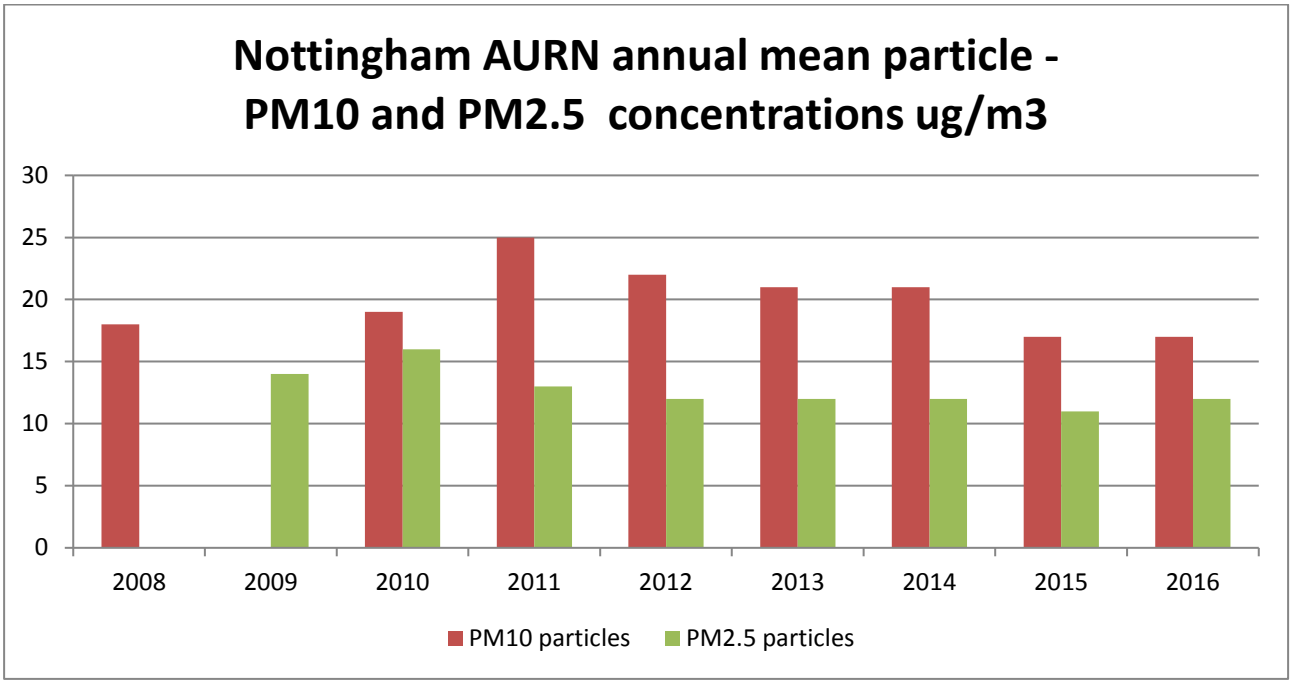


Figure 3



Actions to Improve Air Quality

Nottingham Local Plan and Emerging Local Plan

Nottingham City Council has been working to improve air quality across a broad front by reducing emissions of CO2, NOx and particles by increasing energy efficiency across Nottingham City Council and Nottingham City Homes and building stock and investing in alternative energy generation.

Nottingham City Council has also managed to constrain traffic growth from private motor vehicles by working closely with public transport providers (further details below).

On the 15th June 2017 Nottingham City Council was awarded the prestigious Ashden Award for Clean Air in Towns and Cities for developing greener transport that has helped Nottingham to achieve the lowest emissions per head of population of all large UK cities outside London.

https://www.nottinghamcity.gov.uk/planning-and-building-control/planning-policy/the-local-plan-and-planning-policy/

Air Quality Strategy

Nottingham City Council along with all other Nottinghamshire Local Authorities and other agencies (e.g. Environment Agency) are signatories to the Nottinghamshire Air Quality Strategy 2008 which details a range of strategies and action that may be taken by businesses and individuals to reduce emissions and improve air quality.

In 2016 Nottingham City Council in conjunction with partners and stakeholders carried out a review of the Nottinghamshire Air Quality Strategy identifying further opportunities and potential synergies of a range of statutory plans to improve air quality, health and wellbeing. It is proposed to publish the revised strategy in the Autumn 2017.

http://cms.nottinghamshire.gov.uk/nottsairqualityimprovementstrategy2008.pdf

Air Quality Action Plan

It has been recognised that the current Air Quality Action Plan (embedded within the Local Transport Plan) is focussed solely on reducing emissions from road transport. The Air Quality Action Plan is therefore currently being revised to reflect that air quality is also affected by emissions from fixed sources and that technological

advances now allow emissions from a wider range of sources to be reduced or negated altogether. In 2016 Nottingham City Council successfully obtained funding from DEFRA to investigate and trial the feasibility of replacing natural gas fired boiler plant with zero NO2/NOx emission fuel cell technology. This project is currently underway.

East Midlands Air Quality Network

Partnership working between professions and local authorities is being strengthened by the establishment of an East Midlands Air Quality Network.

This network brings together a range of professions and organisations: public and environmental health, transport and spatial planning, to develop guidance, identify practical solutions and a consistent approach to improve health by reducing emissions of, and exposure to, air pollution.

Nottingham Health and Wellbeing Strategy and Environment Action Plan

Significant work been undertaken to ensure air quality and its health impacts are recognised in Nottingham and Nottinghamshire's Joint Strategic Needs Assessments, and improving air quality is prioritised for action within the Health and Wellbeing Strategy. Furthermore, actions to reduce emissions and improve air quality and health are included as an element of Nottinghamshire's NHS Sustainability and Transformation Plans.

In 2015 Nottingham City Council was one of the first Local Authorities in the UK to undertake a Joint Strategic Needs Assessment for Air Quality, and include actions to improve air quality and health in its recently published Health and Wellbeing Strategy (2016-2020) and accompanying action plans.

http://www.nottinghamcity.gov.uk/health-and-social-care/adult-social-care/looking-after-yourself-and-keeping-healthy/health-and-wellbeing-board/

Nottingham Local Transport Plan

Nottingham's local transport plan outlines the City Council's long term transport strategy. Please visit

http://www.nottinghamcity.gov.uk/transport-parking-and-streets/transport-strategies-funding-bids-and-current-consultations/

With respect to reducing nitrogen dioxide concentrations from traffic the transport plan and strategy has, or aims to:

- constrain traffic growth in the City area
- reduce traffic levels and congestion by developing a spatially (and temporally) comprehensive public transport network with integrated ticketing



- encourage and facilitate walking and cycling



- encourage and facilitate the transition to Zero and Ultra-low Emission Vehicles



Conclusions and Priorities

Monitoring data shows nitrogen dioxide concentrations within Nottingham City Council's two AQMAs are generally falling. Some locations show year on year variation, with some locations showing a significant increase in concentrations. However, all sites which met the annual mean AQO in 2015 continue to meet the AQO in 2016.

As breaches of the NO2 annual mean air quality objective have been measured outside the existing AQMAs, Nottingham will undertake a Detailed Assessment using monitoring information and air pollution dispersion modelling to determine the geographical extent of the exceedence of the AQO.

The Detailed Assessment is likely to lead to the variation or amalgamation and geographical extension of the existing Air Quality Management Areas.

The local (and conurbation wide) priority to improve air quality continues to be how to reduce levels of nitrogen dioxide.

The local priorities and challenges to improve air quality are to design and implement:

i. a low emission zone for the City, and how it can/will work most effectively with,

ii. the Ultra Low Emission Vehicle (ULEV) grant award,

iii. any future Clean Air Zone,

iv. continue and complete the transition to zero and low emission public transport (fully electric and compressed natural gas (CNG) fuelled buses),

v. Work with Nottingham's taxi companies to introduce low and zero emission vehciles.

vi. Further development/extension of Nottingham's Tram network (lines 4 and 5),

vii. Work with major employers to review vehicle use to reduce emissions

viii. Continue to roll-out/improve energy efficiency in Nottingham City Council's housing stock, when funding permits,

ix. Promote energy efficiency and the transition to/installation of alternative technologies that significantly reduce/negate NO2/NOx emissions in the commercial/industrial sector

Local Engagement and How to get involved

When burned in air, fossil fuels emit carbon dioxide, nitrogen oxides (NOx) – nitrogen oxide (NO) and nitrogen dioxide (NO_2), and particles (PM_{10} and $PM_{2.5}$).

Although it doesn't affect 'air quality' carbon dioxide is a greenhouse gas and contributes to climate change.

Nitrogen dioxide and particles adversely affect local air quality therefore reducing emissions of these pollutants will improve air quality.

Measures that can help to reduce emissions of air pollution and thereby improve air quality:-

Travel choices: walk, cycle, and public transport, journey/travel planning

Walking and cycling are called 'active travel' and have health benefits in addition to reducing air pollution. Follow the links below for more information:

Walking in Nottingham: http://www.nottinghamcity.gov.uk/transport-parking-and-streets/rights-of-way-walking-and-cycling/walking-in-nottingham/

Cycling in Nottingham: http://www.nottinghamcity.gov.uk/transport-parking-and-streets/rights-of-way-walking-and-cycling/cycling-in-nottingham/

Nottingham has a high quality public transport network located within the City, including the NET tram network as well as an established bus network with two major operators: Nottingham City Transport and Trent Barton.

Nottingham NET: http://www.thetram.net/

Nottingham City Transport: https://www.nctx.co.uk/

Trent Barton: https://www.trentbarton.co.uk/

A car club is a membership scheme that offers pay-as-you-go basis car rental, At the end of the journey you return your car to its dedicated on-street car club parking space. Nottingham currently has a network for 14 car club vehicles over 11 locations.

Nottingham Car Club: http://www.nottinghamcity.gov.uk/transport-parking-and-streets/public-transport/car-club/

Energy efficiency:

We use energy in the form of electricity or natural gas to heat our homes, cook and power electrical equipment. Insulating our homes and using energy efficient appliances reduces energy consumption and emissions, both at power stations and locally from domestic gas boilers and gas cookers.

Visit http://www.energysavingtrust.org.uk/ for ideas on home to save energy and money.

National Clean Air Day

On the 15th June Nottingham, together with other Cities across the UK, participated in the first National Clean Air Day. The aim of the day was to raise awareness about air pollution and what people could do to reduce emissions and their exposure to air pollution. Please visit https://www.cleanairday.org.uk/ and https://www.cleanairday.org.uk/Pages/Category/nottingham for more information.

For more information, to comment or complain about air pollution and air quality please visit

http://www.nottinghamcity.gov.uk/environmental-health-and-safer-housing/environmental-health-and-safer-places/air-pollution-and-air-quality/

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1 Local Air Quality Management

This report provides an overview of air quality and summary of air pollution monitoring data in Nottingham City Council during 2016. 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 exceedence 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 Nottingham City 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 Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedence or likely exceedence 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 Nottingham City Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=188 .

Alternatively, see Figure 1 or Appendix D: Map(s) of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at

https://uk-air.defra.gov.uk/aqma/details?aqma_id=698 (AQMA No. 2)

https://uk-air.defra.gov.uk/aqma/details?aqma_id=699 (AQMA No. 3)

and

Nottingham Insight: Nottingham's Local Air Quality Management reports

http://www.nottinghaminsight.org.uk/f/63682/Library/Environment/Air-Quality/

See the full list of Local Authority Air Quality Management Areas at

http://uk-air.defra.gov.uk/aqma/list

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 (inc. date of publication)
						At Declaration	Now	
AQMA No. 2 (Carter Gate Real Time Analyser)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	An area encompassing the City Centre arterial routes, roads and junctions including: A60, A610, A6002, A6005, A6008, A612 and properties fronting onto these roads.	NO	44 µg/m3	40 µg/m3	Local Transport Plan Implementation Plan 2015-2017 and 2016-2019 http://www.nottinghaminsight.org.uk/insight/search/unified_search.aspx?q=transport plan]
AQMA No. 2 (St Andrews Road RTA)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	41 ug/m3	39 ug/m3	
AQMA No. 2 (St Andrews Road Diffusion Tubes 24,25,26)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	41 ug/m3	36 ug/m3 36 ug/m3 34 ug/m3	

AQMA No. 2 (Canning Terrace Diffusion Tube 20)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A610	NO	51 ug/m3	49 ug/m3	
AQMA No. 2 (Carter Gate Diffusion Tube 20)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	41 ug/m3	40 ug/m3	
AQMA No.2 (Castle Boulevard DT 19)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A6002	NO	42 ug/m3	33 ug/m3	
AQMA No.2 (Castle Gardens DT 16)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A6002	NO	51 ug/m3	37 ug/m3	
AQMA No.2 (Mansfield Rd DT 23)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	45 ug/m3	46 ug/m3	

AQMA No. 2 (Trent Bridge Dt 28)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	42 ug/m3	39 ug/m3	
AQMA No. 2 (London Rd DT 45)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	42 ug/m3	53 ug/m3	
AQMA No. 2 (Station St DT 46)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	42 ug/m3	46 ug/m3	
AQMA No. 2 (Sheriffs Way DT 47)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	42 ug/m3	45 ug/m3	
AQMA No. 2 (Castle Blvd DT 49)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A60	NO	42 ug/m3	51 ug/m3	

AQMA No. 3	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	Beeston Road (A6005) and properties fronting onto it.	YES	42 µg/m3	35 µg/m3	Local Transport Plan Implementation Plan 2015-2017 and 2016-2019 http://www.nottinghaminsight.org.uk/insight/search/unified_search.aspx?q=transport plan]
AQMA No. 3 (Beeston Road DT 33)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A6005	YES	42 ug/m3	34 ug/m3	
AQMA No. 3 (Beeston Road DT 4)	Declared 2005, Amended 2010	NO2 Annual Mean	City of Nottingham	A6005	YES	41 ug/m3	32 ug/m3	

☒ **Nottingham City 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 Nottingham City Council

Defra's appraisal of last year's ASR concluded:

'The report is well structured, detailed, and provides the information specified in the Guidance. We recognise the detailed measures that have been developed within the local transport plan over recent years, including several high profile sustainable transport schemes within the City, that can expect to contribute to a strong public transport infrastructure over future years. However, the monitoring information provided within the ASR suggests there is still work to do, in order to achieve the air quality objectives, with a future focus on developing a Clean Air Zone in conjunction with Derby City Council.

1. On this basis, the action plan needs to reconsider the prioritisation of measures that can significantly impact on reducing pollution below objective levels on a clear understanding of current and future transport management within the city.

2. It will also be beneficial to review the level of further emissions reductions required at hotspot locations to achieve the air quality objectives, in order to inform the development of the measures within the new AQAP.

3. In relation to reporting, it will be helpful if the monitoring locations can be clearly identified in relation to the AQMA's, to assist in interpreting the results. Current monitoring results reported in Tables A2 and A3 suggests that there are eleven sites with relevant exposure that exceed the annual mean objective for nitrogen dioxide but that only three of these are within an AQMA.

4. If the designation of these monitoring sites are correct, these results suggest that the extent of the current AQMA needs reviewing. It may also be beneficial to review the current monitoring and assessment programme as a basis for providing a clear set of local indicators to aid in the assessment of further measures to achieve the air quality objectives.'

Nottingham City Council has taken forward a number of direct measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

More detail on these measures can be found in their respective Action Plans contained within the annual LTP Implementation Plan for 2017-2020: www.nottinghamshireinsight.org.uk/d/186911. Key completed measures are: the completion of the Creative Quarter public realm works, a successful application to be a Go Ultra Low City to promote the uptake of Low Emission Vehicles, completion of the NET Tram Extensions and Ring Road Major scheme. Further details regarding completed projects can be found in the LTP Annual Monitoring Report: http://www.nottinghaminsight.org.uk/d/184550.

Nottingham City Council expects the following measures to be completed over the course of the next reporting year: Nottingham Cycle City Ambition Programme, Boots Enterprise Zone Sustainable Transport Package, Southern Growth Corridor and City Centre Clear Zone. Nottingham City Council's priorities for the coming year are the Southside Transport Strategy (Broadmarsh) redevelopment works.

The principal challenges and barriers to implementation that Nottingham City Council anticipates facing are implementing the required measures within a coordinated manner, the impact of High Speed Two on travel in the conurbation and future funding uncertainties regarding local and major transport projects.

Although Nottingham City Council anticipates that the measures stated above and in Table 2.2 will help achieve compliance in AQMA Areas 2 and 3.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Nottingham City Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of AQMA Areas 2 and 3.

The additional modelling undertaken by DEFRA (Rapid PCM) indicates a longer stretch of the outer ring road that is unlikely to comply with the Air Quality Objectives.

With respect to the four points raised by the 2016 ASR appraisal:

1. The prioritisation of measures has been reviewed and remain under review
2. The level of emission reductions necessary will be considered further as part of the Detailed Assessment and Clean Air Zone scoping work.
3. The monitoring locations are now clearly indicated on a data map: Figure 1 and Appendix D.
4. A Detailed Assessment will be carried out. If appropriate the existing AQMAs may be varied and extended, or a new AQMA, encompassing the locations where monitoring/modelling identifies exceedence of any air quality objectives, or aligned with another appropriate geographic feature or boundary, declared.

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	Nottingham Cycle City Ambition Programme	Transport Planning and Infrastructure	Cycle Network	Nottingham City Council	2014/15	2015/16 – 2018/18	LTP Indicator: Cycle Index	Positive effect on Dunkirk and City Centre AQMAs	Works completed Western Cycle corridor, Work taking place on Eastern Corridor. Design work taking place of the other corridors.	March 2018	
2	Southside Transport Strategy (Broadmarsh)	Traffic Management	Strategic Highway Improvements, Reprioritising road space away from cars including Access management, selective vehicle priority, bus priority, high vehicle occupancy lane.	Nottingham City Council	2014/15 - 2015/16	January 2016-2020		Positive major effect on City Centre AQMA	Works on Southern Relief route works started on January 2016. Works to take place to enable alterations to traffic flow late 2016/ early 2017.	2020	
3	Southern Growth Corridor	Transport Planning and Infrastructure	Public Transport Improvements – interchanges, stations and services	Nottingham City Council	2015/16	2016/17 – 2017/18	LTP Indicator: Public Transport usage (Bus), Uptake of electric vehicles (VEH0131)	Positive effect on City Centre AQMA	Under construction.	March 2018	
4	Nottingham Enterprise Zone Sustainable Transport Package	Transport Planning and Infrastructure	Cycle Network	Nottingham City Council	2016/2017	2016/17 – 2017/18	Public Transport usage (Bus), LTP Indicator: Cycle Index	Nil	Currently at design stage.	March 2018	
5	Connecting Eastside Phase 2	Traffic Management	Strategic Highway Improvements, Reprioritising road space away from cars	Nottingham City Council	2017/18	2017/18 – 2018/19		Positive major effect on City Centre AQMA	Design work being undertaken at present. Exact implementation date to be determined	2020	

			including Access management, selective vehicle priority, bus priority, high vehicle occupancy lane.								
6	Smarter Travel Hubs / Access Fund	Promoting Travel Alternatives	Personalised Travel Planning	Nottingham City Council	2015	2015/16 – 2019/20	Specific outputs / behavioural change	City-wide effect	Procurement taking place for scheme	2020	
7	Park and Ride Electric Charging Points	Transport Planning and Infrastructure	Public Transport Improvements – interchanges, stations and services	Nottingham City Council	2015/16	2016/17 - 2018/19	LTP Indicator: Public Transport usage (Bus)	Positive Minor effect on City Centre AQMA	Procurement taking place of electric charging points	March 2018	
8	City Centre traffic management (Clear Zone / Broad Street Environs) Contribution	Traffic Management	UTC, Congestion Management, traffic reduction	Nottingham City Council	2016/17	2016/17		Minor positive effect on City Centre AQMA	Work taking place regarding TRO changes	March 2018	Scope of works have expanded to cover larger area.
9	Nottingham Workplace Parking Levy (WPL)	Traffic Management	Workplace Parking Levy, Parking Enforcement on Highway	Nottingham City Council	2011	2012 - onwards	WPL liable businesses, WPL compliance	City-wide effect	Ongoing	2037	
10	Midland Mainline Electrification	Transport Planning and Infrastructure	Public Transport Improvements – interchanges, stations and services.	Network Rail	2016 / 2017	2016 - 2023		Positive Minor effect on City Centre AQMA	Scheme reprogrammed post review. Works in Nottingham expected towards end of programme	2023	
11	A52 Nottingham Junctions Improvement	Traffic Management	Strategic Highway Improvements, Reprioritising road space away from cars including Access management, selective vehicle	Highways England	2016-19	2019 onwards		Impact on the Dunkirk AQMA (Area 3)		2021	

			priority, bus priority, high vehicle occupancy lane.								
12	M1 Smart Motorway	Traffic Management	Strategic Highway Improvements, Reprioritising road space away from cars including Access management, selective vehicle priority, bus priority, high vehicle occupancy lane.	Highways England	2017			Impact on AQMAs along M1 motorway (Greater Nottingham area)	Now on site.	2020	
13	Go Ultra Low Nottingham Programme	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Office of Low Emission Vehicles (OLEV)	2015	2016/17 – 2019/20		City-wide effect		2020	
14	Clean Air Zone	Promoting Low Emission Transport	Low Emission Zone (LEZ)	Joint Air Quality Unit	2017/18	2019/20		Likely positive effect. Scope/scale Unknown at present	Initial modelling and scoping of works underway.	2020	Dependent on DEFRA steer relating to Clean Air Zone scope.

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.

Nottingham City Council is taking and considering the following measures to address $PM_{2.5}$:

Existing measures are focused on

i. reducing emissions from transport by minimising/preventing traffic growth and encouraging/facilitating walking, cycling and use of public transport and

ii. on-going regulatory activity re Permitted Processes and Smoke Control Orders and bonfires, construction/demolition activity, and uncontrolled burning.

Additional measures being considered include:-

i. Reducing emissions from non-vehicle fixed and mobile sources and

ii. Planting to reduce weathering/entrainment of soil/surface particles and increasing green surface area for adsorption/impingement/entrapment of particles by foliage.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Nottingham City Council undertook automatic (continuous) monitoring at three sites during 2016. Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at https://uk-air.defra.gov.uk/data/data_selector

A data map showing the location of the monitoring sites is provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

Carter Gate NOx (CG), Carter Gate, City Centre

This unit has been located at Carter Gate monitoring since December 2003. The site is a suburban mixed commercial/residential area of the City adjacent to the A60. It is approximately 10 metres from the A60 which is a major traffic route and, approximately 3 metres from a busy B road. It is classed as a 'Roadside' site. There are residential properties approximately 12 metres from the unit and 8 metres away from the A60.

Lace Street NOx (LS), Lace Street, Dunkirk

This is a fixed unit located at Lace Street since March 2007. The site is a suburban, mixed commercial/residential area of the City adjacent to the A6005, a busy road traffic route. It is approximately 4 metres from the A6005 and 1 metre from a minor road and is classed as a 'Roadside' site. The unit is sited on the pavement at the boundary with a residential property and in-line with the facade building line.

St Andrews Road NOx (SA), St Andrew's Road, Mapperley

This site was established in June 2010 following the expansion of Nottingham City Council's Air Quality Management Area No.2. The monitoring unit is located on a small residential street - St Andrews Road, approximately 13 metres from the A60

Mansfield Road. The A60 is a major traffic route through the City, and south across the River Trent.

The SA NOx is a fixed unit sited on the pavement at the boundary of a residential property. It is classed as a 'Roadside' site.

3.1.2 Non-Automatic Monitoring Sites

Nottingham City Council undertook non- automatic (passive) monitoring of NO_2 at 49 sites during 2016. The additional 15 locations, mainly in the vicinity of Western Boulevard/Crown Island, was in response to DEFRA modelling that predicted a breach of the annual mean AQO beyond 2020, and to gather more detailed monitoring data to assist with any future Clean Air Zone implementation and LAQM air quality assessment.

Appendix A Table A.2 shows the details of the 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)

Nottingham City Council conducts nitrogen dioxide monitoring in 47 different locations (4 diffusion tubes are co-located with real time analysers, 1 tube is not in a relevant/sensitive location) as detailed in Table A.1 and table A.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 2016 dataset of monthly mean values is provided in Appendix B.

Table A.4 in Appendix A 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.

None of the diffusion tubes show a calculated annual mean of over 60 ug/m3 and therefore are not considered likely to have monitored an exceedance of th e1 hour objective.

Of the 16 new monitoring locations 9 meet the annual mean AQO. Of the 7 which breach the objective, 4 are located immediately adjacent to the stretch of the ring road predicted by DEFRA modelling as likely to be in breach of the AQO in 2020.

It is a moot point as to whether the 4 locations in the vicinity of the ring road that currently breach the annual mean air quality objective are ‘sensitive receptors’ in that although they are places where people may be regularly exposed (e.g. footpath/crossing location and used for comparison for compliance with the EU directive), they do not strictly satisfy the LAQM criteria for where the annual mean objective should apply (TG16 Box 1.1) Appendix E.2.

3.2.2 Particulate Matter (PM_{10})

Nottingham City Council does not undertake its own monitoring for PM_{10}. However, monitoring is undertaken at the DEFRA AURN station located in the City centre and therefore reported here. Monitoring since 2011, when the PM_{10} FDMS, unit was installed, shows levels meet both annual mean and daily mean air quality objectives.

Table A.5 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.

3.2.3 Particulate Matter ($PM_{2.5}$)

Nottingham City Council does not undertake its own monitoring for PM2.5. However, monitoring is undertaken at the DEFRA AURN station located in the City centre and therefore reported here. Monitoring since 2011, when the PM2.5 FDMS, unit was installed, shows levels meet the air quality target.

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

3.2.4 Sulphur Dioxide (SO_2)

Nottingham City Council does not undertake its own monitoring for sulphur dioxide. However, monitoring is undertaken at the DEFRA AURN station located in the City centre and therefore reported here. Monitoring shows levels meet all air quality objectives.

Table A.8 in Appendix A compares the ratified continuous monitored SO_2 concentrations for year 2016 with the air quality objectives for SO_2.

3.3 Conclusion

Inside the Air Quality Management Areas

In general both real time and diffusion tube monitoring shows the annual mean nitrogen dioxide concentrations continue to decline.

There are some locations (Canning Terrace/Derby Road, London Road and Castle Boulevard where congestion from construction activity and changes to the road network and capacity as part of the implementation of the local transport plan are likely to have led to the measured increases.

This suggests that in general the measures in the local transport plan are contributing to the reduction in measured concentrations in the AQMAs.

Outside the Air Quality Management Areas

Monitoring data from a number of diffusion tubes outside the two existing Air Quality Management Areas indicate exceedences of the NO2 annual mean air quality objective and the need to conduct a detailed assessment to determine the full extent and explore (in conjunction with a Clean Air Zone) the need for additional measures to reduce concentrations of NO2 across a larger geographical area and road network.

Next steps

As breaches of the NO2 annual mean air quality objective have been measured outside the existing AQMAs, Nottingham will undertake a Detailed Assessment using monitoring information and air pollution dispersion modelling to determine the geographical extent of the exceedence of the AQO.

The Detailed Assessment is likely to lead to the variation or amalgamation and geographical extension of the existing Air Quality Management Areas and will be progressed during 2017 and early 2018.

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)
CG NOx	Carter Gate	Roadside	457946	339668	NO2 NO NOx	Y	Chemiluminescent	12	4	2.5
LS NOx	Lace Street	Roadside	454941	338315	NO2 NO NOx	Y	Chemiluminescent	3	9	1.5
SA NOx	St. Andrews Road	Roadside	456967	341382	NO2 NO NOx	Y	Chemiluminescent	12	13	1.7
CC AURN	Clinton St East.	Urban background	457437	340049	PM2.5,PM10 NO2, NO, NOx O3 SO2	N	FDMS, FDMS Chemiluminescent Ultra Violet Absorption (UVA) Ultra Violet Fluorescence (UVF)	0	35	3
WB AURN	Western Boulevard	Kerbside	454573	341643	PM10 NO2	NO	FDMS Chemiluminescent	15	1	2.5

Notes:

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

(2) N/A if not applicable.

Table A.2 – 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)
1	Woodside Road	Roadside	452796	338216	NO_2	Y	0	10	N	2
2	Derby Road	Roadside	454522	338938	NO2	N	0	23	N	2
3	Marlborough Street	Roadside	455207	338269	NO2	N	0	5	N	2
4	Beeston Rd	Roadside	454782	338146	NO2	Y	0	10	N	2
5	Abbey Street	Roadside	455153	338510	NO2	N	0	5	N	2
6	Western Blvd	Roadside	454466	340111	NO2	N	0	17	N	2
7	Wilkinson St	Roadside	454829	342014	NO2	N	0	21	N	2
8	Nottingham Rd	Roadside	455573	342860	NO2	N	0	13	N	2
9	Nottingham Road	Roadside	455605	342838	NO2	N	0	3	N	2
10	Valley Road	Roadside	455533	342826	NO2	N	0	7	N	2
11	Danethorpe Vale	Roadside	457250	343815	NO2	N	0	17	N	2
12	Bentinck Rd - Sch	Roadside	455808	340799	NO2	N	0	6	N	2
13	Ilkeston Road	Roadside	455435	340136	NO2	N	0	3	N	2
14	Ilkeston Road	Roadside	455494	340142	NO2	N	0	4	N	2

15	Gregory Blvd	Roadside	455358	341086	NO2	N	0	10	N	2
16	Castle Gardens	Roadside	455870	339133	NO2	N	0	3	N	2
17	Castle Boulevard	Roadside	455861	339133	NO2	N	0	5	N	2
18	LP 3P17 Park Road	Roadside	455809	339178	NO2	N	4	27	N	2
19	Castle Blvd	Roadside	456852	339303	NO2	Y	0	4	N	2
20	Canning Terrace	Roadside	456399	340191	NO2	Y	0	5	N	2
21	Maid Marian Way	Roadside	457092	339641	NO2	N	0	3	N	2
22	LP 80A01 Alfreton Rd	Roadside	456160	340389	NO2	N	0	3	N	2
23	Mansfield Rd	Roadside	457105	340947	NO2	Y	0	2	N	2
24	St Andrew's Rd B	Roadside	456967	341382	NO2	Y	12	16	Y	1.5
25	St Andrew's Rd M	Roadside	456967	341382	NO2	Y	12	16	Y	1.5
26	St Andrew's Rd T	Roadside	456967	341382	NO2	Y	12	16	Y	1.5
27	Cartergate	Roadside	457959	339681	NO2	Y	0	8	N	2
28	Trent Bridge	Roadside	458051	338328	NO2	Y	0	2	N	2
29	Meadow Lane	Roadside	458464	339010	NO2	N	0	3	N	2
30	LP 53890 Manvers Street	Roadside	458081	339896	NO2	N	0	3	N	2

31	Middleton Boulevard	Roadside	454371	339945	NO2	N	0	17	N	2
32	Middleton Boulevard	Roadside	454496	339432	NO2	N	0	19	N	2
33	Lace Street NOx RTA	Roadside	654941	338315	NO2	Y	0	7	Y	2
34	Bradbourne Avenue	Roadside	456367	336428	NO2	N	0	25	N	2
35	Wollaton Road	Roadside	454587	340087	NO2	N	0	2	N	2
36	Western Boulevard Pedestrian Crossing	Roadside	454436	340111	NO2	N	0	2	N	2
37	Wollaton Road Subway	Roadside	454336	340056	NO2	N	0	2	N	2
38	Wollaton Road	Roadside	454247	340047	NO2	N	0	3	N	2
39	Crown Island Crossing	Roadside	454253	340034	NO2	N	0	0	N	2
40	Middleton Boulevard / Crown Island	Roadside	454321	339928	NO2	N	0	2	N	2
41	Crossing Middleton Boulevard/	Roadside	454313	339989	NO2	N	0	3	N	2

	Crown Island									
42	Inside Property, Derby road	-	455453	339602	NO2	N	N/A	N/A	N	2
43	Outside Property, Derby Road	Roadside	455453	339602	NO2	N	0	10	N	2
44	Parking Post Cliff Road	Roadside	457775	339530	NO2	Y	0	2	N	2
45	London Road	Roadside	457870	339530	NO2	Y	0	3	N	2
46	Hicking Building Queens Road	Roadside	457729	339122	NO2	Y	0	3	N	2
47	Sheriffs Way/ Railway Station	Roadside	457402	339145	NO2	N	0	0	N	2
48	Kinglake Place	Roadside	457158	338950	NO2	N	0	1	N	2
49	Castle Boulevard	Roadside	457150	339384	NO2	Y	0	3	N	2

Notes:

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

(2) N/A if not applicable.

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 2016 (%) [2]	NO_2 Annual Mean Concentration (µg/m^3) [3]				
					2012	2013	2014	2015	2016
CG NOx	Roadside	Automatic	94	94	**42**	**44**	39	37	40
LS NOx	Roadside	Automatic	94	94	40	38	37	37	35
SA NOx	Roadside	Automatic	95	95	**44**	**43**	38	39	39
CC AURN	Urban background	Automatic	96	96	37	37	34	32	31
WB AURN	Kerbside	Automatic	83	83	-	-	-	-	39
1	Roadside	Diffusion Tube	100	100	**-**	**-**	38	38	34
2	Roadside	Diffusion Tube	100	100	-	-	28	30	27
3	Roadside	Diffusion Tube	100	100	-	-	31	25	25
4	Roadside	Diffusion Tube	100	100	**41**	40	37	33	31
5	Roadside	Diffusion Tube	100	100	-	-	33	36	33
6	Roadside	Diffusion Tube	100	100	33	33	32	31	30
7	Roadside	Diffusion Tube	100	100	36	32	31	31	31
8	Roadside	Diffusion Tube	100	100	**42**	37	39	38	38
9	Roadside	Diffusion Tube	100	100	-	36	**42**	**42**	**41**
10	Roadside	Diffusion Tube	100	100	-	35	38	39	38

11	Roadside	Diffusion Tube	100	100	31	29	30	30	28
12	Roadside	Diffusion Tube	92	92	39	36	35	32	37
13	Roadside	Diffusion Tube	100	100	-	-	36	36	34
14	Roadside	Diffusion Tube	92	92	-	-	**45**	**41**	**46**
15	Roadside	Diffusion Tube	100	100	33	32	32	36	31
16	Roadside	Diffusion Tube	83	83	**51**	**49**	**52**	**48**	37
17	Roadside	Diffusion Tube	92	92	-	-	**42**	**48**	38
18	Roadside	Diffusion Tube	100	100	-	-	32	32	29
19	Roadside	Diffusion Tube	92	92	**45**	40	40	37	34
20	Roadside	Diffusion Tube	100	100	**57**	**52**	**50**	**48**	**48**
21	Roadside	Diffusion Tube	92	92	-	-	**44**	**44**	**45**
22	Roadside	Diffusion Tube	83	83	-	-	**48**	**41**	**44**
23	Roadside	Diffusion Tube	92	92	-	-	**45**	**43**	**44**
24	Roadside	Diffusion Tube	100	100	-	-	40	38	36
25	Roadside	Diffusion Tube	100	100	-	-	39	38	35
26	Roadside	Diffusion Tube	83	83	-	-	**41**	39	34

27	Roadside	Diffusion Tube	100	100	-	-	**41**	**42**	**40**
28	Roadside	Diffusion Tube	92	92	-	**42**	**42**	37	38
29	Roadside	Diffusion Tube	100	100	-	-	**44**	**42**	**44**
30	Roadside	Diffusion Tube	100	100	-	-	**45**	**41**	**43**
31	Roadside	Diffusion Tube	100	100	-	-	28	31	29
32	Roadside	Diffusion Tube	92	92	-	-	23	26	27
33	Roadside	Diffusion Tube	100	100	-	-	-	-	32
34	Roadside	Diffusion Tube	100	100	-	-	-	-	28
35	Roadside	Diffusion Tube	100	75	-	-	-	-	**43**
36	Roadside	Diffusion Tube	100	75	-	-	-	-	**48**
37	Roadside	Diffusion Tube	100	75	-	-	-	-	**41**
38	Roadside	Diffusion Tube	100	75	-	-	-	-	35
39	Roadside	Diffusion Tube	100	75	-	-	-	-	**42**
40	Roadside	Diffusion Tube	88	67	-	-	-	-	23
41	Roadside	Diffusion Tube	88	67	-	-	-	-	35
42	-	Diffusion Tube	100	75	-	-	-	-	33

43	Roadside	Diffusion Tube	100	75	-	-	-	-	32
44	Roadside	Diffusion Tube	88	67	-	-	-	-	27
45	Roadside	Diffusion Tube	100	75	-	-	-	-	**52**
46	Roadside	Diffusion Tube	100	75	-	-	-	-	**45**
47	Roadside	Diffusion Tube	100	75	-	-	-	-	**45**
48	Roadside	Diffusion Tube	88	67	-	-	-	-	18
49	Roadside	Diffusion Tube	100	75	-	-	-	-	**50**

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

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

☒ **If applicable, all 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.**

(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.

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 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
CG NOx	Roadside	Automatic		99	0	0	0	0	0
LS NOx	Roadside	Automatic		94	0	0	0	0	0
SA NOx	Roadside	Automatic		97	0	0	0	0	0
CC AURN	Urban Background	Automatic		99	0	0	0	0	0
WB AURN	Kerbside	Automatic		83	-	-	-	-	0(138)

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 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
CC AURN	Urban Background	-	96	22	21	21	17	17
WB AURN	Kerbside	-	78	-	-	-	-	20

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

Notes:

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ 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.

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
CC AURN	Urban Background	-	95	0	0	0	0	0
W AURNB	Kerbside	-	78	-	-	-	-	0

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.

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
				2012	2013	2014	2015	2016
AURN	Urban Background	-	96	12	12	12	11	12

☒ **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.

Table A.8 – SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	Number of Exceedances 2016 (percentile in bracket) [3]		
				15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
AURN	Urban Background		99	0	0	0

Notes:

Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(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 relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2016

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.97) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
1	37.2	42.4	20.0	40.0	32.0	37.9	31.0	32.5	34.1	36.5	42.9	41.6	35.7	34.6	34.6
2	33.1	40.6	16.0	26.3	20.8	27.8	24.9	17.9	27.8	27.9	36.0	40.3	28.3	27.4	27.4
3	24.1	31.2	14.9	26.1	22.7	23.8	16.2	25.1	25.7	29.5	33.0	37.9	25.8	25.1	25.1
4	33.5	40.4	19.2	29.1	25.0	33.3	27.7	26.9	35.7	25.1	47.5	48.2	32.6	31.7	31.7
5	39.6	41.0	21.3	34.6	30.8	33.7	38.1	25.2	33.1	31.5	42.1	41.8	34.4	33.4	33.4
6	27.7	37.8	19.0	30.0	24.9	31.8	30.7	26.8	30.5	30.5	42.1	38.5	30.9	29.9	29.9
7	33.4	35.2	18.0	29.2	24.9	30.9	31.6	32.3	29.9	27.6	48.3	41.9	31.9	31.0	31.0
8	38.5	42.1	21.8	39.1	33.0	41.5	36.5	38.7	37.8	43.3	45.4	52.5	39.2	38.0	38.0
9	43.3	44.6	23.5	42.4	38.5	48.9	46.2	32.1	45.2	45.6	52.1	53.7	43.0	**41.7**	**41.7**
10	34.0	46.7	20.0	40.1	37.3	43.3	35.1	27.6	43.3	43.2	47.4	51.6	39.1	38.0	38.0
11	27.4	37.9	17.0	28.3	23.4	29.7	31.9	23.0	30.7	24.0	38.5	41.2	29.4	28.5	28.5
12	34.0	40.9	21.3	37.0	30.2	41.0	31.3	0.0	59.7	36.2	46.3	48.4	38.7	37.6	37.6
13	31.9	38.1	20.0	35.7	34.5	38.7	44.5	27.4	33.5	39.6	42.1	44.8	35.9	34.8	34.8
14	44.5	50.3	28.2	47.4	49.3	53.6	0.0	40.9	47.2	52.0	55.5	63.1	48.4	**46.9**	**46.9**
15	33.3	35.4	19.0	32.6	26.2	32.0	31.1	28.0	30.0	31.7	39.5	45.1	32.0	31.0	31.0
16	49.7	50.7	24.0	45.2	36.3	38.5	32.4	30.4	35.6	35.1	0.0	0.0	37.8	36.7	36.7

17	45.8	0.3	46.7	39.8	33.3	39.1	36.1	33.4	37.4	37.2	45.8	48.0	40.2	39.0	39.0
18	31.1	32.5	18.1	28.1	22.2	29.5	26.2	23.9	29.4	28.8	45.8	41.4	29.8	28.9	28.9
19	38.9	41.2	22.3	39.1	29.9	34.1	29.0	25.8	30.4	34.1	0.0	45.8	33.7	32.7	32.7
20	43.2	50.5	34.5	57.2	58.7	58.3	40.2	40.8	44.7	57.6	63.2	61.6	50.9	**49.3**	**49.3**
21	40.0	45.3	25.1	52.9	27.2	55.4	0.0	40.5	42.7	50.2	55.4	57.0	44.7	**43.4**	**43.4**
22	38.8	43.1	25.2	51.0	0.0	0.0	31.4	31.9	37.8	56.0	79.7	84.2	47.9	**46.5**	**46.5**
23	45.5	46.7	27.0	48.9	0.0	52.8	36.4	37.9	51.8	51.8	55.3	64.0	47.1	**45.7**	**45.7**
24	41.9	47.1	19.4	35.0	22.1	37.7	41.8	33.4	39.8	29.4	45.4	47.7	36.7	35.6	35.6
25	39.5	43.1	21.9	36.6	30.1	40.2	39.3	32.5	37.7	30.4	44.2	51.2	37.2	36.1	36.1
26	0.0	0.0	21.0	32.8	31.3	39.1	41.3	30.4	36.4	30.0	37.7	46.0	34.6	33.5	33.5
27	44.0	41.1	23.9	43.8	35.2	43.8	33.4	38.5	38.3	39.9	55.2	56.2	41.1	39.9	39.9
28	38.8	42.6	21.5	37.7	31.1	46.0	36.3	0.0	30.2	38.3	56.8	61.4	40.1	38.9	38.9
29	37.2	51.1	25.2	52.2	46.9	50.2	43.4	38.5	47.7	45.4	59.2	59.1	46.4	**45.0**	**45.0**
30	47.4	50.6	27.6	46.5	44.8	51.1	42.4	39.6	44.8	46.8	58.2	58.6	46.5	**45.1**	**45.1**
31	29.1	34.7	18.1	28.7	26.4	29.8	25.6	23.2	30.0	29.6	38.2	40.3	29.5	28.6	28.6
32	30.2	28.3	19.5	21.1	20.2	22.4	20.9	0.0	23.6	31.8	39.9	43.7	27.4	26.6	26.6
33	36.2	41.0	14.1	35.3	31.5	34.2	32.1	20.0	35.6	39.1	48.4	54.5	35.2	34.1	34.1
34	29.9	32.0	18.3	24.9	22.3	25.1	27.0	32.4	27.1	25.3	36.4	36.0	28.1	27.2	27.2
35	0.2	0.3	0.0	36.6	34.1	58.6	62.9	30.2	34.6	35.7	47.9	52.6	43.7	**42.4**	**42.4**
36	0.0	0.0	0.0	47.4	45.3	42.3	46.9	39.5	48.8	42.8	66.6	72.1	50.2	**48.7**	**48.7**
37	0.0	0.0	0.0	0.0	32.1	35.8	40.7	34.8	38.5	36.7	57.0	54.1	41.2	40.0	40.0
38	0.0	0.0	0.0	30.8	29.7	35.8	29.2	28.2	34.6	33.2	39.5	55.7	35.2	34.1	34.1
39	0.0	0.0	0.0	40.8	38.2	45.0	30.6	32.7	44.2	43.0	58.0	68.0	44.5	**43.2**	**43.2**
40	0.0	0.0	0.0	35.1	46.7	39.9	0.0	27.9	34.8	47.6	44.8	0.0	23.9	23.2	23.2
41	0.0	0.0	0.0	54.4	56.4	59.4	0.0	39.5	53.5	55.5	70.4	64.4	37.8	35.4	35.4
42	0.0	0.0	0.0	27.6	31.6	35.5	26.9	24.1	29.1	38.2	45.4	44.8	33.7	32.7	32.7
43	0.0	0.0	0.0	27.8	26.1	28.4	23.3	22.8	26.7	34.5	42.4	45.3	30.8	29.9	29.9

44	0.0	0.0	0.0	0.0	27.2	39.7	30.7	32.5	42.0	42.3	55.2	55.2	27.4	26.3	26.3
45	0.0	0.0	0.0	33.1	38.5	66.5	49.6	44.3	59.4	51.2	74.0	70.6	54.1	**52.5**	**52.5**
46	0.0	0.0	0.0	27.2	32.1	51.8	36.5	43.8	57.7	46.0	64.1	62.8	46.9	**45.5**	**45.5**
47	0.0	0.0	0.0	34.3	37.6	49.0	52.3	36.3	43.4	49.7	56.1	61.9	46.7	**45.3**	**45.3**
48	0.0	0.0	0.0	17.6	20.0	26.1	0.0	19.3	26.5	33.5	44.2	42.6	18.5	17.9	17.9
49	0.0	0.0	0.0	34.1	40.8	50.6	52.3	42.5	43.5	57.6	78.0	69.8	52.1	**50.6**	**50.6**

☐ **Local bias adjustment factor used (national bias adjustment used please see appendix C)**

☒ **National bias adjustment factor used**

☒ **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) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

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

QA/QC for Diffusion Tube Monitoring

Gradko International supply and analyse Nottingham City Council's diffusion tubes. The organisation is UKAS accredited and is assessed annually for compliance to ISO 17025 and participates in other proficiency schemes.

Gradko have confirmed that their procedures follow the guidance issued on behalf of Defra (AEA Energy & Environment, Feb 2008) relating to the preparation, extraction, analysis and calculation procedures for passive NO_2 diffusion tubes

Gradko participate in a number of QA/QC monitoring systems to demonstrate satisfactory performance including the Workplace Analysis Scheme for Proficiency (WASP) programme to ensure uniformity in data throughout the year.

Precision vs Accuracy (Bias)

A further aspect of QA/QC for a laboratory is the reproducibility of results i.e. precision. Precision should not be confused with accuracy. Diffusion tube precision can be described as the ability of a measurement to be consistently reproduced, i.e. how similar the results of duplicate or triplicate tubes are to each other.

Accuracy represents the ability of the measurement to represent the 'true' value, which for the monitoring results, is defined as the results from the automatic analysers. When averaged over a number of sets of results bias can be evident. This represents the overall tendency of the diffusion tubes to depart from the 'true' value, i.e. to systematically over-or under-read when compared against the reference method.

Once identified, bias can be adjusted for to improve the accuracy of diffusion tube results. This is done using bias adjustment factors which have been found to be specific to a laboratory and tube preparation method. See Appendix A subsection A-1 above.

Unlike bias, poor precision cannot be adjusted for. It can only be improved by careful handling of the tubes in both the laboratory and the field.

The LAQM website provides a link to the summary of precision results for individual laboratories - **Summary of Diffusion Tube Precision 2008-2016**. It can be downloaded as a PDF from http://laqm.defra.gov.uk/diffusion-tubes/precision.html.

The 2016 precision rating for Gradko supplied/analyzed diffusion tubes was 'good'. This precision reflects the laboratory's performance/consistency in preparing and analyzing the tubes, as well as the subsequent handling of the tubes in the field.

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	04/01/2016	03/02/2016	41.9	39.5		41	1.7	4	15.7	42	96	Good	Good
2	03/02/2016	02/03/2016	47.1	43.1		45	2.9	6	25.7	43	97	Good	Good
3	02/03/2016	31/03/2016	19.4	21.9	21.0	21	1.3	6	3.1	44	82	Good	Good
4	31/03/2016	26/04/2016	35.0	36.6	32.8	35	1.9	5	4.7	36	97	Good	Good
5	26/04/2016	07/06/2016	22.1	30.1	31.3	28	5.0	18	12.3	34	97	Good	Good
6	07/06/2016	30/06/2016	37.7	40.2	39.1	39	1.3	3	3.1	36	94	Good	Good
7	30/06/2016	29/07/2016	41.8	39.3	41.3	41	1.3	3	3.2	35	97	Good	Good
8	29/07/2016	24/08/2016	33.4	32.5	30.4	32	1.6	5	3.9	29	97	Good	Good
9	24/08/2016	28/09/2016	39.8	37.7	36.4	38	1.7	5	4.3	36	97	Good	Good
10	28/09/2016	26/10/2016	29.4	30.4	30.0	30	0.5	2	1.3	32	97	Good	Good
11	26/10/2016	30/11/2016	45.4	44.2	37.7	42	4.1	10	10.3	45	96	Good	Good
12	30/11/2016	04/01/2017	47.7	51.2	46.0	48	2.7	6	6.6	45	96	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

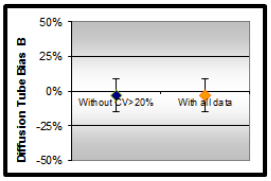
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Nottingham City: St Andrews Road

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 12 periods of data	
Bias factor A	1.04 (0.93 - 1.18)
Bias B	-4% (-15% - 8%)
Diffusion Tubes Mean:	37 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	38 μgm^{-3}
Data Capture for periods used:	95%
Adjusted Tubes Mean:	38 (34 - 43) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	1.04 (0.93 - 1.18)
Bias B	-4% (-15% - 8%)
Diffusion Tubes Mean:	37 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	38 μgm^{-3}
Data Capture for periods used:	95%
Adjusted Tubes Mean:	38 (34 - 43) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/17

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 spreadhseet 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 2017

LAQM Helpdesk Website

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

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

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[2] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[4]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2016	R	Gateshead Council	12	29	26	10.5%	G	0.90
Gradko	20% TEA in water	2016	R	Gateshead Council	11	35	37	-6.0%	G	1.06
Gradko	20% TEA in water	2016	R	Gateshead Council	12	37	31	19.0%	G	0.84
Gradko	20% TEA in water	2016	R	Wokingham Borough Council	11	45	41	9.0%	G	0.92
Gradko	20% TEA in water	2016	R	Wokingham Borough Council	11	37	34	9.5%	G	0.91
Gradko	20% TEA in water	2016	R	Cheshire West and Chester	12	37	39	-5.3%	G	1.06
Gradko	20% TEA in water	2016	R	Thurrock Borough Council	12	29	26	11.0%	G	0.90
Gradko	20% TEA in water	2016	R	Borough Council of King's Lynn & West Norfolk	11	30	25	18.2%	G	0.85
Gradko	20% TEA in water	2016	UB	Eastleigh Borough Council	11	29	30	-4.7%	G	1.05
Gradko	20% TEA in water	2016	R	Eastleigh Borough Council	12	44	42	2.9%	G	0.97
Gradko	20% TEA in water	2016	R	Brighton & Hove City Council	12	52	48	8.8%	G	0.92
Gradko	20% TEA in water	2016	R	Eastleigh Borough Council	11	29	37	-22.0%	G	1.28
Gradko	20% TEA in water	2016	KS	Marylebone Road Intercomparison	12	99	79	25.2%	G	0.80
Gradko	20% TEA in water	2016	R	Monmouthshire County Council	11	39	34	16.6%	G	0.86
Gradko	20% TEA in Water	2016	R	Preston City Council	10	30	27	10.0%	G	0.91
Gradko	20% TEA in water	2016	B	Breckland	12	11	26	-55.3%	G	2.24
Gradko	20% TEA in water	2016	R	Dudley MBC	12	37	34	11.0%	G	0.90
Gradko	20% TEA in water	2016	UB	Dudley MBC	12	26	22	18.6%	G	0.84
Gradko	20% TEA in water	2016	R	Dudley MBC	11	43	38	12.4%	G	0.89
Gradko	20% TEA in water	2016	R	Dudley MBC	12	51	54	-5.6%	G	1.06
Gradko	20% TEA in water	2016	B	LB Waltham Forest	12	31	30	2.3%	G	0.98
Gradko	20% TEA in water	2016	R	NOTTINGHAM CITY COUNCIL	12	37	39	-5.4%	G	1.06
Gradko	20% TEA in water	2016		Overall Factor[3] (22 studies)				Use		0.97

QA/QC Information for Automatic Monitoring

Quality Control, Maintenance, Calibration

AURN Site

The analysers at the AURN site are subject to a four weekly calibration regime. The calibrations are undertaken by a trained local site operator (LSO) and conducted in accordance with the Local Site Operators' Manual.

CG NOx, LS NOx and SA NOx Sites

At Nottingham City Council's CG NOx, LS NOx and SA NOx sites calibrations are carried out fortnightly. The calibrations, using zero air and span gases, are undertaken by the LSOs that prior to 2016 were also the LSOs for the City Centre AURN site. Calibrations are conducted using the same principles and procedures as given in the AURN LSO Manual.

The equipment is fully serviced every six months by EnviroTechnology Services plc, Gloucester.

Calibration Gas Traceability

AURN Site

Calibration gases used in the AURN are supplied by AIR Liquide who have demonstrated compliance with relevant quality control procedures in the preparation of gas mixtures. The gas mixtures are certified by AEA Energy & Environment.

CG NOx, LS NOx and SA NOx Sites

Calibration gases used in the CG NOx, LS NOx and SA NOx monitoring sites are supplied by AIR Liquide who have demonstrated compliance with relevant quality control procedures in the preparation of gas mixtures. The gases are supplied with a certificate of analysis.

Data Collection and Processing

AURN Site

The AURN station's data is continuously interrogated by Bureau Veritas the Central Management and Co-ordination Unit (CMCU). The data obtained is validated by CMCU and passed to the Data Dissemination Unit (DDU).

Information about the AURN station and available data can be found on the internet at http://uk-air.defra.gov.uk

CG NOx, LS NOx and SA NOx Sites

During 2016 data collection, validation and ratification was carried out by Air Quality Data Management Ltd.

Throughout 2016, data from the CG NOx, LS NOx and SA NOx sites was polled remotely directly from the analysers and collected as 15 minute averages using Envista ARM data collection software. The data has been scaled and converted into hourly (or other values) using the Envista ARM data management system.

The software allows users to remotely view, analyse, report and distribute environmental quality data. Manipulation of raw data to verified data can be conducted in a structured approach.

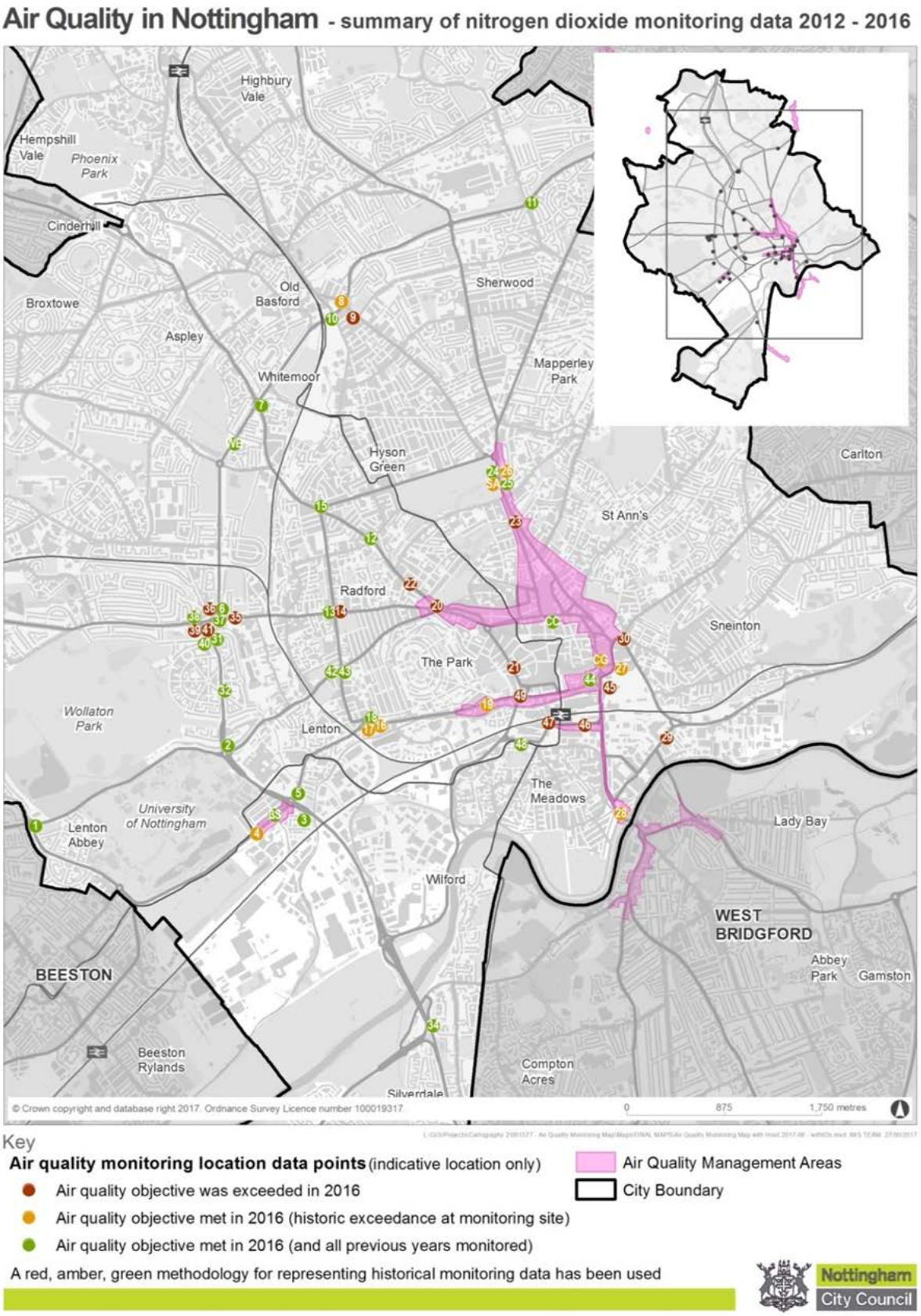
Data validation is carried out and involves screening the scaled values to identify unusual measurements, errors due to equipment failure etc. and flagging them for further investigation.

Data ratification is carried out monthly. This involves looking at the data more closely and includes:

- examination of calibration records to ensure correct application of calibration factors;
- examination of data for other pollutants and monitoring sites to highlight any anomalies;
- deletion of data shown from chart or other records to be spurious, for example, spikes generated by the analyser;
- correction of any baseline drift as indicated by examination of daily automatic calibration records.

Once this process has been carried out and data has been verified, amended or rejected as appropriate, the data is ratified. This final data set is used for the R & A process.

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



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	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

Table E.2 – Examples of Where the Air Quality Objectives Should Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties[9].	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes	

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

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
…	…

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