GMCA GREATER MANCHESTER COMBINED AUTHORITY

2018 Air Quality Annual Status Report (ASR)

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

June 2019

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Executive Summary: Air Quality in Our Area

Air Quality in Greater Manchester

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 Greater Manchester Air Quality Working Group, led by Transport for Greater Manchester (TfGM), represents the ten authorities that constitute the Greater Manchester Combined Authority (GMCA). These authorities are Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, and Wigan. These are also the main members of the Association of Greater Manchester Authorities (AGMA). The Combined Authority, shares the same statutory powers for Local Air Quality Management (LAQM) Sections 82 to 84 of the Environment Act 1995 as the Greater Manchester local authorities.

Greater Manchester has a population of over 2.7 million residents over an area of approximately 500 square miles. Within the conurbation there is a mix of high-density urban areas, suburbs, semi-rural and rural locations, and the area is characterised by the strong regional centre of Manchester, The Quays and Trafford Park.

Long term trends show that there has been an improvement in air quality but areas still remain above the annual mean air quality objective for Nitrogen Dioxide (NO_2).

The assessment of monitoring data shows that real time monitoring data for the NO_2 annual mean objective broadly confirms the Air Quality Management Area (AQMA) boundaries declared in 2016. Exceedances were noted at several roadside monitoring sites. Recent modelling showed that the extent of previous exceedances, and therefore the previously declared AQMAs, reduced in size due to falling NO_2 emissions, but

[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

measurements in some areas, particularly those close to the M60, show that concentrations of NO_2 experienced at the roadside have not gone down as expected. This is thought to be largely due to diesel cars having higher emissions 'in the real world' than was anticipated and the fact that there are now more of them on the road. The new single AQMA was designated on the 1st May 2016 for the whole of Greater Manchester and reflects the location of the motorways, major roads and urban areas. In terms of the effect on people, this is greatest where high density residential areas coincide with major highways.

Three automatic sites out of the 16 in Greater Manchester exceeded the NO_2 annual mean objective of 40µg/m^3 in 2018. These three sites were Salford M60, Manchester Oxford Road, and Tameside Mottram Moor. Bury Prestwich and Stockport Cheadle A34, which both exceeded legal limits in 2017, are now below the annual mean objective for NO_2 with annual mean concentrations of 38µg/m^3 and 37µg/m^3 respectively.

The number of exceedances of the NO_2 1-hour mean objective (200µg/m^3) at the Manchester Oxford Road site reduced to 2 in 2018, from 6 in 2017 and a peak of 90 in 2016. An investigation concluded that this elevated number of exceedances were the result of an increase in buses being stationary on Oxford Road adjacent to the monitoring station because of significant roadworks and road closures causing diversions. During early 2017, TfGM implemented a £122m Bus Priority Package, which enables cross-city bus services to run directly through Manchester city centre. Oxford Road has had significant road layout alterations, and general traffic is now prohibited from travelling through new 'bus gates' that restrict access between 6am and 9pm, 7 days a-week. As a result of the road layout changes, traffic flow has improved past the monitoring site.

Measurements from the Greater Manchester's diffusion tube network confirms there are locations that continue to be above the annual mean NO_2 air quality objective.

Real time monitoring data for PM_{10} (particulate matter - less than 10 microns) shows that annual average objectives are not exceeded. 13 sites have displayed small increases in annual mean concentrations, and no sites had more than 35 occurrences of the daily mean particulate objective and therefore this objective is met.

$PM_{2.5}$ (particulate matter less than 2.5 microns) is measured at 5 automatic monitoring sites across Greater Manchester. The data shows that there have been no exceedances of the UK Air Quality Strategy annual mean objective of 25 µg/m3, and concentrations have been gradually reducing. The highest annual mean PM2.5 concentration measured in Greater Manchester in 2018 was 12 µg/m3 at the Wigan Centre monitoring site.

Sulphur dioxide monitoring was carried out at 2 sites, with no exceedances of the air quality objectives. Air quality monitoring and reporting of carbon monoxide and benzene has been discontinued at many sites, as previous assessments indicated no exceedances – however, this is still monitored at Manchester Piccadilly by Defra.

The Greater Manchester Low Emission Strategy (LES) and Air Quality Action Plan (AQAP) was published on the 16th December 2016 after going out to public consultation and being signed off by the Greater Manchester Combined Authority (GMCA). The LES & AQAP propose a range of measures to improve air quality and reduce ill-health across Greater Manchester, focusing on 'key priority areas' in urban centres and near major roads which currently fail to meet national air quality objectives and EU air quality limit values. The LES & AQAP is being led by TfGM on behalf of the GMCA, and includes close working with the Greater Manchester local authorities, Highways England, Public Health England, The Environment Agency, Greater Manchester Police, and charitable organisations to ensure the best outcome can be achieved.

Actions to Improve Air Quality

The AQAP has been produced following a programme of consultation and workshops with key stakeholders, including the Greater Manchester local authorities, Public Health England, TfGM and Highways England, to obtain feedback on the new measures proposed.

Policies and actions were subsequently identified and divided into the following broad subjects, based on the area and type of effects that may be achieved:

- **Development management and planning regulation:** including standardisation of regulation and policy across the Greater Manchester region.

- **Freight and HGVs:** there are several opportunities to reduce emissions associated with the movement of freight and goods by road.

- **Buses:** Buses have a vital role to play in transporting the public and give opportunities to improve air quality. New legislative developments, the creation of the future Greater Manchester bus strategy and improvements to vehicle standards will all assist in ensuring that bus continues to play a vital role into the future, carrying the majority of public transport journeys made within the conurbation.

- **Cycling:** Existing strategies and initiatives encourage cycling.

- **Travel Choices:** Encouraging the public and businesses to make sustainable travel choices is essential in realising lasting air quality benefits.

- **Cars:** Measures to reduce emissions from cars and reduce the number of vehicle trips can deliver real improvements.

- **Information and resources:** Education and the provision of information to the public, businesses and policy makers is seen as vital in bringing air quality improvements.

In 2018, progress has been made on a number of actions in the Air Quality Action Plan. Highlights include:

Metrolink

Developing Greater Manchester's rapid transit network has been essential to improving air quality in the region. The Metrolink has expanded to become the largest light rail network in the UK, with services now running on seven lines to 93 stops covering nearly 60 miles. Construction of the Trafford Park Line is currently ongoing, due for completion in the first half of 2020. This service will run through the busy Trafford Park Industrial Estate, serving a large employment centre of Greater Manchester and having the potential to bring a large number of private vehicle journeys off the roads.

The fleet of 120 modern M5000 trams now carries more than 41 million passenger journeys a year. A further 27 new trams are expected to be delivered soon to provide extra capacity on the network.

'Tram-train' options are also being explored, which would mean 'metro-style'- services in more areas. This would help to improve access to the city centre at the busiest times, while also offering more capacity on the heavy rail network.

Buses

A pilot testing priority at traffic signals for late-running buses has taken place on A6 Manchester - Hazel Grove; and is under development for a number of other areas. GMCA, through a bid prepared by TfGM, along with three operators, First Manchester, Manchester Community Transport and Stagecoach Manchester, have been awarded £15 million from the central government Office for Low Emission vehicles to go towards the cost of obtaining a fleet of 70 plug-in electric buses, along with infrastructure, to run on routes across GM.

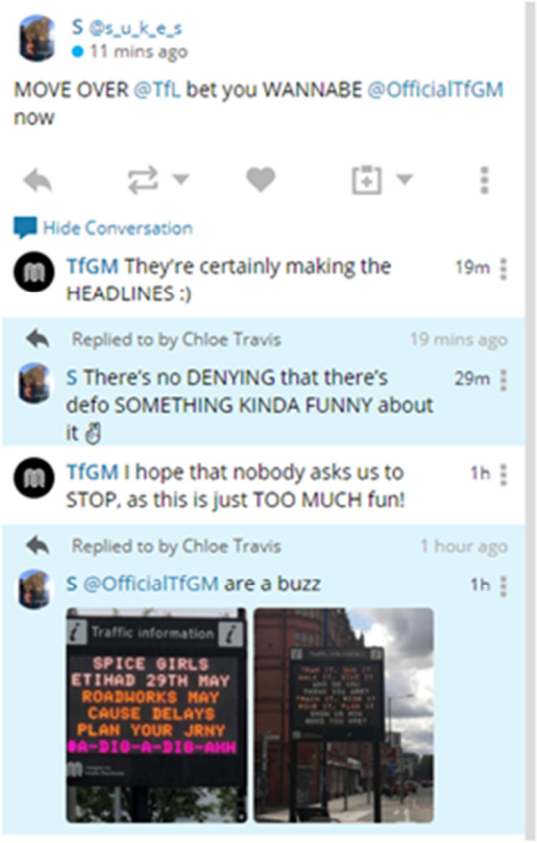
Cycling

The appointment of Chris Boardman as Greater Manchester's Cycling and Walking Commissioner in September 2017 marked the start of big ambitions for walking and cycling. Following the publication of Chris Boardman's 'made to move strategy' in December 2017, Greater Manchester has set out a proposal for a city-region wide 'bee network'. This is a vision which would see over 1000 miles of joined up walking and cycling infrastructure. Its aim is to encourage the two thirds of local residents who currently use the car as their main mode of transport to consider walking and cycling for local journeys instead. Maps of the proposals were co-developed with local people and shared online, with user feedback being used to further inform the plans. An updated version of the plans is due for publication in June 2019.

Alongside the development of these plans, £160m from Greater Manchester's transforming cities fund allocation has been used to form the mayor's cycling and walking challenge fund (MCF) which is intended to deliver the first parts of the network.

Travel Choices

In 2018, TfGM's Variable Messaging Signs (VMS) have been sharing travel choices messaging with road vehicle users, drawing on large events to promote sustainable travel behaviour in humorous ways. These signs were also used to share information for road users on Clean Air Day.



Actions taken by individual local authorities around car clubs are listed in Section 2.2.3 below.

Cars

In March 2018, TfGM were awarded £3 million of new funding as part of the Defra national air quality plan 'Early Measures' fund to expand and promote the Greater Manchester Electric Vehicle (GMEV) network. 48 rapid charging points (24 x dual bays) are now set to be installed in 2019. This adds to the 324 charging points that already exist in the GMEV network.

Information and Resources

Clean Air Day in 2018 took place on June 21st 2018. Travel on the Metrolink was free for passengers in the morning before 7am, and after 7pm. A lung-testing dome was present in a city-centre location, alongside an exhibition of electric vehicles and cycle logistics options. Communities, schools and shoppers around Greater Manchester engaged with a number of events that took place concurrently throughout the day. A total of 5115 pledges were submitted by members of the public, outlining ways that they could change their behaviour to improve local air quality.

The Clean Air Greater Manchester website – www.CleanAirGM.com – was launched in October 2018 as the main resource for air quality information in the city-region. Visitors can find information on what actions are being taken by their local councils, local air quality monitoring data, information on the health impacts of poor air quality, and tips on how they can improve air quality through their own actions.

Progress is discussed in more depth in Section 2 of this report.

Since the Air Quality Action Plan was agreed a UK Plan for tackling roadside nitrogen dioxide concentrations (DEFRA, July 2017) has been published. It identified 29 local authorities, including seven in Greater Manchester (GM), with areas likely to exceed the statutory NO_2 annual mean EU Limit Value of 40 µg/m^3 beyond 2020. In March 2018, 33 more local authorities were defined as having "shorter-term NO_2 problems" - including Oldham in GM. The UK Plan compels these local authorities to follow a specific process to undertake initial evidence development, detailed feasibility studies and develop plans for the implementation of appropriate measures to deliver compliance with the EU Limit Value in the 'shortest possible time'. UK Government

guidance identifies charging Clean Air Zones (CAZ) as the benchmark measure for achieving compliance in the shortest possible time.

The Full Business Case of this feasibility study ultimately acts as the final GM Clean Air Plan and will include measures to achieve compliance as well as mitigation measures. Subject to approval and the necessary funding being obtained, the package of measures identified in the GM Clean Air Plan will then be implemented to deliver compliance with the EU Limit Value. TfGM has been coordinating the GM feasibility study on behalf of the GMCA and the ten GM local authorities, working closely with Districts, who remain legally responsible for compliance. The Outline Business Case (OBC) was approved by all ten GM local authorities and submitted to the government in March 2019. For the most up-to-date information on the Greater Manchester Clean Air Plan visit www.CleanAirGM.com.

Conclusions and Priorities

The 2018 ASR covers in detail progress on all actions listed in the Air Quality Action Plan, and includes information on the development of GM's Clean Air Plan.

Analysis of the automatic and non-automatic air quality monitoring network has found that largely there have been reduced levels of Nitrogen Dioxide (NO_2) across Greater Manchester in 2018. Evidence of this downward trend are summarised as follows:

- The highest NO_2 annual mean concentration recorded at an automatic site in 2018 was 62 µg/m^3, down from 65 µg/m^3 in 2017 and 66 µg/m^3 in 2016, at Oxford Road, Manchester. This is still well above the annual mean objective of 40 µg/m^3.

- In 2018, 13 of the 16 automatic air quality monitoring sites have recorded reductions in NO_2 annual mean concentrations of between 1 µg/m^3 and 6 µg/m^3.

- There have been no exceedances of the NO_2 1-hour mean objective since 2016 across Greater Manchester.

- Of the 113 diffusion tube (non-automatic) sites operating inside the AQMA in 2011, 102 of them recorded lower concentrations in 2018 than 2017. Of the 68

diffusion tube sites operating outside of the AQMA across the same period, 63 have also recorded lower concentrations, with 31 sites showing an improvement of 5 µg/m^3 or more

Exceedances of the annual mean objective (AMO) for NO_2 (40 µg/m^3) are continuing to be recorded at numerous sites within the AQMA across Greater Manchester. Outside of the AQMA, diffusion tube (non-automatic) sites in Wigan (119, 122, 129, 178, 180) have shown readings exceeding the AMO. The majority of these sites are new, and there are discussions ongoing within Wigan Council as to whether an Air Quality Management Area is declared around these sites.

Slight increases in annual mean PM_{10} and $PM_{2.5}$ concentrations were measured across Greater Manchester in 2018 compared to 2017. The cause of these increases is not certain but thought to be due to the colder than average winter increasing the need for heating as well as a dry summer which increased re-suspended dust; and the Saddleworth Moor and Winter Hill fires, which continued for more than 3 weeks in June and July and caused smoke to drift across Greater Manchester. The demolition and rebuilding of a school near the Wigan Centre site is thought to have caused increases here.

The Greater Manchester Clean Air Plan is projected to have the most significant impact on air quality in the city-region going forward.

Local Engagement and How to get involved

The Clean Air Greater Manchester website (https://cleanairgm.com) has been a key development in the local authorities' communication with the general public since its launch in 2018. Facebook (facebook.com/cleanairgm) and Twitter (@cleanairgm) have also been launched, with the conversation being tracked using the hashtag #cleanairgm.

The website www.CleanAirGM.com contains a wealth of information about local air quality, the GM Clean Air Plan, how to play a part and tips on reducing and avoiding air pollution. A schools section is also included on the website that includes a free air quality toolkit for schools to download, and free online air quality game.

The GMCA have carried out Clean Air Days/Weeks, which raised awareness and help people understand what they can do to improve their impact. These days were also carried out with events at schools, hospitals and workplaces.

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1 Local Air Quality Management

This report provides an overview of air quality in Greater Manchester during 2018. Transport for Greater Manchester (TfGM) represents the ten authorities that constitute the Greater Manchester Combined Authority (GMCA). The ten authorities are:

- Bolton Metropolitan Borough Council (BoMBC)
- Bury Metropolitan Borough Council (BMBC)
- Manchester City Council (MCC)
- Oldham Metropolitan Borough Council (OMBC)
- Rochdale Metropolitan Borough Council (RMBC)
- Salford City Council (SCC)
- Stockport Metropolitan Borough Council (SMBC)
- Tameside Metropolitan Borough Council (TMBC)
- Trafford Borough Council (TBC)
- Wigan Metropolitan Borough Council (WMBC)

The report 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 the 10 Local Authorities of Greater Manchester to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found**Error! Reference source not found.** 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 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 the AQMA declared by the GMCA 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/maps.The current AQMA was declared on the 1st May 2016 following a detailed assessment of air quality in 2014.

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		Now		Name	Date of Publication	Link
AQMA Greater Manchester	Declared 01/05/2016	NO2 annual mean	Greater Manchester	An Area covering the 10 districts of Greater Manchester, including arterial routes, district centres, and airport.	YES	66	µg/m3	62	µg/m3	Greater Manchester Air Quality Action Plan 2016-2021	16.12.2016	Air Quality Action Plan

☒ **Transport for Greater Manchester 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 Greater Manchester

2.2.1 Response to Defra's 2017 appraisal

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

- *Greater Manchester is encouraged to develop $PM_{2.5}$ specific measures.*

  GM: A bid for Air Quality Grant funding was submitted by GM to DEFRA in 2018, which was unsuccessful. Collaboration between TfGM and the University of Manchester is planned, to explore options for greater $PM_{2.5}$ improvements in Greater Manchester. Measures listed in the Air Quality Action Plan will also contribute to reducing $PM_{2.5}$ as well as NO_2.

  Greater Manchester councils remain aware of the contribution of garden bonfires and commercial burning of waste to $PM_{2.5}$ concentrations. Efforts to improve the enforcement of legislation aimed at preventing illegal smoke-producing activity have been promoted. The GM councils commit to the satisfactory resolution of complaints of smoke from domestic and commercial chimneys, as well as garden bonfires and commercial burning of waste. Ecodesign ready wood-burning stoves are also being promoted. For example, Manchester City Council and Salford City Council have promoted Defra's BurnRight national consumer awareness campaign during 2018, through social media, contacting retailers and providing links on the Council's website.

  GM local authorities are also adopting the most recent Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction as current best practice guidance to assess and mitigate particulate matter emissions from construction sites.

  Securing funding for green infrastructure around schools in Greater Manchester also marks a positive step towards improving $PM_{2.5}$ concentrations around schools.

- *It is not clear that the AQAP contains measures designed to address known hotspots, for which there are many. The Councils should ensure, as far as possible, that this list does not contain generic non-specific measures that are unfit for the immense challenge the region faces. Traffic management and*

infrastructure planning type measures will have the most success and are more objective, in that their performance is easily tracked.

GM: Specific measures designed to address known hotspots are being developed as part of the GM Clean Air Plan proposals. Detailed dispersion modelling carried out in consultation with central government has shown that concentrations of NO_2 will exceed the annual air quality objective at over 150 roads, spanning all ten Greater Manchester local authority areas in 2021 if no further action is taken.

A Strategic Outline Case was submitted to central government in March 2018 that set out 96 potential measures to tackle NO_2 exceedances, some of which were detailed to address 'known hotspots'. These 96 potential measures were further refined to a shortlist of 17, using primary success criteria:

- Reduction of NO_2 concentrations in the "shortest possible time".
- That the measures can be implemented in the shortest possible time to achieve compliance.

The current proposal is to introduce a GM-wide Clean Air Zone, along with wide-ranging support measures:

A Clean Air Zone for buses, coaches, taxis, private hire vehicles and HGVs across Greater Manchester implemented in 2021, extending to vans and minibuses, in 2023.

Measures to communicate the importance of air quality across Greater Manchester, promote cleaner vehicles and help residents, businesses and bus operators to upgrade.

Further information can be found at www.cleanairgm.com.

The AQMA is also a deciding factor with local authorities when looking for appropriate locations for targeting specific interventions. For example, Clean Air Day activity took place in locations situated within the AQMA. Also, sites within the AQMA have been chosen for green infrastructure installation.

An example of a traffic related measure to improve air quality in the AQMA is the guided bus way service from Leigh to Manchester (which uses the A580 and A6, located in the AQMA). This service has a 98% satisfaction rating from

customers and in December 2018 recorded its highest weekly patronage figures. In this period, 65,000 people were using the service each week, an increase of 132% since launch in April 2016 when the weekly patronage started at 28,000. Customer surveys show that 36% of passengers could have made the same journey by car but are opting to use the bus due to the faster, more punctual and reliable bus service, saving as many as 12,500 car journeys being made on this route when compared to the previous year. It is hoped that further improvements to the service, including the use of electric buses will be provided in the next 12 months, and passenger number are expected to rise further still in 2019. In 2018 the Greater Manchester Metropolitan Mayor Andy Burnham published the Congestion Deal. This contains actions which target congestion in many areas that correspond with the AQMA, furthering the attention that these hotspots get when intervention is designed.

- *The Councils are advised to review the AQMA boundaries. There are many sites outside of the AQMA that have recorded exceedances, some for a number of years. It is clear many of these sites are getting worse each year and given the concentrations at relevant exposure there should be no delay is amending boundaries so that these sites can be targeted in the AQAP. For further guidance please refer to TG16.*

  GM: TfGM have reviewed their air quality monitoring site specifications and have found some diffusion tubes to have been erroneously categorised as being outside the Air Quality Management Area. This has since been corrected.

- *The Councils are encouraged to review their monitoring programmes. Sites that record continually low concentrations should be relocated to identify new hotspots, or to better understand the extent of exceedances.*

  GM: The GM air quality monitoring network was formally reviewed by consultants Bureau Veritas in 2017. Local authorities in partnership with TfGM are taking action on the recommendations made, including upgrading a significant amount of ageing NO_2 and PM_{10} analysers and installing 4 new automatic monitoring sites into the GM air quality monitoring network at locations in Wigan, Bolton, Rochdale & Tameside. The diffusion tube network will be kept under periodic review by local authorities. In recent months GM local

authorities have added more NO_2 diffusion tube sites in locations of predicted exceedances as part of the GM Clean Air Plan work.

Other conclusions were received which related to the formatting of the ASR. These issues have been corrected for this annual report.

Greater Manchester 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 2.2.

More detail on these measures can be found in the 2016-2021 Air Quality Action Plan, which is located at this link. This action plan is complimented by the 2016 Low Emission Strategy, which can be downloaded at this link.

2.2.2 Summary of Progress on Actions across Greater Manchester

Development Management and Planning Regulation

Efforts to integrate IAQM/EPUK guidance documents in development and construction planning processes have continued, with some of the GM local authorities now referring to these documents as part of their application assessment procedure.

GM's taxi licensing group have drafted harmonised taxi age limits and conditions across GM. The proposed GM Minimum Licensing Standards must support the Clean Air Plan proposals to improve air quality across Greater Manchester in the shortest possible time. Therefore it is proposed that all GM licensed vehicles meet the standards in government's Clean Air Framework: Euro 4 petrol engines (typically registered from 2005 onwards), Euro 6 diesel engines (likely to have been registered from 2016 onwards), or an ultra-low emission engine.

It is also proposed to introduce GM wide vehicle licensing age requirements - when a vehicle is first licensed, it would be under 5 years old (from the date of manufacture) and would only be licensed until it was 10 years old. This is part of a wider remit to look at public safety standards. A formal consultation on the proposals will take place in late 2019.

Freight and Heavy Goods Vehicles

The Delivery and Service Plan (DSP) programme established at TfGM has continued to see collaboration with local authorities in the gathering and analysing of delivery

data at key council building sites. Recommendations produced from this analysis are then used to implement a reduction of deliveries to these sites. Collaboration with the NHS has led to plans for a consolidation centre for several hospitals in Greater Manchester, which would see a reduction in deliveries to and from hospitals. TfGM has also worked in collaboration with CityCo to oversee the launch of a pilot in key city centre districts aiming to reduce the number of waste vehicles operating. This has been effected through the use of contract consolidation. The Greater Manchester Freight Forum has continued to meet regularly to discuss key messages relating to the Greater Manchester Freight network. Furthermore, a 'green-wave' trial was run on a major corridor in Greater Manchester, and monitored to determine whether or not giving freight vehicles greater priority at traffic lights would have a positive effect on air quality. The evidence from this trial was inconclusive.

Buses

A pilot testing priority at traffic signals for late-running buses has taken place on the A6 Manchester - Hazel Grove route; and is under development for Salford - Bolton Network Improvements area; A57 Hyde Road; and A5103 Princess Road. There have been whole-route upgrades of busy bus corridors with a focus on quality and reliability. Planning is underway for Ashton-under-Lyne - Oldham - Rochdale; Rochdale - Bury - Bolton; and Bolton - Wigan.

TfGM is working with the bus supplier and the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) to establish solutions to improve the emission performance of the TfGM hybrid bus fleet. Measures include SCRT (a combination of Continuously Regenerating Trap and Selective Catalytic Reduction to reduce emissions) and conversion to electric vehicles. Currently there is not a retrofit solution available for the Optare hybrid vehicles.

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In March 2018, TfGM were awarded £3 million of new funding as part of the Defra national air quality plan 'Early Measures' fund to expand and promote the Greater Manchester Electric Vehicle (GMEV) network. 48 rapid charging points (24 x dual bays) are now set to be installed in 2019. This adds to the 324 charging points that already exist in the GMEV network.

Trials of electric vehicles are taking place that could be deployed into the TfGM ancillary car/van fleet. This will provide input into the solutions available when conducting the procurement of the ancillary fleet in 2020.

Information and Resources

Clean Air Day in 2018 took place on June 21st 2018. Travel on the Metrolink was free for passengers in the morning before 7am, and after 7pm. A lung-testing dome was present in a city-centre location, alongside an exhibition of electric vehicles and cycle logistics options. Communities, schools and shoppers around Greater Manchester engaged with a number of events that took place concurrently throughout the day. A total of 5115 pledges were submitted by members of the public, outlining ways that they could change their behaviour to improve local air quality.

The Clean Air Greater Manchester website was launched in October 2018 as the main resource for air quality information in the city-region. Visitors can find information on what actions are being taken by their local councils, local air quality monitoring data, information on the health impacts of poor air quality, and tips on how they can improve air quality through their own actions.

An air quality forecasting and alert service has been developed as part of the upgraded Clean Air Greater Manchester website. The service was launched in January 2019 and users are able to sign up to receiving alerts if pollution levels are expected to be at 'moderate' or above - as defined by the Defra Daily Air Quality Index.

The "Air Quality in Greater Manchester – from a Public Health Perspective" report, produced by Public Health England North West in September 2018, estimates the health burden associated with exposure to anthropogenic $PM_{2.5}$ air pollution in GM and for each individual district. Estimated mortality attributable to exposure to $PM_{2.5}$ for Salford in 2016 = 5.1% (GM average = 5.0 %, England average = 5.3%). Further work is being carried out by Public Health England to look at the health effects of NO_2 in GM.

The GM Green Summit was held in March 2018 (and March 2019), and an air quality theme was included.

2.2.3 Progress on actions in individual districts

Bolton Metropolitan Borough Council (BoMBC)

- (AQAP 6.3) There are no current proposals to change car parking charges in Bolton. However EV charging points are available in multi-storey car parks in the town centre and are due to be installed in Le Mans Crescent. There are proposals for significant redevelopment in the town centre and the design of these proposals will seek to encourage walking and cycling as an alternative to driving and parking.
- (AQAP 6.4) No longer an allocated officer within the LA, however a number of schools in the borough have been working on plans to encourage walking and cycling to school, for example Beaumont Primary and Markland Hill Primary.
- (AQAP 7.9) Presentations to Councillors to raised awareness of air pollution as an issue. Commitment to delivering awareness raising events. Clean Air Day 2018 events were held in the Town centre, Farnworth District Centre and Middlebrook shopping centre. Further events are planned in 2019 to raise general awareness of air quality issues and engage with residents and businesses to get views on the proposed GM Clean Air Plan.

Bury Metropolitan Borough Council (BMBC)

- (AQAP 1.6) 90 Bury businesses have been engaged with and offered advice and information on sustainable and active travel;
- (AQAP 5.1) EST review for BMBC on our Grey Fleet described the need to review car allowance and the potential. Their report has shown the potential savings and emissions benefits of introducing a travel hierarchy and low emission car club. We are now looking into the business case for this approach;
- (AQAP 6.1) BMBC have a motion to install at least one EV charge point per ward;
- (AQAP 6.2) BMBC were awarded grant funding from TfGM to provide Brompton pool bikes for employees. This scheme will be implemented in 2019;

- (AQAP 6.4) 2017 – 2018 Road safety training provided to 41 primary schools at least twice for each school and 7 High schools at least 6 times per school. Cycle training provided to 1243 Primary school pupils;
- (AQAP 7.9) Council officers held an e-bike and electric car showcasing event in our main shopping centre on Clean Air Day 2018. We had a stand at a community event to raise awareness of air quality issues. Officers have provided presentations at a local business and early years care providers fora. Councillors have also been provided with briefings re the development of the GM Clean Air Plan.

Manchester City Council (MCC)

- (AQAP 1.8) MCC is participating in a university research project to determine the optimum hedge species mix for trapping and absorbing pollution and fine particulate matter and measuring the improvement in air quality at 4 school sites in Manchester. This is with a view to prove a business model that could drive down the cost of such an approach and change behaviour around travel to school and urban design;

  MCC Planning encourage the incorporation of Green Infrastructure within new developments. MCC has been continuing to implement its Green Infrastructure (GI) strategy and action plan (further details at: https://www.manchester.gov.uk/info/500002/council_policies_and_strategies/7061/green_and_blue_infrastructure) and carried out a three-year review of progress of the GI Strategy (available at https://democracy.manchester.gov.uk/documents/s3615/Appendix%201%20Green%20and%20Getting%20Greener.pdf), which concluded that the following key measurables were delivered:

  - 4% increase in sites of biological importance in active conservation management;
  - 1 km of hedgerow planted;
  - 43 community orchards planted;
  - 8,500 trees planted.

Major infrastructure work improving access to GI within and beyond the city, including:

  - £8million Cycle City to help improve cycling infrastructure through Didsbury into the city centre and along the Oxford Road Corridor;
  - £1.2million improvements to 7.5km of Rochdale Canal towpath from Newton Heath into the city centre Rochdale Canal access as part of the VeloCity programme;
  - £160,000 Trans Pennine Trail improvements along the River Mersey in south Manchester.

Planting works which took place during 2018 included 2994 trees, including 3 orchards and 582 hedge trees;

MCC produced a Manchester Tree Management Principles guidance document (available at: https://secure.manchester.gov.uk/info/500002/council_policies_and_strategies/7061/green_and_blue_infrastructure/3).

- (AQAP 2.1) MCC are currently implementing the TfGM DSP Toolkit and have gathered data on servicing and deliveries, TfGM to review & provide feedback to MCC on next steps. A policy is in place to prohibit workplace deliveries;
- (AQAP 2.7) MCC currently resolve isolated idling incidents informally in accordance with the Council's Enforcement Policy and have established a sub-group in order to engage Manchester schools to promote anti-idling, particularly within the AQMA;
- (AQAP 5.1) A feasibility study was completed during 2018 for an MCC depot for the introduction of a dedicated commercial car club scheme with low emission vehicles. The scheme was concluded to be unviable for EVs;
- (AQAP 6.2) MCC's review of essential car users several years ago resulted in a significant reduction in allowances. Council policy was updated during 2018 to promote flexible working, working from home and locations which result in reduced travel time. Several teams have fleet EVs and this number is increasing when vehicle lease contracts end;

- (AQAP 6.4) MCC have established a sub-group in order to engage Manchester schools to promote awareness of air quality, sustainable travel and anti-idling, particularly within the AQMA;
- (AQAP 7.9) MCC actively participates in annual Clean Air Days which includes promoting awareness of air pollution and measures the public can take to reduce their own exposure and impacts.

Oldham Metropolitan Borough Council (OMBC)

- (AQAP 7.9) OC has participated in Clean Air Day by distributing pledge cards and sharing information via the council's social media accounts.

Rochdale Metropolitan Borough Council (RMBC)

- (AQAP6.2) Council staff are only eligible for casual car user rate to encourage use of public transport. Metrolink is now available into the town centre alongside the new bus interchange, also increased train services 4 to 6 per hour to a larger number of destinations has encouraged staff to use public transport.
- (AQAP 6.3) There is no staff car parking available at the majority of council offices. Officers are no longer able to purchase disounted annual passes for car parking due to the town centre redevelopment and shortage of parking facilities has seen a greater uptake of public transport/ park and ride schemes.
- (AQAP 6.4) School travel plans are required to be undertaken by all new schools and those which are being extended.
- (AQAP 7.9) Rochdale have held a number of events to raise the profile of air quality within the Borough, including the publicity of Clean Air Day 2018, hosting workshops on the streets for all scheme and active promotion and development of the Bee Network. Initiatives to develop awareness of sustainable transport issues include consultation workshops with Councillors and partnership bodies on proposals developing Greater Manchester's Streets for All approach on the Orbital Route between Wigan and Ashton including Heywood and Rochdale. Workshops were held in those town on how these routes could be more pedestrian, cycle and bus friendly and identifying where public realm could be enhanced encouraging people to loiter and spend time to the benefit of local business and using unused road space to redress the balance of streets

towards sustainable travel, visitors and shoppers, reducing the dominance of private motor vehicles;

- Design work on a Mayors Cycle Fund project in Castleton took place in 2018-2019 and public consultation on the proposals will take place later in 2019. Design work has also started on Phase 2 of the project to Rochdale Town Centre and also continues in 2019-2020;
- A number of improvements to the local rail network have also been carried out in 2018 increased services stopping at Rochdale Station up from 4 to 6 an hour in each direction. Platform extensions at Littleborough, Mills Hill and Smithybridge Stations to accommodate 6 carriage trains. A £3 million "access for All" scheme at Mills Hill Stations all enhance the attraction of the rail services serving the Borough.

Salford City Council (SCC)

- (AQAP 2.1) Meeting held with TFGM freight team in Jan 2018 to look at DSP toolkit requirements and applicability in Salford. A Delivery/ service vehicle data collection exercise was carried out during May/ June 2018 for the Civic Centre campus (post room, catering deliveries and waste collections), Turnpike depot and Swinton Hall Road depot. The recommendations have been under consideration by Council officers:
    - Swinton Hall Rd depot: adjusted standard delivery times to avoid peak time deliveries;
    - Turnpike depot: Looking at whether any non-urgent, peak time deliveries could be re-scheduled so that they occur outside of peak times;
    - Civic waste collections: Mostly occur in peak hours, but are part of a larger collection round. Therefore moving individual collections (from the Civic) would just move to a nearby location and so unlikely environmental benefit;
    - Civic post room: Identified that there are many peak time deliveries and multiple courier drops during the day – may be potential to consolidate deliveries/ collections and courier activities.

Procurement team: A new e-procurement system is being introduced in late 2019 to allow better management of orders and delivery schedules with contractors. This should reduce numbers of purchases from ad hoc organisations that may use couriers for delivering goods, and therefore should result in fewer deliveries.

- (AQAP 5.1) The Salford Co-Wheels car club covers 13 sites across the city with a total of 39 vehicles including 8 fully electric Nissan Leafs (20% of the total car club fleet);

  The public Pay as You Go electric vehicle charging point sites in Broughton, Orsdall and Central Salford that were pump primed with Car Plus funding have seen usage plateau, further input from Co-Wheels to market the scheme to the public has been requested;

  A feasibility study of increasing the share of fully electric vehicles into the car club fleet to 16 without changing the existing charging infrastructure is ongoing and requires improvements to charging behaviours from users;

  Data for the Salford City Council car club has been collected and shared with TfGM. Data includes mileage, time of trip data, fleet make up data etc.

  Further data has been collected in partnership with Electric Blue who will be able to gather more in depth information on trip data and a feasibility study on replacing petrol vehicle trips with EV trips. Data includes location of travel and number of stops;

- (AQAP 6.1) A planning condition is applied to all planning applications where an air quality assessment is necessary, that requires type 2 charging facilities on all properties with dedicated off road parking, and a proportion of spaces to have electric vehicle charging points for apartments / high rise. Requirements for electric vehicle charging points are also set out in planning conditions for commercial/ retail developments in accordance with the IAQM/ EPUK air quality and planning guidance.

  A policy is in place in the new draft Local Plan that aligns with this action (Policy A10). The Local Plan is going through a consultation process (closing date for comments was 22/03/2019). Once the Local Plan is adopted, Salford City

Council will be in a stronger position to require charging points as part of planning conditions.

Salford City Council is currently working with the Private Hire and Hackney trades to promote the use of electric vehicles within these fleets (with a company called Electric Blue). Surveys of trip patterns on approximately 70 vehicles were undertaken during March / April 2019 to assess where the likely demand for EV charging will be. Drivers were also provided with bespoke costs / benefit analysis for their trips, to inform their decision making on moving towards EV's, when considering replacement vehicles.

- (AQAP 6.2) Existing Salford City Council travel hierarchy has been implemented as part of the Council Green Wheels Travel Plan. The travel hierarchy is available via the staff intranet. The travel hierarchy is:

  1. Walk, Cycle:

  A pedal cycle allowance is payable to designated car users who choose to use a pedal cycle to transport them in carrying out their duties, payable on a monthly basis.

  2. Public transport:

  1% discounted bus tickets are available to order in advance or employees to claim expenses back

  3. Car club vehicles

  4. Salford City Council Vehicle Management Services hire vehicles

  5. Privately owned vehicles paid back to employees through casual mileage payments:

  Mileage claims will only be allowed in exceptional circumstances.

- (AQAP 6.3) A car parking permit scheme is currently in place at principal SCC office/ depot locations. Monthly salary deductions are charged at 1% of employee annual salary to enable employees to utilise any free spaces on the car park. Specific parking spaces are allocated for pool vehicles, electric vehicles and car share vehicles at Salford Civic Centre to encourage their use.

Car parks are regularly patrolled by Parking Wardens – a £70 fixed penalty fee is in place for not displaying a permit;

A car parking review has been completed to highlight potential alternative management options that would encourage and support more sustainable travel by staff. Future operations will be considered by senior management as part of a wider campus review. In the interim an additional disabled parking area has recently been provided for staff, and various restrictions and timings are being amended to improve accessibility and turnover;

- (AQAP 6.4) SCC have recently secured membership to Modeshift, which is a national organisation and software that allows users to engage with schools on a larger scale and schools can receive awards and accreditation for their Travel Plan work. The travel Plan Officer has engaged with schools to encourage them to sign up to Modeshift, this is ongoing;

  'Living streets' project in initial stages – partnership project with SCC and University of Salford to trial intervention measures at a school location to reduce traffic flow and encourage cycling & walking to reduce congestion, road safety and air quality impacts of the school run. 2 schools have been identified to be involved:

  1. Cadishead Primary, 32 Allotment Rd, Cadishead, M44 5JD (not in AQMA);

  2. Peel Hall Primary, Greencourt Dr, Little Hulton, M38 0BZ (close to AQMA near Cleggs Lane/ Peel Lane junction).

  Engagement with schools to educate pupils on air quality issues and positive actions that can be taken to reduce air pollution carried out as part of Clean Air Day 2017 & 2018 events.

- (AQAP 7.9) Environmental Protection & Public Health Teams gave air quality presentations at Community Committee meetings, Transport Advisory Group Meetings and Community Safety Meetings (October 2016 to August 2018);

  Engagement activities with businesses and residents have taken place as part of the GM Clean Air Plan conversation process.

Stockport Metropolitan Borough Council (SMBC)

- (AQAP 1.6) Travel Choices and Stockport ICT are working together to offer online personalised travel planning to residents changing their address for council tax purposes online. As part of the Town Centre Access Plan work in the Town Centre Stockport is providing personalised travel planning for all Businesses. The Council is taking part in the trial of the online Planning Toolkit for Travel Plans;
- (AQAP 5.1) Stockport has a rolling programme of reducing the Essential Car users on the Council Fleet and all casual car users are being offered access to the Car Club for trips. Stockport's Staff Travel Plan and Guidance on Car Club usage are based on a hierarchy of travel types at which SOV use is the last option. A further public car has been made available in Stockport Town Centre for public use. Data is being collated for this and it will support the extension of the scheme in 2019;
- (AQAP 6.2) The council offers salary sacrifice options for bus and rail season tickets. Currently the Car Parks in the Town Centre are all charged for via permits and the cost of these permits increased when salary sacrifice for this stopped. Staff with less need for their car for work purpose are also moved out to less accessible parking;
- (AQAP 6.3) Currently the Car Parks in the Town Centre are all charged for via permits and the cost of these permits will be increased when salary sacrifice for this stopped. The Council offers permits for Low and No Emission vehicles to park more cheaply across the borough to encourage uptake of these technologies;
- (AQAP 6.4) The Road Safety Team work with schools to address their travel planning and hearts and minds work regarding how children travel to school. Every development application from schools requires a new travel plan is produced as well as an ongoing update programme taking place;
- (AQAP 7.9) The Council took part in Clean Air Day and encouraged Schools and businesses to do the same. The council provided supporting information and goodies to those businesses that took part in this.

Tameside Metropolitan Borough Council (TMBC)

- (AQAP 2.1) DSP toolkit has been received, work to implement plan yet to begin;
- (AQAP 5.1) The CarShare GM scheme is promoted to staff via TMBC's employee webpages;
- (AQAP 6.2) Review of Essential / Casual car user allowances has been undertaken. Provision of pool bicycles at Tame Street Depot;
- (AQAP 6.3) Review of car parking provision and charging to be undertaken;
- (AQAP 7.9) Tameside Green Summit held in November 18 including air quality. Delegates encouraged to make pledges for themselves and their organisations. Idling campaign focusing on primary schools including press releases, social media campaign, pupils issuing "enforcement" notices - June 18. Several elected member air quality training events have been run.

Trafford Borough Council (TBC)

- (AQAP 1.6) TfGM already review travel plans which accompany planning applications. Traffic Assessment and travel planning are part of the Councils planning application validation checklist;
- (AQAP 5.1) Work between TfGM and Trafford Council progressing for a Car Club operating across the Trafford Borough;
- (AQAP 6.2) Essential car user allowance discontinued. Council provide facilities for bicycle usage and operate the bike to work scheme. Currently working with Energy Saving Trust regarding the Council's 'grey fleet';
- (AQAP 6.3) Charges in place for staff parking at Council buildings;
- (AQAP 6.4) The Council are working with the Living Streets organisation, a UK charity that promotes everyday walking. Living Streets, which is based in Manchester, run a programme to promote walking to school: https://www.livingstreets.org.uk/walk-to-school; this gives excellent resources to support schools in promoting active travel to children and parents;
- (AQAP 7.1) Use of Council social media to promote clean air agenda and offer advice and tips regarding travel choices.

Wigan Metropolitan Borough Council (WMBC)

- (AQAP 1.6) Travel Plan required by Development Management for certain higher impact developments;
- (AQAP 2.7) Anti-idling campaign currently being planned;
- (AQAP 6.4) Ongoing Mode Shift Stars program; anti-idling campaign being planned to include school engagement;
- (AQAP 7.9) Have held ULEV awareness day, planning for Clean Air Week 2019, plus planning second ULEV awareness day for June 22 2019.

Table 2.2 – Progress on Measures to Improve Air Quality

A list of additional Strategies which have measures that could improve air quality with links and progress.

The full list of Measures sites is detailed in Table 2.2 of the attached “Appendix 2_ASR_2018_Datatable_V1” file.

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.

The EU has also set a target of a 20% reduction in urban background concentrations of $PM_{2.5}$ between 2010 and 2020. Greater Manchester currently has 5 sites that monitor $PM_{2.5}$: Manchester Piccadilly; Manchester Sharston; Salford Eccles; Salford M60; and Wigan Centre. Monitoring sites that have been in place for a number of years have showed an overall downward trend in $PM_{2.5}$ annual mean concentrations.

Given the need to meet EU limits for NO_2 as soon as possible, and the downward trend of particulate matter, the short-term focus will need to be on NO_2. Many of the measures that will help achieve this will also be of some benefit in reducing greenhouse gases and particulates, which will be the focus over the longer-term.

Air quality impacts will need to be assessed for all major development schemes where an impact is likely, and mitigation measures implemented where necessary. IAQM's *Guidance on the Assessment of Dust from Demolition and Construction* has been adopted by GM local planning authorities in order to properly assess potential impacts from construction activity and implement appropriate mitigation controls consistently.

Designated under 1993 Clean Air Act legislation, each GM council has a Smoke Control Area in place, where only smokeless or 'authorised fuels' can be burnt unless they are being used in an 'exempt appliance'. Additionally, particulate concentrations will also see reductions through many of the actions which are featured in the Clean Air Plan and the Air Quality Action Plan.

In addition, local authorities investigate complaints and take enforcement action where necessary against smoke nuisance from bonfires. Advice is provided to local residents on disposing of garden and household waste as an alternative to burning.

Public Health Outcomes Framework Indicator 3.01 - Fraction of mortality attributable to particulate air pollution

In 2010 the Department of Health included an air quality indicator based on annual average background concentrations of $PM_{2.5}$ in the Public Health Outcomes Framework (PHOF). Population exposure to anthropogenic (man-made) $PM_{2.5}$ is used as the basis of PHOF indicator 3.01. This indicator measures the percentage of all deaths in people aged 30 and over in a single year that is attributable to long-term exposure to current levels of $PM_{2.5}$. Concentrations of man-made (rather than total) $PM_{2.5}$ are used as the basis of this indicator because estimates based on total $PM_{2.5}$ could give a misleading impression of the extent to which potential policy interventions could have an impact on this measure. The data is presented as 'Fraction of mortality attributable to particulate air pollution' and is updated annually. The latest available dataset is for 2017.

Background annual average $PM_{2.5}$ concentrations for the year of interest are calculated using a computer dispersion model, based on a 1km x 1km grid. The dispersion model is calibrated using measured concentrations taken from background sites in Defra's Automatic Urban and Rural Network (http://uk-air.defra.gov.uk/interactive-map).

Expressing the mortality effect associated with long-term exposure to current levels of air pollution in this way allows comparisons to be made between different areas. In 2017, it is estimated that approximately 4.3% of deaths each year in Greater Manchester are attributable to exposure to man-made $PM_{2.5}$ particulate air pollution. The average figure for Greater Manchester is slightly lower to the England average (5.1%), but similar to the North West region average (4.1%).

It is important to note that these deaths are not individually attributed to air pollution, but instead it is an estimated measure of how many deaths air pollution contributes to. Individuals will have other contributory causes such as respiratory or cardiovascular disease.

By using the PHOF indicator for the percentage of deaths attributable to $PM_{2.5}$, it is possible to estimate the number of deaths attributable to air pollution in Greater Manchester, and in turn the number of life years lost to the local population (by estimating the average years these people would have lived if they had not died

prematurely due to long term exposure to particulate air pollution). However, it is recognised that there is a high degree of uncertainty in making these estimates.

The percentage and number of attributable deaths due to exposure to man-made $PM_{2.5}$ for each Greater Manchester district in 2016 is shown in the following table, provided by Public Health England Northwest.

Table 2.3 - An estimate of the attributable deaths and years of life lost in Greater Manchester based on 2016 data

Greater Manchester District	Number of deaths (age 25+)	Percentage of attributable deaths due to exposure to man-made $PM_{2.5}$ (PHOF indicator 3.01)	Estimated number of attributable deaths due to exposure to man-made $PM_{2.5}$	Estimated associated life-years lost
Bolton	2559	5.0	129	1545
Bury	1798	4.9	88	1057
Manchester	3480	5.2	181	2166
Oldham	2085	5.0	104	1245
Rochdale	2027	4.8	98	1173
Salford	2157	5.1	110	1319
Stockport	2666	4.9	131	1571
Tameside	2177	5.1	110	1323
Trafford	1959	4.9	97	1162
Wigan	3165	4.7	150	1798

Greater Manchester	**24073**	**5.0**	**1196**	**14347**

The table above shows that Manchester, Salford and Tameside had the highest percentage fraction of mortality attributable to particulate air pollution in 2016. It is estimated that there were approximately 1,200 attributable deaths due to exposure to man-made $PM_{2.5}$, which in turn is estimated to have resulted in approximately 14,000 years of life lost to the Greater Manchester population.

Further information on the PHOF indicator is available from the Public Health England website:

https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/3/gid/1000043/pat/6/par/E12000002/ati/101/are/E08000006

The Committee on the Medical Effects of Air Pollutants (COMEAP) has concluded that evidence associating NO_2 with health effects has strengthened substantially in recent years. COMEAP is currently considering how to quantify the mortality effects associated with long-term average concentrations of NO_2.

Further information on the measures that Greater Manchester is taking to address $PM_{2.5}$ can be found in Section 2.2.1.

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

3.1 Summary of Monitoring Undertaken

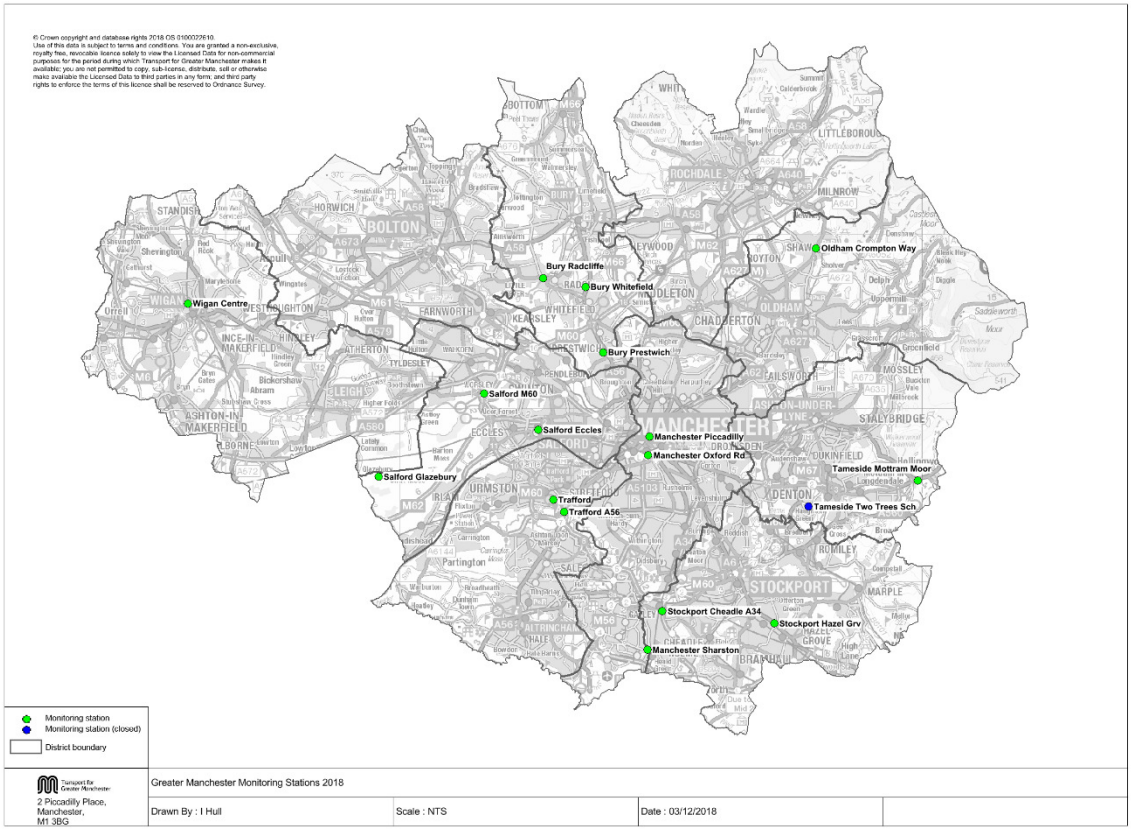
3.1.1 Automatic Monitoring Sites

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

Greater Manchester undertook automatic (continuous) monitoring at 16 sites during 2018. Table A.1 in Appendix A shows the details of the sites. N.B. Local authorities do not have to report annually on the following pollutants: 1, 3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem.

A map showing the location of automatic monitoring sites are below, and also at this link. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

Figure 3.1. GM Automatic Monitoring Stations



3.1.2 Non-Automatic Monitoring Sites

Greater Manchester undertook non-automatic (passive) monitoring of NO_2 at 369 sites during 2018. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided https://cleanairgm.com/air-quality-data/diffusion-tubes. 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. Trend data tables and graphs are provided in Appendix A.

3.2.1 Nitrogen Dioxide (NO_2)

Annual Mean Concentrations

Automatic monitoring site results:

In 2018 the Greater Manchester Air Quality Network (GMAQN) operated 16 automatic NO_2 chemiluminescence monitors. The ratified annual mean NO_2 results from 2014 to 2018 are provided in Table A.3 in Appendix A.

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.

The following stations were decommissioned during 2011/12:

- Bolton College, Oldham West End, Stockport Shaw Heath in 2011
- Wigan Leigh 2, Bury Roadside in 2012

The following sites were relocated in 2016:

- Manchester South was relocated and named as Manchester Sharston.

The following site was added in 2016:

- Stockport Cheadle A34

The Bury roadside site was decommissioned by DEFRA as it did not meet EU site criteria, and was relocated in 2014 to the A56. The Tameside Two Trees site was closed in November 2016. Bury Radcliffe and Prestwich were re-commissioned in 2011. Bury Whitefield and Oldham Crompton way were commissioned in 2015 and 2014 respectively.

Figure A.1 shows the annual mean results of all automatic monitoring sites in GM over the last five years, separated by site type. The general trend is either a stabilisation or decline of NO_2 concentrations, with the exception of Manchester Sharston, Stockport Hazel Grove and Glazebury, which each show a small increase in NO_2 concentrations. In 2018, Manchester Oxford Road continued to record the highest annual mean NO_2 concentration at 62µg/m^3 (99.47% data capture), down 3µg/m^3 from the 2017 annual mean. Oxford Road is one of the main corridors from south Manchester into the city centre, with two major Universities, student accommodation and a teaching hospital, making it one of the busiest commuter routes in Europe with a high proportion of buses. There have also been a lot of roadworks near the monitoring site to improve the network, which is believed to have caused temorary congestion in the area. Tameside Mottram Moor remains the second highest site with a 2018 annual mean NO_2 concentration of 43µg/m^3, down 1µg/m^3 from 2017.

Diffusion tube results:

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in the document 'Appendix 2_ASR_2018_Datatable_v1'.

In total, during 2018 there were 46 exceedances of the NO_2 annual mean (AM) air quality objective (AQO) inside the AQMA. These were recorded in all of the boroughs except for BMBC and OC. Further to this, there were 36 sites which recorded NO_2 AM concentrations within 10% of the AQO. Outside of the AQMA, there were 7 exceedances of the NO_2 AM AQO (in TMBC and WC), with a maximum concentration of 57.7 in WC. There were 4 sites outside of the AQMA that recorded NO_2 AM concentrations within 10% of the AQO.

Of the 113 DT sites operating inside the AQMA in 2011, 102 of them recorded lower concentrations in 2018. Of the 68 DT sites operating outside of the AQMA across the same period, 63 have shown some improvement, with 31 sites showing an improvement of 5 µg/m^3 or more. Yearly improvements have typically been relatively minor across this period, with the exception of a triplicate site in Bury which has shown significant reductions. From 2017 to 2018, 119 DTs recorded lower NO_2 AM concentrations (with an average decrease of 3.5 µg/m^3). Over the same period, 30 DTs showed elevated concentrations, with an average increase of 1.9 µg/m^3, which is similar to the period 2016-2017. Outside of the AQMA, 87 of 109 DT sites showed improvement between 2017 and 2018, with an average reduction of 2.7 µg/m^3. 20 Sites outside of the AQMA saw NO_2 AM concentrations rise over the last year. Wigan 118 and Rochdale 14A have shown particularly concerning increases – 12.8µg/m^3 and 14.1µg/m^3 respectively.

With regards to NO_2 AM concentrations in individual local authority areas, the following observations are made:

- BoMBC has seen good improvement over the last 8 years. Of the 21 DTs operating in 2011, all of those still operating have seen reductions averaging 6.6µg/m^3. Of the 22 sites operating between 2017 and 2018, 16 sites showed improvement, with an average reduction of 2.5µg/m^3. This average reduction has decreased from last year by 1.2 µg/m^3. The largest annual increase was 6.1µg/m^3, and was seen at site 60. 7 Additional sites have been added within the AQMA in 2018, 4 of which showed exceedances of the annual mean objective.

The Diffusion tube BO62 has been excluded from these annual results due to abnormal readings. A quality control investigation has concluded that this was the result of duplication caused by human error.

- In BMBC there have been improvements at 5 sites, and increased concentrations at 5 sites. These increased concentrations have averaged of 0.8µg/m^3. In 2017 there were improvements at all 10 sites. The highest concentration of 36.7 µg/m^3 was recorded at Bolton Road, Bury.
- In MCC, there have been improvements at all 26 sites since 2011, with an average reduction of 7.2 µg/m^3. The sites on Oxford Road have seen large reductions of up to 18.1 µg/m^3 during this time period, yet remain well above the annual mean objective with concentrations of over 50 µg/m^3. Of the 38 sites operating since 2016, all but 3 have shown lower concentrations in 2018 relative to 2017. This is an improvement on the year before, where just 29 of 38 sites showed lower concentrations. Between 2017 and 2018, 3 sites showed increases averaging 1.8 µg/m^3. The average AM concentration inside this part of the AQMA is 37.9µg/m^3.
- In OC, all but one of the 15 DTs have recorded good improvements in 2018. The New Street, Lees site showed a 4 µg/m^3 increase on 2017. This site is not within the AQMA. Otherwise, an average decreased concentration of 6.7 µg/m^3 has been recorded at 15 Oldham DTs. Over the past 8 years air NO_2 concentrations have significantly deteriorated.
- In RMBC NO_2 concentrations have shown mixed results. There were some significant increases at 5 of the 16 continuing sites of up to 15.9 µg/m^3. This site (Heybottom Calderbrook) is not in the AQMA. 11 Sites have seen decreases averaging 4.1 µg/m^3. 5 new sites have been added, of which 2 are in the AQMA.
- In SCC, of the 25 DT sites operating in 2011, lower levels were recorded in 2018 at all of these. Of the 37 DT sites operating in 2017, lower levels were recorded at 35 of these in 2018. No increases in annual mean NO_2 concentrations were seen within the AQMA. SA28, SA37 and SA42 were not operational this year.
- In SMBC, of the 29 DT sites in 2011, higher concentrations were recorded at 5 sites in 2018. 6 sites showed higher concentrations in 2018 than in 2017. Most are minor increases.

- In TMBC, reductions were recorded at all sites operational between 2011-2017. All but 3 DT sites showed lower levels compared to 2017, and the average increase at these three sites was 1.2 µg/m^3. 7 Sites within the AQMA recorded exceedances in 2018.
- In TBC, 7 of the 23 DT sites showed higher concentrations in 2018 than in the previous year, 4 of which were outside the AQMA. In 2018, increases have been seen at five or the 9 original 2011 DT sites.
- In WC there have been good improvements since 2011, with all 21 sites that were operating then recording lower levels in 2018. Between 2017 and 2018, there were 10 sites that showed elevated levels from 2017, 7 of which were inside the AQMA. The average increase here was 4.4 µg/m^3.[4]

The diffusion tube network will be kept under periodic review by local authorities to ensure that it remains fit for purpose.

Hourly Concentrations

Table A.4 shows the number of automatic monitoring site hourly exceedences above 200µg/m^3 with 99.8 percentile in brackets for some years. There were no exceedences of the hourly air quality objective in 2018.

The 99.8 percentile is a useful indicator to compare against the 200µg/m^3 for sites with low data capture. If the 99.8 percentile is above 200µg/m^3, then the hourly standard is likely to be exceeded. No sites have a 99.8 percentile above 200µg/m^3 in 2018 .

3.2.2 Particulate Matter (PM_{10})

Annual Mean Concentrations

Figure A.2**Error! Reference source not found.** 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.

This shows that the annual mean PM_{10} concentration for sites in Greater Manchester continue to remain well below the objective level. However, in 2018, 13 sites saw small

[4] For NO_2 tubes there were some operational anomalies during a short period of time in 2018 which has now been addressed. We believe that this may have resulted in anomalies in a small number of tubes which we have identified. The following tubes were impacted. Tube references 24 and 122 recorded abnormally elevated levels during November and tube references 33, 51 and 129 recorded abnormally elevated levels in December. Whilst we have little confidence in the accuracy of these particular results we have included them in our annual averages for reasons of completeness and openness.

increases of between 0.84µg/m3 to 3µg/m3 on 2017 concentrations, a pattern which has also been seen nationally. The cause of these increases is not certain but may be due to a combination of a colder than average winter which extended into March and the first half of April, increasing the need for heating as well as a dry summer which increasing re-suspended dust. Locally, prolonged fires on the moorlands surrounding Greater Manchester also elevated PM_{10} concentrations. The demolition and rebuilding of a school near the Wigan Centre site may be responsible for the higher concentrations recorded at this site. Therefore only 2 of the 15 automatic monitoring stations measuring PM_{10} recorded either no change or a reduction in annual mean concentrations. Figure A.2 present the results graphically. There are still no sites that exceed the annual mean air quality objective of 40µg/m3.

As expected concentrations at roadside sites remain higher than other sites in the network. The highest annual mean concentration recorded was 30µg/m^3 at a roadside location (Manchester Oxford Road), compared with 14µg/m^3 at the site with the lowest annual mean concentration (Trafford Moss Park).

Hourly Concentrations

Table A.5 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. No site exceeded this objective.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.6 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

$PM_{2.5}$ is monitored at 5 sites in Greater Manchester. All these sites had been seeing a downward trend until 2017. In 2018 all sites have recorded an increase of between 0.5 and 3µg/m^3, except for Salford Eccles which remained stable at 11µg/m^3. As with PM_{10} concentrations, the cause of these increases is not certain but may be due to the colder than average winter, prolonged fires on the moorlands surrounding Greater Manchester, and to the demolition and rebuilding of the school at the Wigan Centre site.

3.2.4 Sulphur Dioxide (SO_2)

Table A.7 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2018 with the air quality objectives for SO_2. No exceedances of the SO_2 annual mean objective were recorded for 2018, as with 2017.

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)
BURY	Bury Whitefield	Urban Traffic	380637	406974	NO2 PM10	YES	Chemiluminescent & FDMS	24	7	3.5
BUR2	Bury Prestwich	Urban Traffic	381650	403222	NO2 PM10	YES	Chemiluminescent & TEOM	15	2.5	1.5
BUR1	Bury Radcliffe	Urban Traffic	378190	407480	NO2 PM10	YES	Chemiluminescent & TEOM	10	2.5	1.5
GLAZ	Glazebury	Rural Background	368758	396031	NO2 O3	YES	Chemiluminescent & UV absorption	132	1370	3
MAN1	Manchester Oxford Rd	Urban Traffic	384233	397287	NO2 PM10	YES	Chemiluminescent & BAM	1	1	2
MAN3	Manchester Piccadilly	Urban Background	384310	398337	NO2 O3 PM10 PM2.5 SO2	YES	Chemiluminescent & UV absorption & BAM & FDMS & UV fluorescence	2	30	4
MAN8	Manchester South	Suburban Background	383904	385818	NO2 O3 SO2 PM10 PM2.5	NO	Chemiluminescent & UV absorption & UV fluorescence & Partisol	30	15	2
CW	Oldham Crompton Way	Urban Traffic	393887	409191	NO2 PM10	YES	Chemiluminescent & TEOM	10	1	1.5
ECCL	Salford Eccles	Urban Industrial	377924	398728	NO2 PM10 PM2.5	YES	Chemiluminescent & FDMS, Palas Fidas (from Aug 2018)	6	5	3.5
M60	Salford M60	Urban Traffic	374807	400858	NO2 PM10 PM2.5 O3	YES	Chemiluminescent, BAM & UV absorption	82	22.5	3
STK5	Stockport Hazel Grv	Urban Traffic	391481	387637	NO2 PM10	YES	Chemiluminescent & TEOM	33	4	2

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)
TAM1	Tameside Mottram M'r	Urban Traffic	399719	395804	NO2 PM10	YES	Chemiluminescent & TEOM	4	5	4
TAME	Tameside Two Trees Sch	Urban Background	393454	394330	NO2 O3 PM10	NO	Chemiluminescent & TEOM	0	53	3
TRAF	Trafford	Urban Background	378783	394726	NO2 PM10 SO2	NO	Chemiluminescent & TEOM	60	98	2.5
TRF2	Trafford A56	Urban Traffic	379413	394014	NO2 PM10	YES	Chemiluminescent & TEOM	40	2	2.5
WIG5	Wigan Centre	Urban Background	357816	406024	NO2 O3 PM10, PM2.5	NO	Chemiluminescent & TEOM	0	175	2.5
MAHG	Manchester Sharston	Suburban	384179	386086	NO2 O3 SO2	NO	Chemiluminescent & UV absorption & UV fluorescence & Partisol	35	6	2.7
STK7	Stockport Cheadle A34	Roadside	385047	388339	NO2 PM10	YES	Chemiluminescent & TEOM	18	2	2
CM2	Name2	Select	332200	433540	NO_2	YES/NO	Chemiluminescent	0	N/A	1.5

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

The full list of non-automatic monitoring sites is detailed in Table A.2 of the attached "Appendix 2_ASR_2018_Datatable_V1" file.

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/m^3) (3)				
					2014	2015	2016	2017	2018
Bury Whitefield	Urban Traffic	Automatic	N/A	99.43%	-	25	30	28	25
Bury Prestwich	Urban Traffic	Automatic	N/A	99.14%	**49**	**42**	**42**	**42**	38
Bury Radcliffe	Urban Traffic	Automatic	N/A	98.78%	29	27	28	27	25
Glazebury	Rural Background	Automatic	N/A	78.12%	14	15	16	13	14
Manc Oxford Rd	Urban Traffic	Automatic	N/A	99.47%	**68**	**66**	**66**	**65**	**62**
Manch Piccadilly	Urban Background	Automatic	N/A	99.11%	40	39	40	36	35
Manchester South	Suburban Background	Automatic	N/A	N/A	22	20	-	-	-
Oldham Crompton Way	Urban Traffic	Automatic	N/A	94.80%	32	33	34	32	28
Salford Eccles	Urban Industrial	Automatic	N/A	98.69%	30	27	29	26	25
Salford M60	Urban Traffic	Automatic	N/A	95.66%	**60**	**52**	**46**	**43**	**41**
Stockport Hazel Grove	Urban Traffic	Automatic	N/A	78.94%	27	24	25	22	25
Tameside Mott'm M'r	Urban Traffic	Automatic	N/A	95.54%	**49**	**54**	**49**	**44**	**43**
Tameside Two T's	Urban Background	Automatic	N/A	N/A	16	19	18	-	-
Trafford	Urban Background	Automatic	N/A	99.60%	22	20	22	19	18
Trafford A56	Urban Traffic	Automatic	N/A	99.65%	32	30	33	30	29

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2014	2015	2016	2017	2018
Wigan Centre	Urban Background	Automatic	N/A	97.71%	22	19	21	18	17
Manchester Sharston	Suburban	Automatic	N/A	98.30%	-	-	23	24	24
Stockport Cheadle A34	Roadside	Automatic	N/A	99.68%	-	-	-	**43**	37

For Diffusion Tube data, please see file 'Appendix 2_ASR_2018_Datatable_V1'.

☒ **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 40$\mu g/m^3$ are shown in **bold**.

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

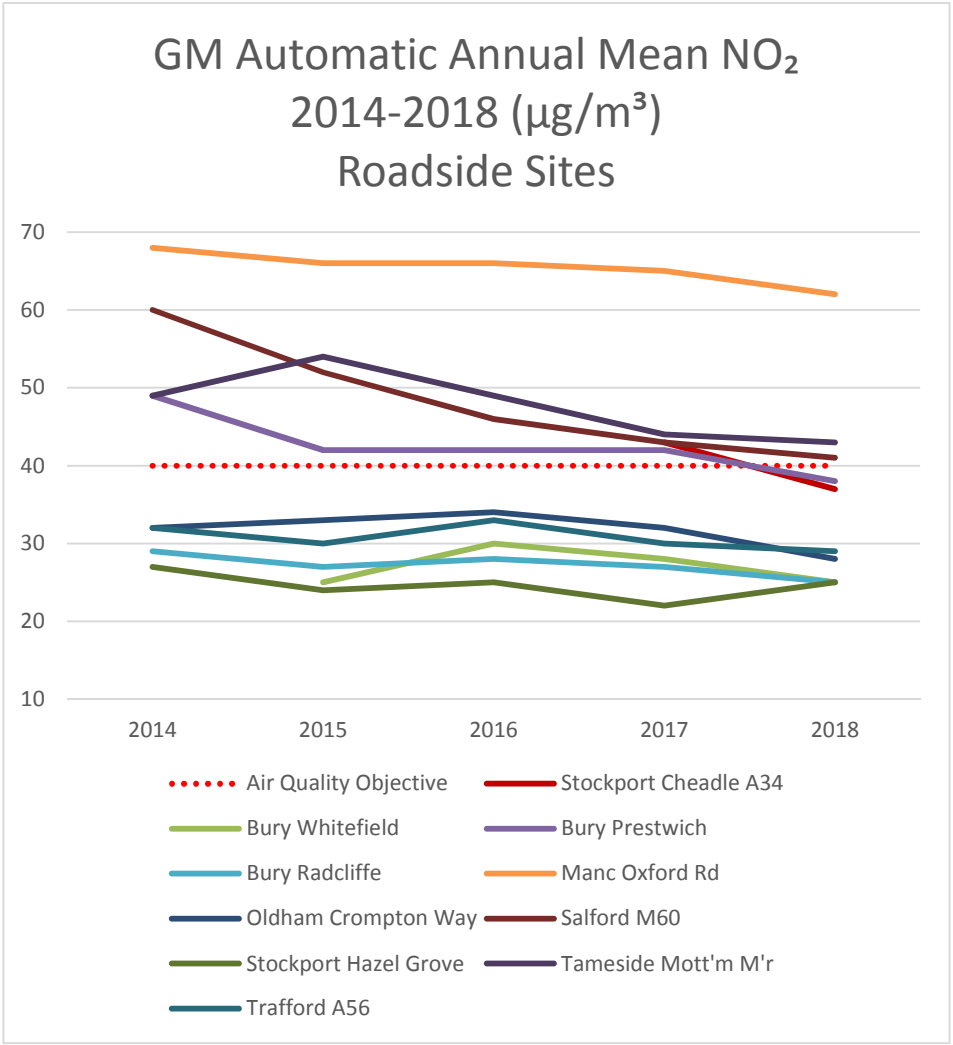
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(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.

(4) Data capture for Salford Glazebury was affected by a power cut to the site which occurred from July to September 2018.

Figure A.1. Trends in Annual Mean NO_2 Concentrations



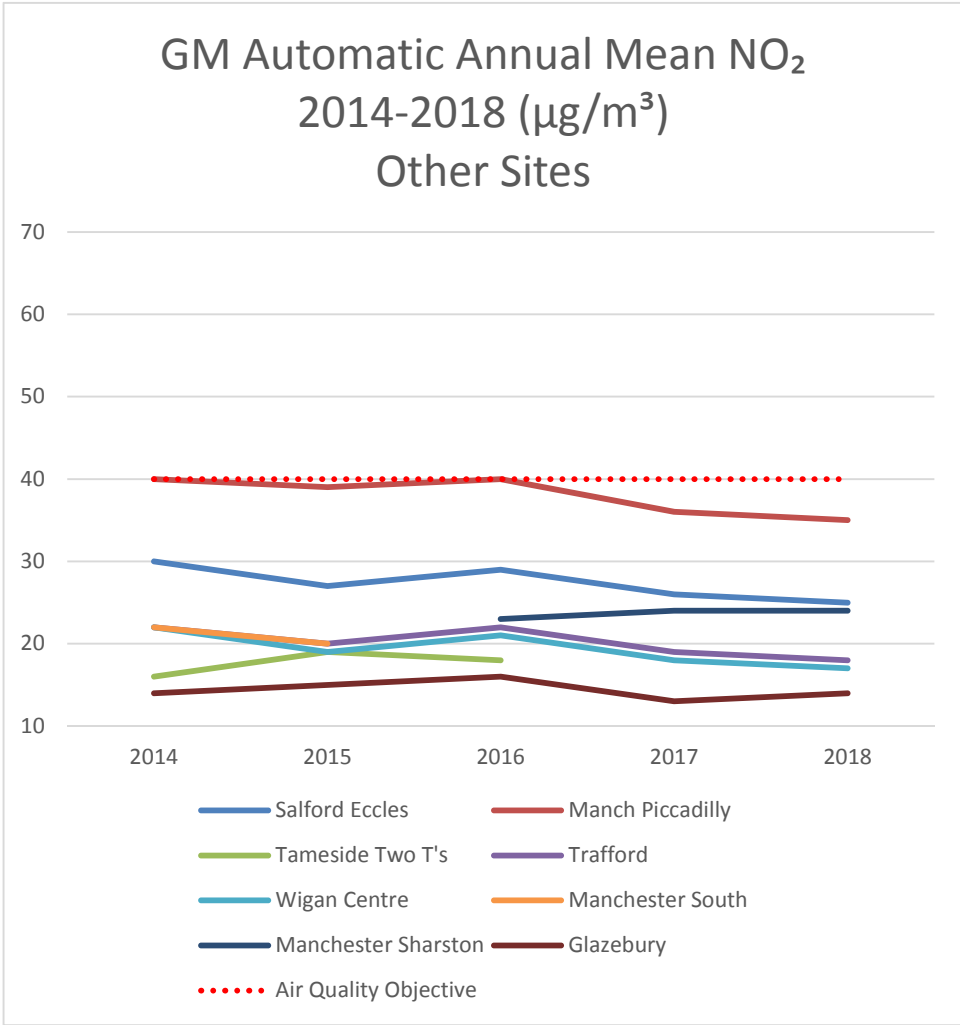


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

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
Bury Whitefield	Urban Traffic	Automatic	N/A	99.43%	-	0	0	0	0
Bury Prestwich	Urban Traffic	Automatic	N/A	99.14%	0	0	0	0	0
Bury Radcliffe	Urban Traffic	Automatic	N/A	98.78%	0	0	0	5	0
Glazebury	Rural Background	Automatic	N/A	78.12%	0	0	0	0	0(69)
Manc Oxford Rd	Urban Traffic	Automatic	N/A	99.47%	14	60	90	6	2
Manch Piccadilly	Urban Background	Automatic	N/A	99.11%	2	1	0	1	0
Manchester South	Suburban Background	Automatic	N/A	N/A	0	0	-	-	-
Oldham Crompton Way	Urban Traffic	Automatic	N/A	94.80%	**0(301)**	0(109)	0	0	0
Salford Eccles	Urban Industrial	Automatic	N/A	98.69%	0	0	0	0	0
Salford M60	Urban Traffic	Automatic	N/A	95.66%	0	3	0	0	0
Stockport Hazel Grove	Urban Traffic	Automatic	N/A	78.94%	0	0	0	0	0
Tameside Mott'm M'r	Urban Traffic	Automatic	N/A	95.54%	13(199)	8(189)	0	0	0
Tameside Two T's	Urban Background	Automatic	N/A	N/A	0	0	0	-	-
Trafford	Urban Background	Automatic	N/A	99.60%	0	0	0	0	0
Trafford A56	Urban Traffic	Automatic	N/A	99.65%	0	0(107)	0	0	0
Wigan Centre	Urban Background	Automatic	N/A	97.71%	0	0	0	0	0
Manchester Sharston	Suburban	Automatic	N/A	98.30%	**-**	-	0	0	0
Stockport Cheadle A34	Roadside	Automatic	N/A	99.68%	**-**	-	-	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.

(4) Data capture for Salford Glazebury was affected by a power cut to the site which occurred from July to September 2018.

Table A.5 – Annual Mean 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 ($\mu g/m^3$) [3]				
				2014	2015	2016	2017	2018
Bury Whitefield	Urban Traffic	N/A	94.14%	-	17	15	15	16
Bury Prestwich	Urban Traffic	N/A	97.91%	23	20	19	19	19
Bury Radcliffe	Urban Traffic	N/A	97.27%	22	18	18	16	18
Manc Oxford Rd	Urban Traffic	N/A	94.06%	28	28	27	27	30
Manc Piccadilly	Urban Background	N/A	94.82%	20	20	20	20	21
Manchester Sharston	Suburban	N/A	94%	-	-	13.6	13.4	14.24
Manchester South	Suburban Background	N/A	N/A	16	15	-	-	-
Oldham Crompton Way	Urban Traffic	N/A	94.79%	-	19	17	17	19
Salford Eccles	Urban Industrial	N/A	86.29%	18	18	17	16	17
Salford M60	Urban Traffic	N/A	96.54%	21	20	20	20	20
Stockport Hazel Grove	Urban Traffic	N/A	83.56%	22	18	19	16	19
Tameside Mott'm M'r	Urban Traffic	N/A	94.51%	23	18	18	17	19
Tameside Two T's	Urban Background	N/A	N/A	17	14	13	-	-
Trafford	Urban Background	N/A	98.93%	17	15	15	13	14
Trafford A56	Urban Traffic	N/A	96.68%	20	18	17	15	18
Wigan Centre	Urban Background	N/A	92.82%	18	18	16	15	17
Stockport Cheadle A34	Roadside	N/A	91.63%	-	-	-	18	19

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

Notes:

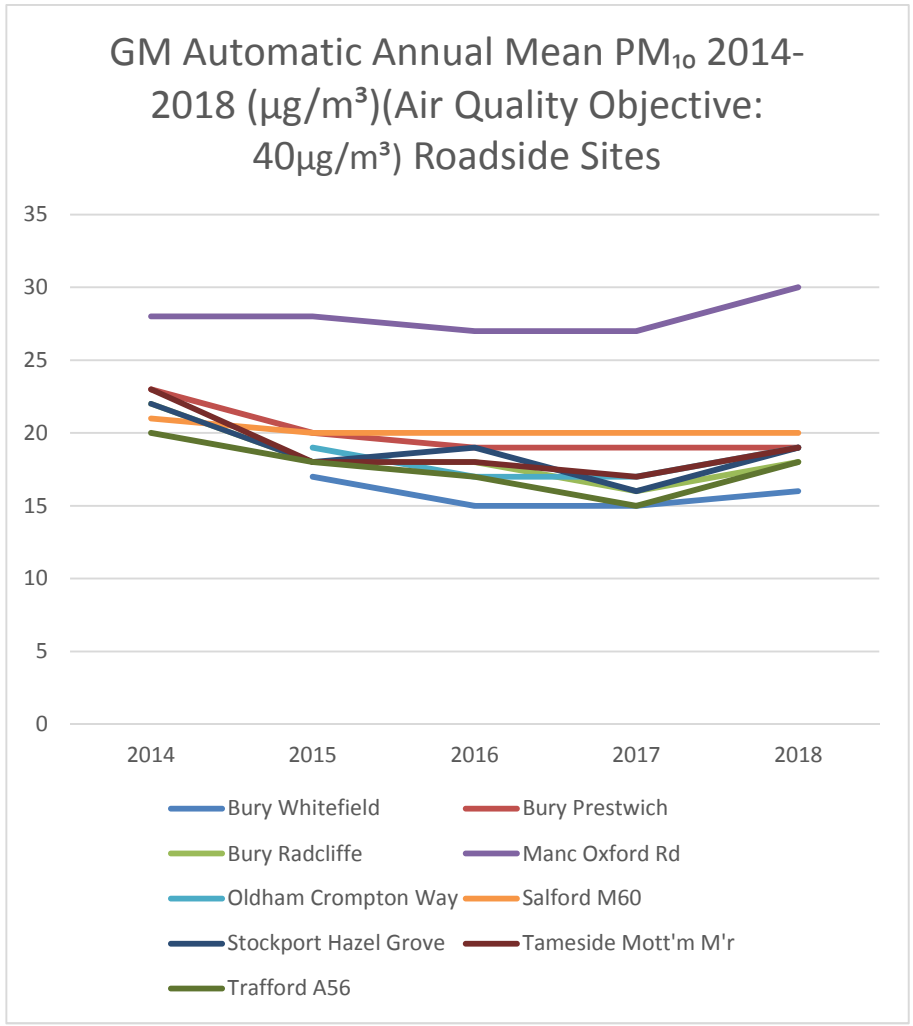
Exceedances of the PM_{10} annual mean objective of $40\mu g/m^3$ are shown in **bold.**

(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.

Figure A.2. Trends in Annual Mean PM_{10} Concentrations



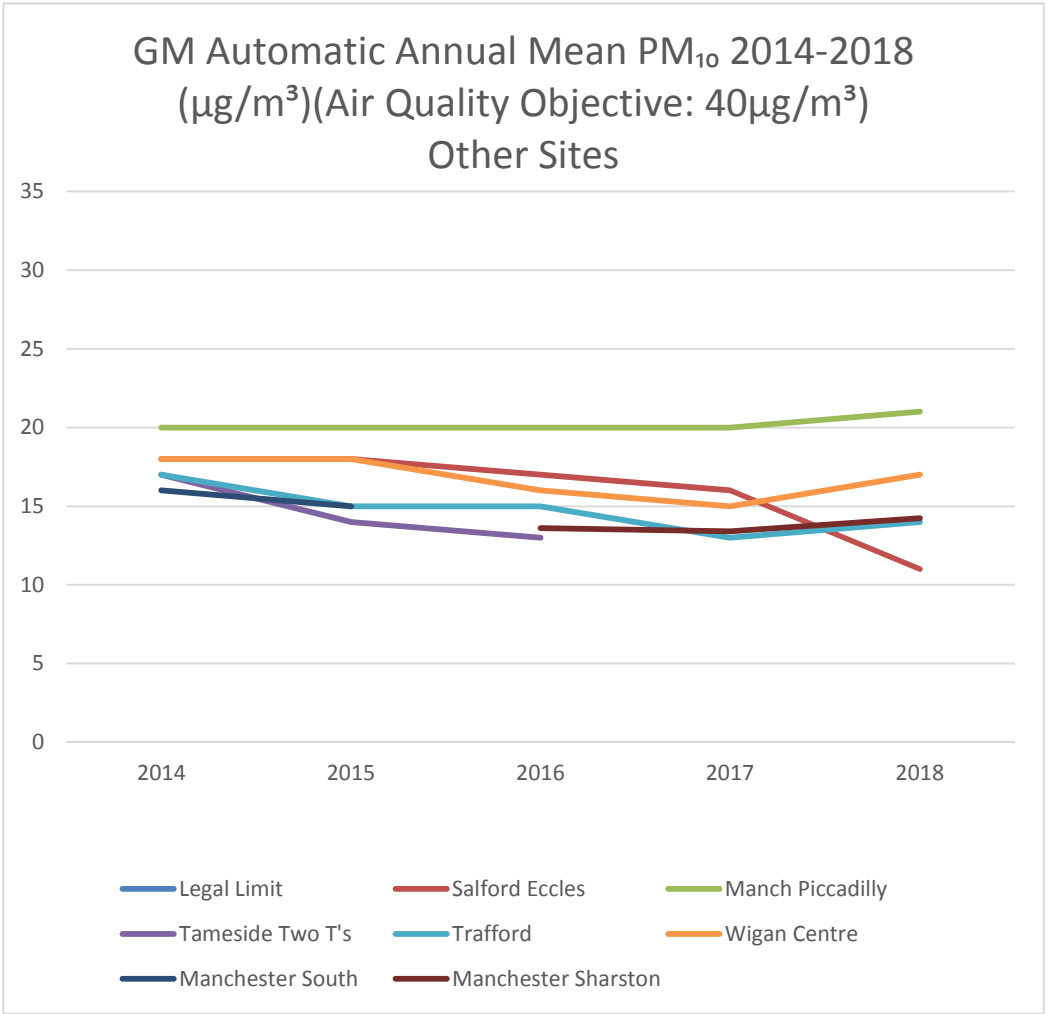


Table A.5 – 24-Hour Mean PM_{10} Monitoring Results

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
Bury Whitefield	Urban Traffic	N/A	94.14%	**-**	6	1	1	2
Bury Prestwich	Urban Traffic	N/A	97.91%	4	6	1	4(29)	1
Bury Radcliffe	Urban Traffic	N/A	97.27%	4	5	2	1	1
Manc Oxford Rd	Urban Traffic	N/A	94.06%	18	25	16	15	15
Manch Piccadilly	Urban Background	N/A	94.82%	5	3	3	3	2
Manchester Sharston	Suburban	N/A	94%	-	-	0	0	0
Manchester South	Suburban Background	N/A	N/A	8	4	-	-	-
Oldham Crompton Way	Urban Traffic	N/A	94.79%	5(28)	11	1	2	0
Salford Eccles	Urban Industrial	N/A	86.29%	6	5	2	5	2
Salford M60	Urban Traffic	N/A	96.54%	3(34)	5	5(34)	8	4
Stockport Hazel Grove	Urban Traffic	N/A	83.56%	11	6	5	1	5(33)
Tameside Mott'm M'r	Urban Traffic	N/A	94.51%	3	3	0	2	0
Tameside Two T's	Urban Background	N/A	N/A	0	1	0	-	-
Trafford	Urban Background	N/A	98.93%	1	2	0	0	0
Trafford A56	Urban Traffic	N/A	96.68%	3	5	0	0	0
Wigan Centre	Urban Background	N/A	92.82%	1(26)	1	0	3	1
Stockport Cheadle A34	Roadside	N/A	91.63%	**-**	-	-	0	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.6 – $PM_{2.5}$ 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
Manc Piccadilly	Urban Background	N/A	94.77%	12	10	10	8	11
Manchester South	Suburban	N/A	N/A	10	8	-	-	-
Salford Eccles	Industrial	N/A	83.45%	15	11	10	11	11
Wigan Centre	Urban Background	N/A	77.71%	14	11	11	10	12
Manchester Sharston	Suburban	N/A	99.50%	-	-	8.2	7.6	8.1
Salford M60	Roadside	N/A	99.45%	-	-	-	9	10

☒ **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.3. Trends in Annual Mean $PM_{2.5}$ Concentrations

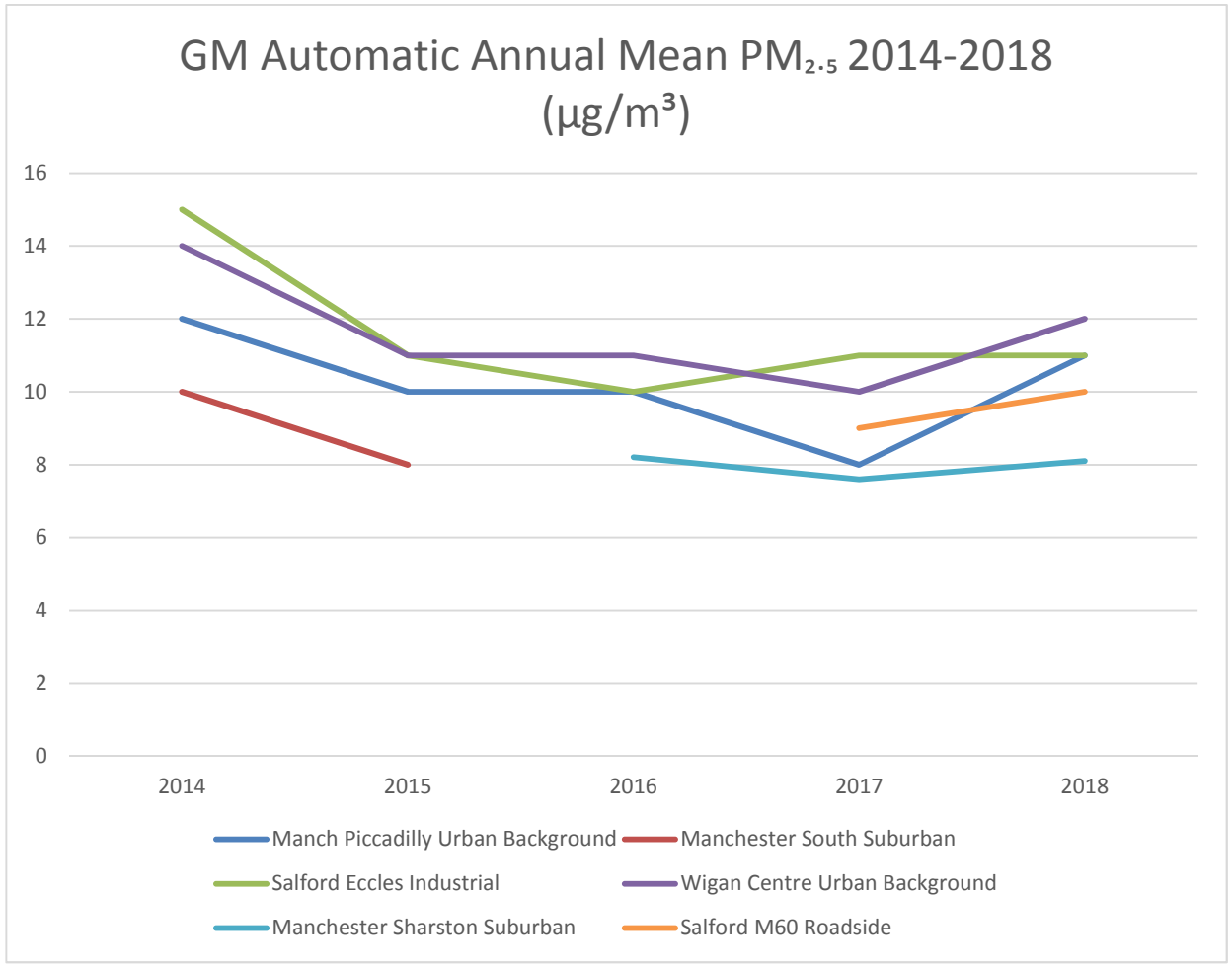


Table A.7 – SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	Number of Exceedances 2018 (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)
Manchester Sharston	Suburban	N/A	98.22%	0	0	0
Manchester Piccadilly	Urban Background	N/A	97.29%	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 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2018

See accompanying file Appendix 2_ASR_2018_Datatable_V1 for full table of NO_2 monthly diffusion tube results (2018).

☐ **Local bias adjustment factor used**

☒ **National 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.**

(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

Diffusion Tube Annualisation

Annualisation is applied where monitoring has been completed for less than 75% of the year, and are used to estimate an annual average from a part year average. The example in Figure C1 below shows calculations used to annualise 11 diffusion tubes, as recommended by DEFRAs Local Air Quality Management Technical Guidance (TG16).

Figure C1. Annualisation Calculations

Diffusion tube BO61 - Primrose Street, Kearsley. Annualisation factor

Start Date	End Date	B1	D1	B1 when D1 is availabl
01/01/2017	01/02/2017	34.2		
01/02/2017	01/03/2017	23.9	55.1	23.9
01/03/2017	29/03/2017	27.3	46	27.3
29/03/2017	04/05/2017	19.5	31.8	19.5
04/05/2017	31/05/2017	17.6		
31/05/2017	28/06/2017	16.4	26.9	16.4
28/06/2017	02/08/2017	16.6	38.6	16.6
02/08/2017	30/08/2017	17.7	34.2	17.7
30/08/2017	27/09/2017	21.6	44	21.6
27/09/2017	01/11/2017	20.8		
01/11/2017	06/12/2017	34.2		
06/12/2017	03/01/2017	33.2	54	33.2
Average		23.6	41.3	22.0

B1 - Real-time background site (Manchester, Sharston)
D1- Diffusion tube BO61

Ratio B1 / B1 when D1 is available	23.6 / 22.0	annualisation factor	1.07
D1 x 1.07	41.3 x 1.07	Annualised result	44.3
		NOTE: Not bias adjusted	

Diffusion Tube Bias Adjustment Factors

The tubes are prepared and analysed by Staffordshire Scientific Services using the 20% triethanolamine (TEA) in water method. The laboratory method is UKAS accredited, and the laboratory takes part in the AIR-PT independent quality assurance scheme. A summary report on laboratory performance in the AIR-PT scheme between April 2017 to February 2019 shows good performance during 2018.

NO_2 diffusion tubes are affected by several factors, which may cause them to have bias (over-read), or negative bias (under-read) relative to the reference technique. To

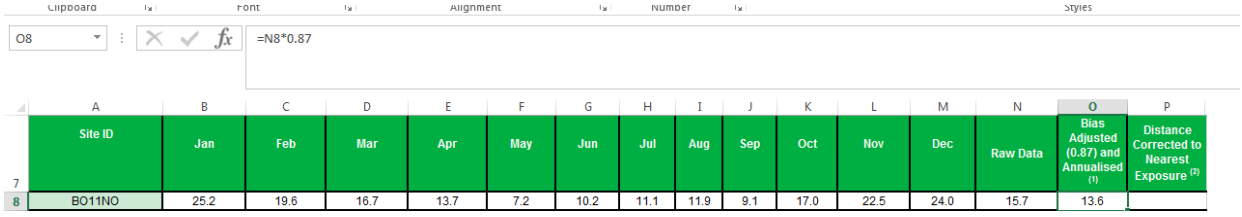
compare with the AQS objectives it's important that tubes are corrected (adjusted) by comparing with a chemiluminescent analyser reference method for NO_2.

A bias factor is calculated using a spread sheet provided by the National Physical Laboratory. Bias factors are collated in a national database enabling a large number of factors at a range of different site locations using the same laboratory and analysis method. There is a choice of using a locally derived bias factor based on local data or using the national dataset.

The bias adjustment factor used for 2018 is 0.87. This is the average bias adjustment factor for all colocation studies for Staffordshire Scientific Services, from the Defra National Bias Adjustment Factors Spreadsheet, March 2019 (version 03/19), available from the DEFRA website:

https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Figure C2. Bias Adjustment Calculation



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
7	Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.87) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
8	BO11NO	25.2	19.6	16.7	13.7	7.2	10.2	11.1	11.9	9.1	17.0	22.5	24.0	15.7	13.6	

As can be seen in Figure C2, the bias adjustment is applied to the annual average NO_2 concentration.

Distance Correction

Distance Correction is also required to represent the relevant exposure as it is not always possible to measure concentrations at precisely the desired location. For this, the DEFRA's NO_2 Fall-off with distance calculator (v4.2) has been applied to the bias adjusted concentrations. The methodology consists of comparing the monitored annual mean NO_2 concentrations at a given point against known relationships between NO_2 concentrations and the distance from a road source. Results should be treated with caution as a number of limitations of this methodology are acknowledged and can be downloaded from the DEFRA website: https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

Figure C3 shows an example of the calculator being used to determine distance correction values. This calculation was only applied to DTs with concentrations within 10% of the NO_2 AM objective.

Figure C3. Examples of Distance Correction Calculations

Enter data into the pink cells

Site Name/ID	Distance (m)		O_2 Annual Mean Concentration (µg/m			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
BO15NO	0.5	16.0	20.6	37.8	27.2	
BO3NO	0.5	2.0	22.2	40.3	35.8	
BO43NO	1.0	20.0	20.3	36.1	26.6	
BO60NO	1.5	5.9	23.5	36.9	32.8	

Automatic Analysers

Automatic air quality analysers in Greater Manchester area are subject to a high level of quality assurance/ quality control. All analysers are either operated as part of the national Automatic Urban and Rural Network (AURN) or are part of the 'Calibration Club' scheme run by Ricardo-AEA.

The procedures are equivalent to the UK Automatic Urban and Rural Network (AURN) the main features of the services being:-

Calibration Club

- Data screened daily for errors and final data ratified and published to same standard as AURN sites.
- Data checked daily for errors and faults reported to Local Site operators.
- Independent audits twice per year.
- Final data set scaled and ratified to same standard as AURN.

Greater Manchester Air Quality Network (GMAQN)

Ricardo-AEA manages QA/QC and audit of the air quality stations to the same standard as the AURN. The GMAQN officially started on 1 September 2013. Table A1 lists the Greater Manchester sites that are currently operational.

Particulate Monitoring

A number of different instruments are used in Greater Manchester for the measurement of particles. Historically TEOM have been used, but DEFRA replaced a number of instruments with TEOM FDMS and some sites use the BAM or Partisol.

The reference method for the UK PM_{10} Objectives (and EU limit values) is based upon measurements from a gravimetric sampler. This samples over a 24 hour period and the particulate proportion less than 10 microns (PM_{10}) is measured by the mass difference before and after exposure. It is labour intensive and the UK, and European countries have invested heavily in the TEOM (Tapered Element Oscillating Microbalance). The TEOM measurements have been historically adjusted by a factor of 1.3 to make them gravimetric equivalent. However to further improve the technique; the measurement was modified by lowering the sampling temperature from 50 C to 30 C and adding a dryer to remove water vapour. This system is referred to a Filter Dynamics Measurement System (FDMS) and is equivalent to the EU reference method.

Due to widespread use of the TEOM, and its reliability and the need to report to the EU using an 'equivalent method', The Volatile Correction Model (VCM) was developed by Kings College London, to adjust the TEOM data. Studies have shown that FDMS sites within 200 kilometres can be used to correct the TEOM data as it assumes that the sample lost by the heating is the same over this geographical area. Sufficient FDMS sites have only been available since 2008/9 for the correction to be applied. VCM corrections have been applied to TEOM analyser results automatically since 2014 and historic records within the ASR have been altered to reflect VCM corrected results.

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

Maps below are for reference. For more detailed locations of diffusion tubes, see https://cleanairgm.com/air-quality-data/diffusion-tubes.

Figure D1. Bolton diffusion tube locations

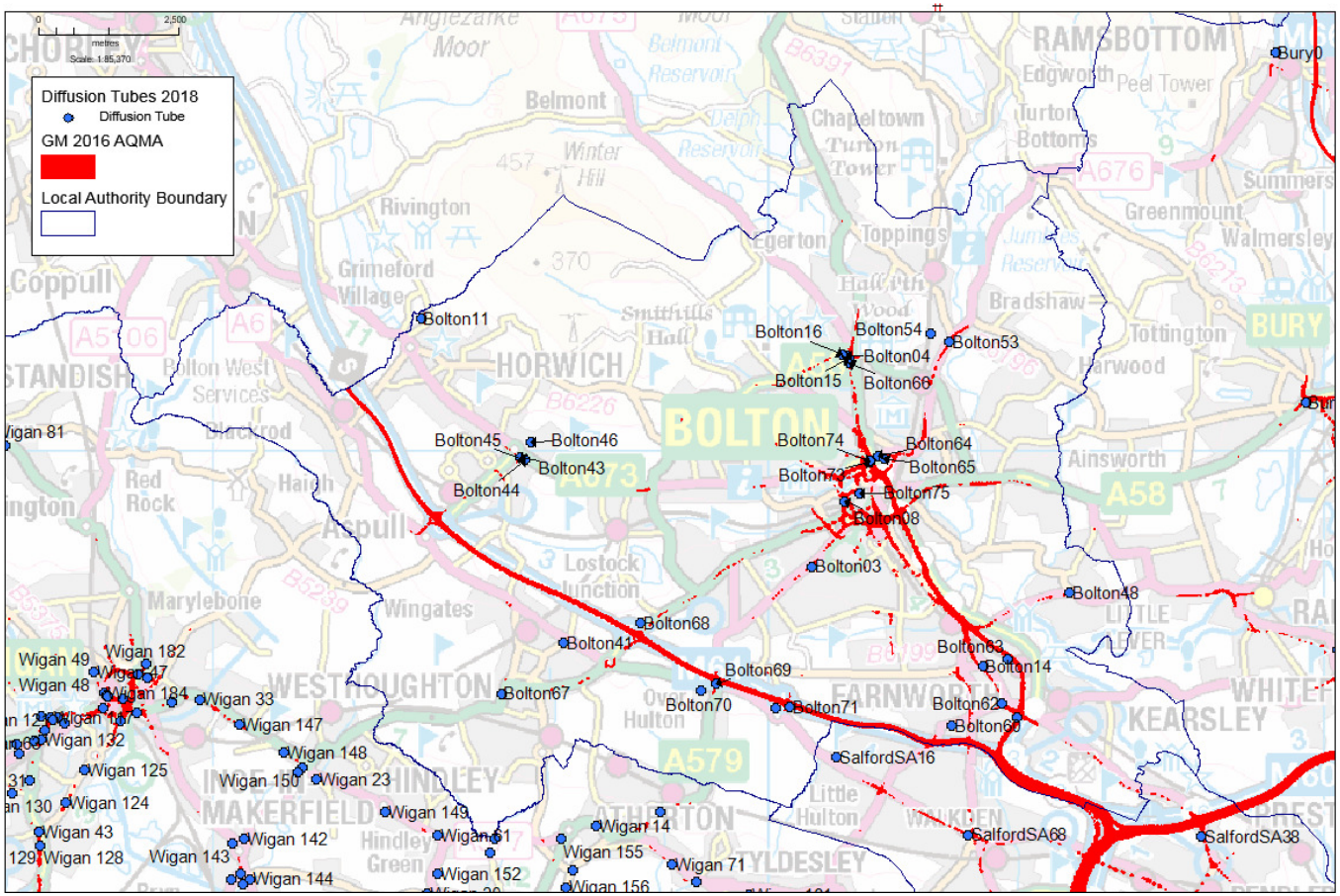


Figure D2. Bury, Rochdale and Oldham Diffusion Tube Locations

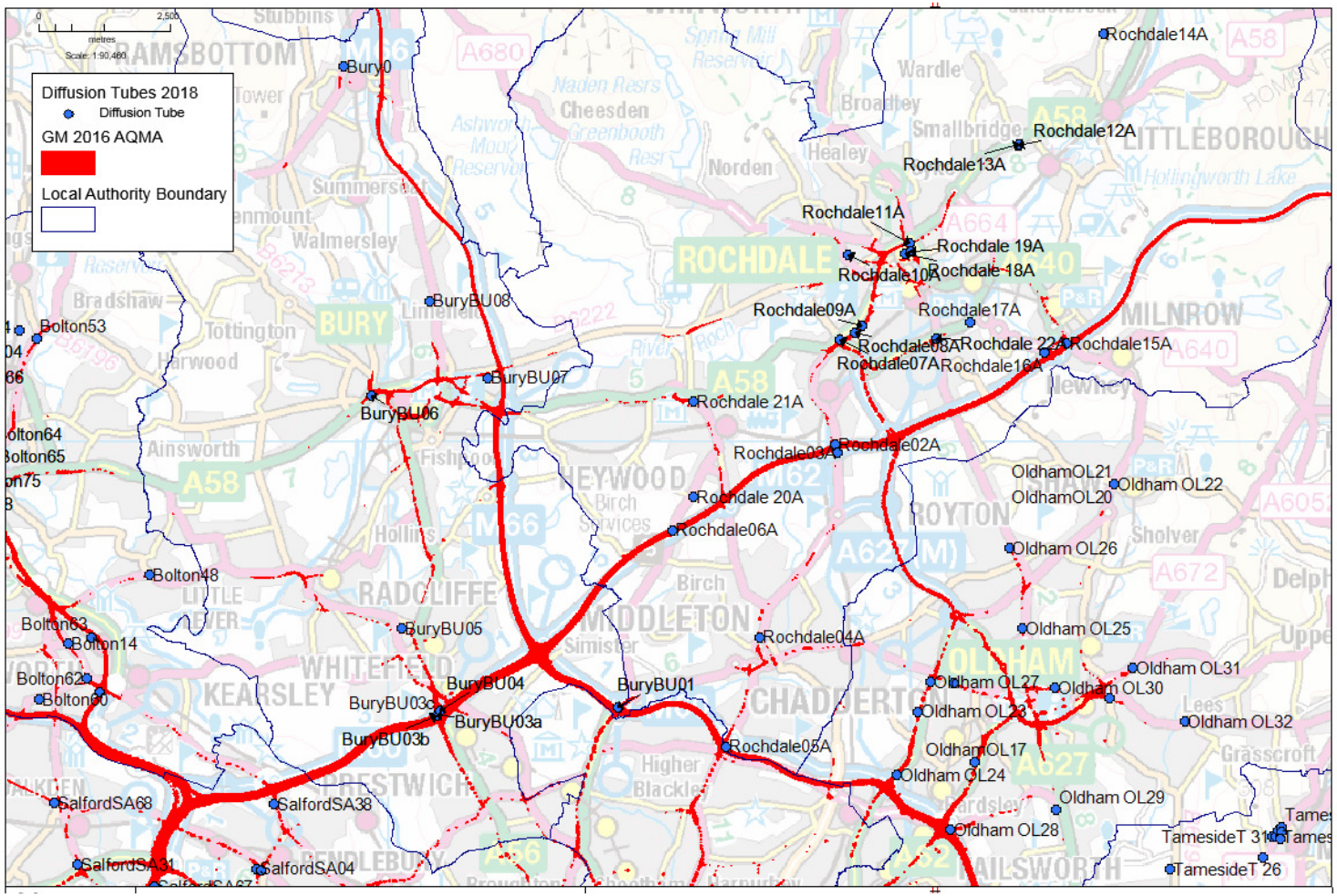


Figure D3. Tameside diffusion tube locations.

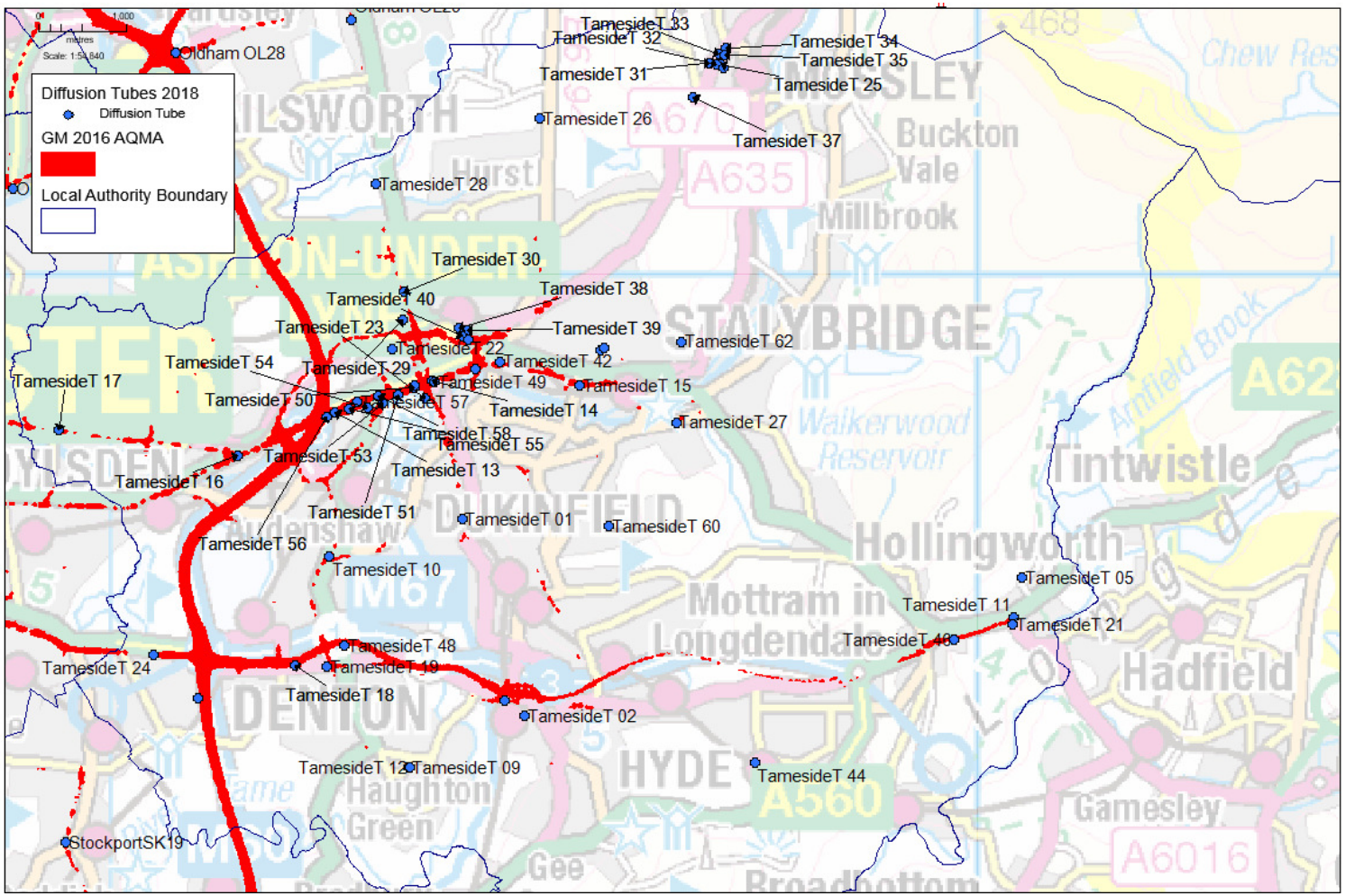


Figure D4. Stockport and South Manchester diffusion tube locations.

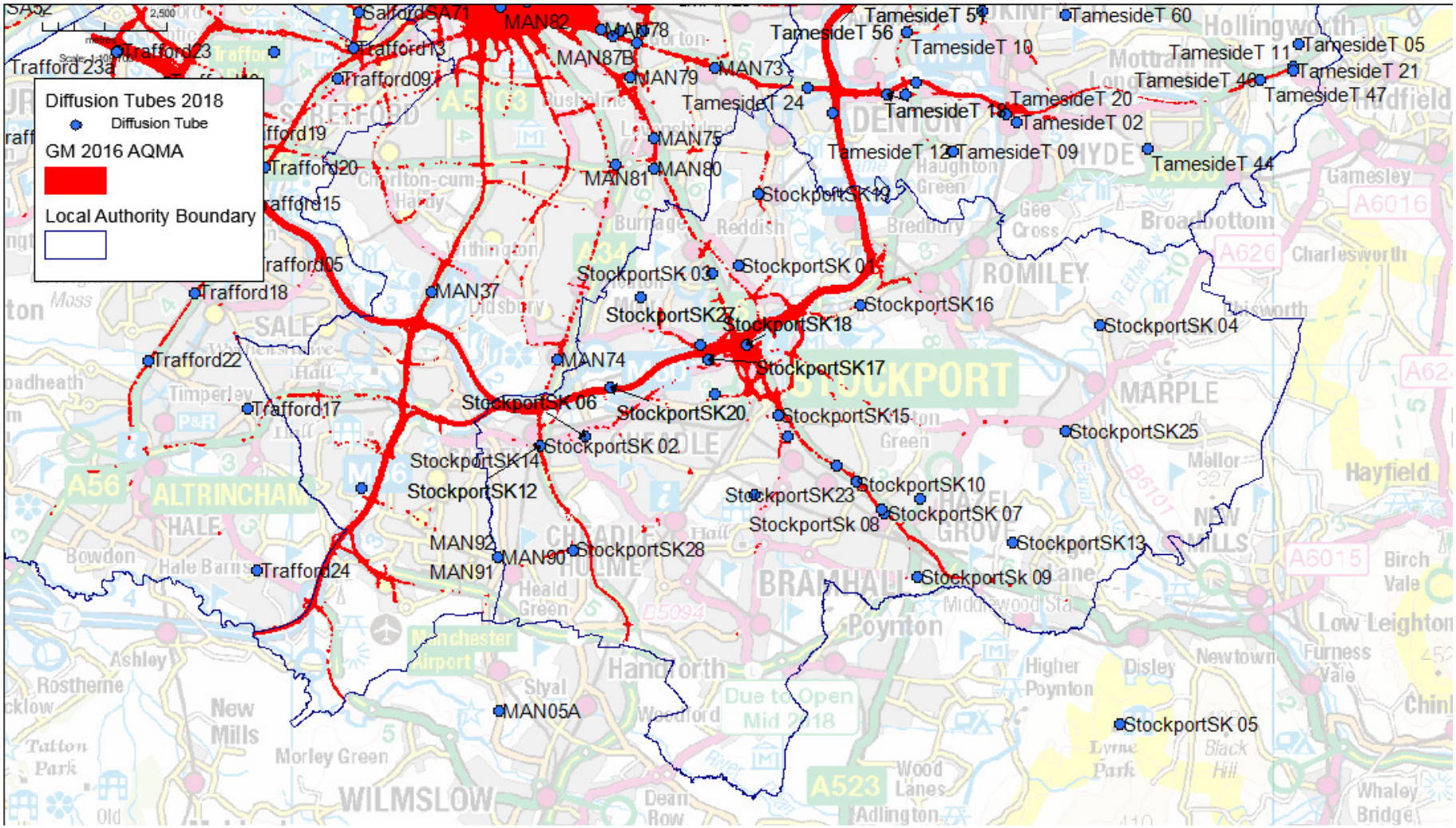


Figure D5. Manchester, Trafford and Salford diffusion tube locations.

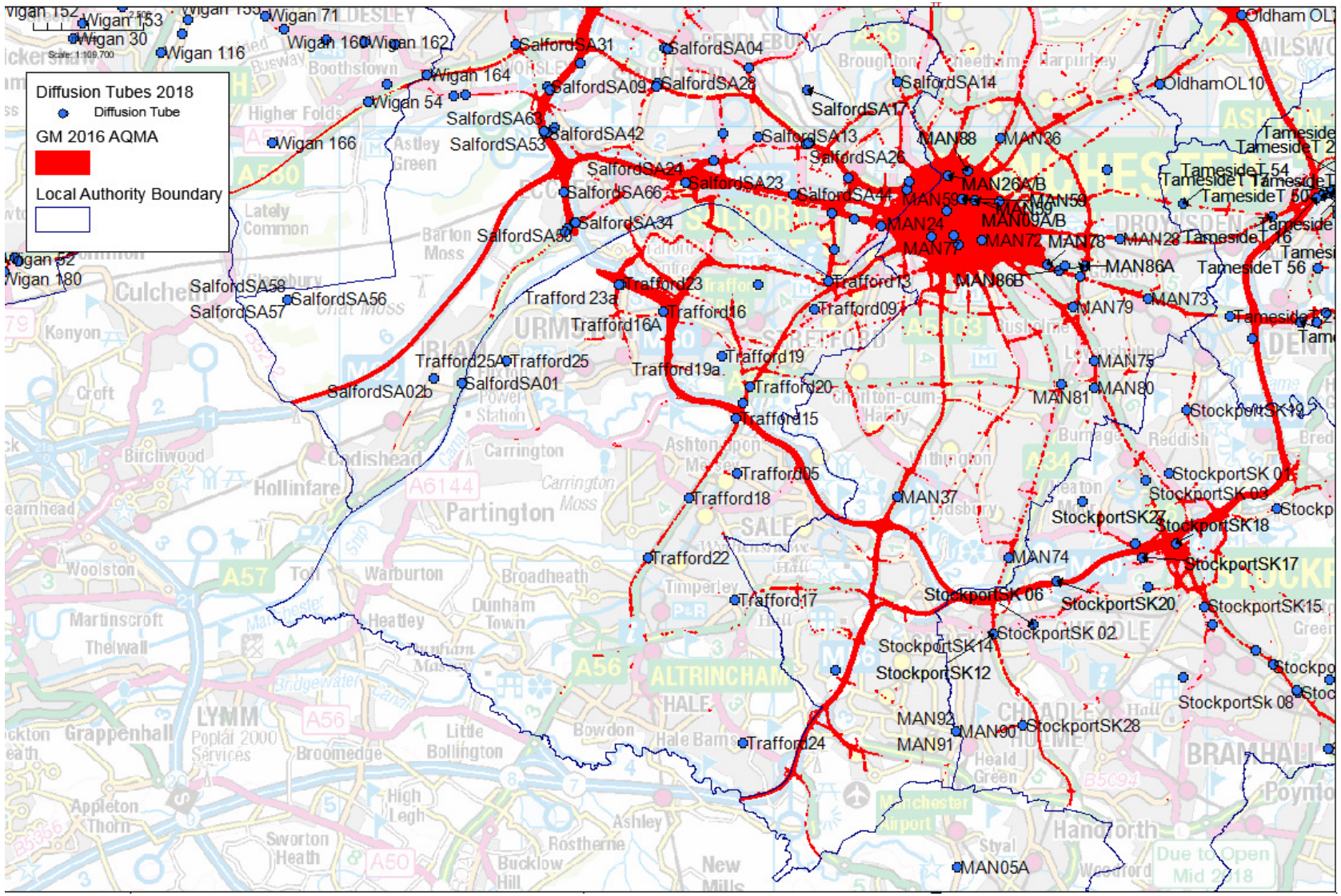
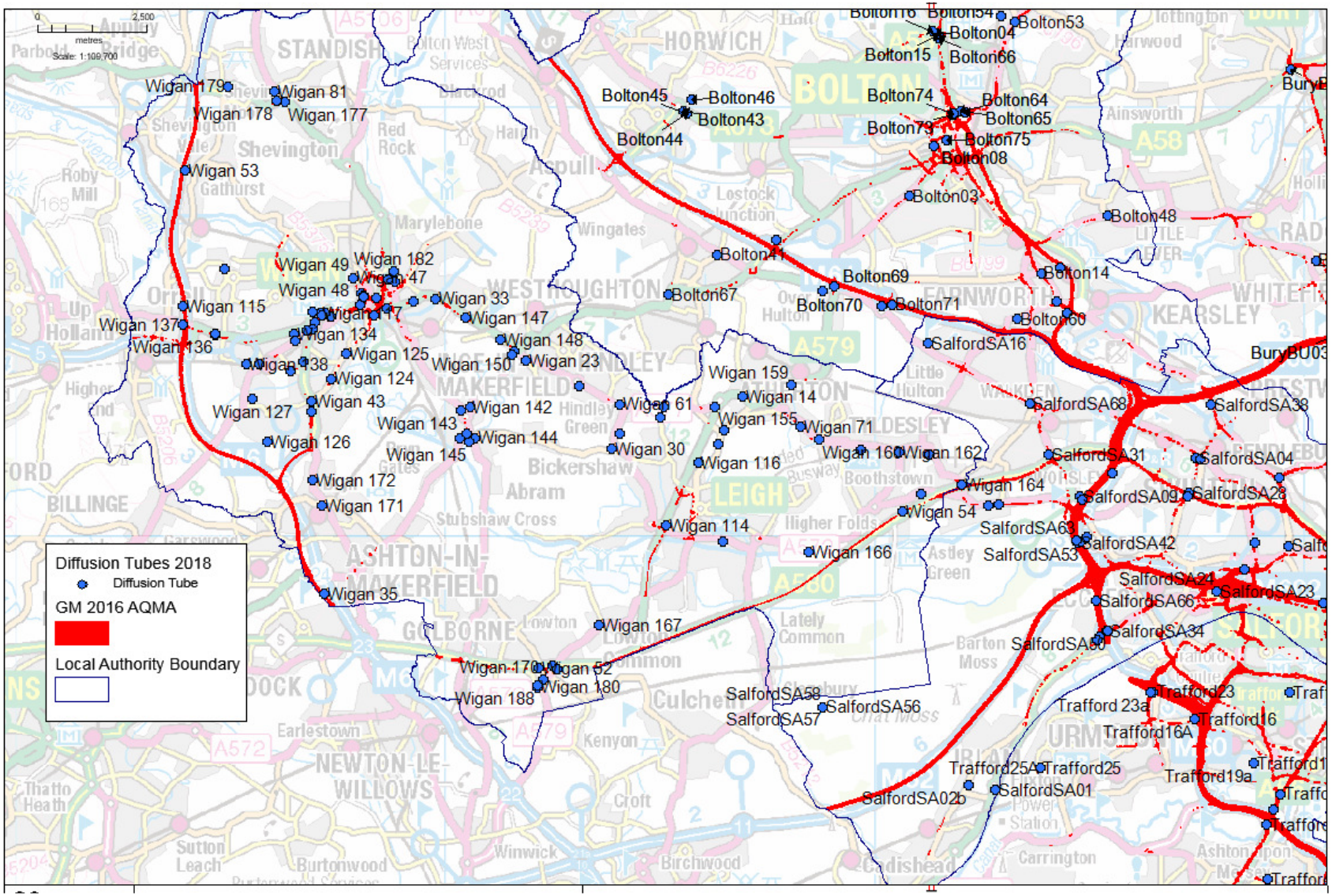


Figure D6. Wigan and Salford diffusion tube locations.



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[5]	
	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

National air quality policy guidance states that concentrations of benzene, 1,3-butadiene, lead and carbon monoxide have been well below objective levels for several years and national monitoring is currently providing a sufficient basis for the review and assessment of these pollutants.

[5] 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
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

References

Environmental equity, air quality, socioeconomic status and respiratory health, 2010

Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

Defra. Abatement cost guidance for valuing changes in air quality, May 2013