2016 Air Quality Annual Status Report (ASR) for Greater Manchester

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

Date: 31st July 2017

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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.

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[1].

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 districts.

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 new 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 old AQMAs, reduced in size due to falling NO_2 emissions, but 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.

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

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 (http://www.gmtu.gov.uk/gam_maps/) 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.

5 automatic sites out of the 17 in Greater Manchester exceeded the NO_2 annual mean objective of 40µg/m^3. These 5 sites were Salford M60, Manchester Oxford Road, Manchester Piccadilly, Bury Prestwich and Tameside Mottram Moor. One site (Manchester Oxford Road) had more than 18 exceedances of the hourly NO_2 objective (total of 90 exceedances).

The 2015 Greater Manchester Annual Status Report made reference to exceedances of the hourly NO_2 objective at the Manchester Oxford Road automatic monitoring site. The national objective is for there to be no more than 18 exceedances, and there were a total of 60 exceedances of the hourly objective at this site during that year. A commitment was made in the report to investigate the matter and, in accordance with Technical Guidance TG16, measurements over several years and relevant local factors have been considered, together with Air Quality Action Plan (AQAP) measures.

The investigation concluded that the elevated number of exceedances identified in 2015 were the result of an increase in buses being stationary on Oxford Road adjacent to the monitoring site. This situation was the result of significant roadworks and road closures in the city centre and Mancunian Way during 2015, leading to additional buses being diverted past the monitoring site and queuing back from traffic lights further along Oxford Road towards the city centre. A large proportion of the city centre diversions during 2015/16 were due to the Metrolink works, which have extended the tram network across the city and wider Greater Manchester area. This measure was one of the actions in the GM AQAP predicted to improve air quality in the future.

During 2016 there were 90 exceedances of the hourly objective, which were again due to additional buses queuing close to the monitoring site as a result of diversions due to the ongoing Metrolink works and other road closures.

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 and the exceedances of the hourly objective have reduced; there were 4 occurrences in January 2017 (prior to the Bus Priority works), and no further exceedances at the time of writing. Monitoring continues at this location, and a further update will be provided in the ASR for 2017, but it has been determined that the existing AQMA should not be amended to include exceedances of the hourly NO_2 objective.

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 particulate matter (less than 10 microns) shows that annual average objectives are not exceeded and are mostly remaining stable at low concentrations. No sites had more than 35 occurrences of the daily mean particulate objective and therefore this objective is met.

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, as previous assessments indicated no exceedances.

The new Low Emission Strategy (LES) and 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 UK Government and EU air quality objectives. The LES & AQAP is being led by TfGM on behalf of the GMCA, and includes close working with 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 and the creation of the future Greater Manchester bus strategy will assist in growing bus usage and improving vehicle standards.
- **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.

Work is currently underway on a Clean Air Zone feasibility study which has been funded through the Defra Air Quality Grant Fund 2015, and is expected to be completed by September 2017.

Part of a Clean Air Zone (CAZ), would look to reduce the number of polluting vehicles that can enter a specific area, as a potential tool for improving air quality. Any proposal would require careful research to identify the positive and negative economic, social and environmental impacts.

The study to date has looked at the scenario for business as usual for 2020, and scoped 3 geographical areas to study the outcomes of implementing a CAZ. The next stage has then taken 2 of these geographical areas to complete a more in depth analysis to give a preferred area and vehicle class options.

Local Priorities and Challenges

Given the need to meet EU limits for NO_2 as soon as possible, 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. Key challenges will be obtaining funding to enable the Local Authorities to carry out some of the actions in the plan.

How to Get Involved

www.greatairmanchester.org has information and links to air quality and how to play a part. The main considerations would be to think about how you travel, reducing single occupancy car use, use carpooling, changing to cleaner alternative fuels, and using public transport, cycling and walking. Other considerations could include avoiding excessive idling of your vehicle, or even considering where the products you buy are coming from.

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.

TfGM are also looking into improving the website to include more information which would also include getting messages about air quality to vulnerable people by text, email or call.

Air Quality Initiatives

Cycling

Cycling is a quick and easy way to get around and, six new cycleways have been opened in Greater Manchester

The new routes give cyclists more space as some are separated from traffic and others are completely traffic-free, making it easier to get around Greater Manchester.

A new Dutch style cycle lane has opened on Oxford/ Wilmslow Road, which offers safer segregated (largely by kerb) cycle routes along one of the busiest corridors in Greater Manchester. The Wilmslow Road Cycleway links Didsbury, Withington, Fallowfield and Rusholme, and will also connect directly with Manchester city centre once further cycle lane improvements are completed on Oxford Road. The route is mainly along the highway but special new kerbs have been built to give cyclists dedicated space away from other traffic for the majority of the cycleway. It also has new bus stop and car parking bypasses, allowing cyclists to enjoy their ride.

Yellow School Buses

Transport for Greater Manchester (TfGM) launched its 'Clean Air for Schools' programme in 2013, targeting the tailpipe emissions of its diesel Yellow School Buses. Of the 93-strong fleet, 52 Yellow School Buses are already low-emission vehicles. Funded through the Department for Transport's (DFT's) Clean Bus Technology Fund, the programme involved retro-fitting innovative air pollution control equipment to the remaining 41 diesel vehicles. Emission tests were carried out before the pollution control systems were fitted and again after they had been on the road one year. The results showed a 99% reduction in nitrogen oxide level – far higher than the 50% minimum target set by the DfT – with a 93% reduction in particulates, 99% in hydrocarbons and more than 97% in carbon monoxide. The final seven diesel buses were retrofitted with the same equipment in 2016 marking the completion of the project.

Transport for Greater Manchester (TfGM) won the Local Authority and Public Sector Air Quality Initiative of the Year title for this project.

Table of Contents

List of Tables

List of Figures

1 -Local Air Quality Management

This report provides an overview of air quality in Greater Manchester during 2016. 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. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an AQMA and prepare an 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 Greater Manchester Local Authorities to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Appendix E.

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 the objectives.

A summary of the AQMA declared by The Greater Manchester Combined Authority can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at http://www.gmtu.gov.uk/gam_maps/. The current AQMA was declared on the 1st May 2016 following the 2014 detailed assessment.

Table 2.1 - Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
AQMA Greater Manchester	• NO_2 annual mean	Greater Manchester	An area covering the 10 districts of Greater Manchester, including arterial routes, district centres and airport.	Greater Manchester Air Quality Action Plan 2016-21

2.2 Progress and Impact of Measures to address Air Quality in Greater Manchester

Greater Manchester has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

More detail on these measures can be found in their respective Action Plans (Greater Manchester Air Quality Action Plan 2016-21). Key completed measures are:

Bus Priority Packages

- The Bus Priority Package enables cross-city bus services to run directly through the heart of Manchester city centre – free from other traffic.
- The North West's first guided busway from Leigh to Ellenbrook opened.
- New hybrid buses used on route.
- Alongside the guided busway dedicated walking and cycling route which runs the full 4.5 miles have been created, with improvements to shorter sections of the existing shared use pedestrian and cycle route alongside the A580.
- Three new park and ride sites

Electric Vehicles

- 13 hybrid taxis licensed in Bury. 38 hybrid taxis in Wigan (1 plug in). 1 hybrid in Rochdale
- Salford City Council currently waives licensing and testing fees for Private Hire Drivers with an Electric Vehicle, to encourage take up of EV's amongst the trade.
- The Salford City Council car club fleet includes 8 battery powered electric vehicles (BPEVs). Four semi rapid charging points were installed in 2016 to serve the car club fleet.
- From 1/1/16 to 31/12/16 electric vehicle charging points hosted 49,182 charging sessions which represents a 171% increase on the charging demand for the

same time period in the previous year, and a 521% increase since December 2014.

Cycle works/initiatives

- Our vision is to make cycling a convenient, attractive and safe travel choice for everyone, regardless of age or ability. We're working hard to build a bright cycling future for Greater Manchester.
- We have made a great start, building the infrastructure and providing the support needed to encourage people to start cycling; segregated cycle lanes, Cycle Hubs and free skills training sessions are all helping turn Greater Manchester into a true cycle city.

The improvements so far have included:

- 60km of largely segregated cycle lanes built since 2013.
- Around 9,000 people enjoying free adult bike training sessions.
- The construction of Cycle Hubs at bus, train and Metrolink stops, with more on the way in 2016.
- Working with 11 schools and colleges to promote cycling to pupils and staff.

The next steps are:

- A further 45km of new or improved cycle lanes to be completed by 2018.
- Four Cycle Friendly District Centres to focus investment on cycle routes and parking.
- Build more cycle and ride facilities and transport interchanges.
- Work to improve facilities in and around more schools and colleges, meaning we'll eventually have helped pupils and staff at more than 20 educational sites since 2013.
- The improvements have been partly funded by £42m from two Cycle City Ambition Grants, awarded by the Government, which last until 2018, and the Local Sustainable Transport Fund.

- Elizabethan Way Cycle/Pedestrian Route & Toucan – Total Scheme Cost £400, 982.05

  Outputs and benefits of scheme - Within Milnrow the main barrier to active travel is created by Elizabethan Way. An existing pedestrian crossing facility links with existing pedestrian/ cycle routes to the Metrolink station via Harbour Lane North, upgrading to a Toucan will supported cycle use. This crossing is available to pedestrians and cyclist accessing the station from the west of Milnrow, which created a formalised route to the Kingsway Business Park.

  To the North of Milnrow the main direct access to the Metrolink station was initially is along Harbour Lane North. However during the evening and night time this route would not have natural passing/frontage observation due to the industrial nature of the area. However Elizabethan Way is at a raised profile and does not overlook this route. The section of Harbour Lane that bridges the Metrolink track provides a direct link to the pedestrian crossing on Elizabethan Way and the housing estate beyond that.

  The scheme provided a mixture of shared use and off highway cycle lanes in the vicinity of Elizabethan Way, providing a new segregated cycle and walking link from Milnrow to Newhey, including access to Kingsway Business Park.

- Burnside Road Toucan/Cycle Link – Total Scheme Cost £91, 269.83

  Outputs and benefits of scheme - National Cycle route number 66 runs along the canal towpath through the Newbold area and this can be accessed via Burnside Road. The scheme provided a direct part segregated cycle link from the Metrolink station to the existing Route 66 along Burnside Road via introducing a Toucan crossing facility at this existing signalised junction.

  Part of this pedestrian link required the installation of a build out to create an extension to the existing pedestrian island to safely provide the Toucan crossing.

Campaigns

- I Will If You Will Team working with TfGM on the following:-Road Rider Ready and Learn to Ride sessions at Clarence Park, Women on Wheels (WOW) projects including family cycling activities, Breeze led rides.
- Cycle City Ambition Grant to fund: the upgrade of the canal towpath from School Street to Farnworth and new route through the town centre from School Street to Coney Green – and the upgrade of cycle parking at the station.
- The Growth Fund active travel fund is funding Radcliffe East cycleway, which should complete an off road/quiet road route from Bury to Bolton, partly on the line of the former railway.
- Growth Fund allocation to improve the Angouleme Way/Market Street junction for pedestrians
- I Will if You Will are operating a Walking for Health programme with groups in Summerseat, Prestwich, Greenmount and MacMillan Cancer Support Walk, Walk leader training course delivered March creating 9 new leaders.
- 55 schools registered as Eco Schools. Seven of these have achieved the highest Green Flag standard with two gaining their second Green Flag.
- 2309 LED streetlights installed in Bury 2015/16
- 484 NIBE units (exhaust air heat pumps) have been installed in Pendleton.

Dirty Diesel Campaign:

- Encouraging the public to report smoky, grossly polluting vehicles, leading to a reduction in vehicle emissions.
- The campaign began in November 2004 and is still publicised via the website: www.cleanervehicles.org.uk.
- Individual buses with excessive bus emissions can be reported via TfGM as per their website: http://www.tfgm.com/Corporate/environment/Pages/environment_faq.aspx. Other commercial vehicles in addition to buses can also be reported via the DVSA website: https://www.gov.uk/report-smoky-vehicle. Taxis can be reported

to the local authority issuing the licence. Privately owned vehicles can be reported to the local authority in whose area the vehicle was observed.

- The total number of vehicles reported in Manchester between 1/04/15 to 31/03/16 was 25.

Solar panels & Electric vehicle:

- Project to use an electric vehicle for MCC staff and make the vehicle effectively 'emission free' by offsetting emissions produced from the charging of the vehicle using solar power.
- Total CO2, NOX and PM10 emissions were reduced by 118%, 127% and 50% respectively over the study period. This resulted in savings of 1.69 tonnes of CO2, 2.54 kg NOX and 0.13 kg PM10.
- The vehicle continues to be used by Council staff in replacement of their own vehicles to carry out their duties.

Low emission taxi scheme:

- Manchester CC - Implementation of a 12-year maximum age limit policy on all hackney carriages, and 7-year age limit an all private hire vehicles.
- Salford City Council licensing rules state that any new Private Hire registrations need to have a vehicle of less than 4 years old.
- Emissions tests carried out on all hackney carriage and private hire vehicles at four monthly mechanical inspection tests.

Future Measures

Greater Manchester expects the following measures to be completed over the course of the next reporting year:

- TfGM along with the stated LA's will be addressing the requirements of the national plan, and investigating a number of mitigation options to bring Greater Manchester into compliance with the legal levels of NO_2 as soon as possible.
- Clean Air Zone Feasibility Study: TfGM are undertaking an appraisal of the effects of Clean Air Zones (CAZs), and will be reported in the Autumn 2017

- Plugged-in Places EV Charging Network: Continue to increase the number of EV charging points.
- Further improvements on Bus Priority Programme (Oxford Road Corridor).
- Engine Idling: promotion of anti-idling policies with freight transport companies.
- Alternative Fuels: Investigate the potential of alternative fuels and carry out trials using different vehicle types.
- TfGM Delivery and Servicing Plan (DSP) Toolkit: Air quality considerations will be incorporated into the DSP toolkit to reduce HGV movements, and hence emissions, in the Key Priority Areas.
- Encouraging Travel Planning: TfGM will work with the local authorities to encourage travel planning measures in businesses and individuals to affect a significant modal shift.
- Green Infrastructure: Investigate the potential of green infrastructure in improving air quality.
- Cycle Programmes: Improve the cycle infrastructure and provide practical support to reduce vehicle movements in the Key Priority Areas.
- Public Cycle Hire: Explore the feasibility of public cycle hire facilities.
- Cycle Logistics: Encourage and promote a logistics programme to use cycle or electrically-assisted cycles for short distance deliveries and distribution in urban centres.
- 2040: Undertake further work to better understand the more innovative options available to further promote cycling and walking, and to set out a clear delivery plan in line with the 2040 transport strategy.
- Local Authority Parking Charges: Work with local authorities to review the introduction of parking charges at local authority offices to discourage private car use.
- School Travel: TfGM will appraise opportunities to reduce air quality impacts from school car travel.

- Awareness Raising: Air quality awareness programmes to encourage people to take action against air pollution.
- Greater Manchester delivered phase 1 of the Cycle City Ambition Grant (CCAG) programme in March 2016 to encourage a step change in cycling, and work towards the GM cycling strategy target of a 10% cycling mode share by 2025. Within Salford the highlight of this programme was a 2.0km light segregation cycleway, the longest scheme of this type in the country. Early results show that cycling in the peak commuting periods has doubled on the corridor, since the introduction of light segregation. Several other high profile cycling projects in Salford were completed that will encourage more cycle trips, and reduce poor air quality. Including the final section of the Roe Green loopline, with this, the 7.5km traffic free route from Bolton to Monton Green is now open, providing an excellent commuter route and direct traffic free access to 7 schools along the route to encourage cycling to school and a reduction on car trips during the 'school run'.
- A study into Alternative Fuels for heavy vehicles
- A trial of electric buses on standard routes
- A trial of GTL fuel

Table 2.2 - Progress on Measures to Improve Air Quality

Details of progress on measures is located in the attached “GM Monitoring Results 2016” 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 4 sites that monitor $PM_{2.5}$. All of these sites have showed a significant downward trend over the last year.

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.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

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

Greater Manchester undertook automatic (continuous) monitoring at 17 sites during 2016. Table A.1 in Appendix A shows the details of the sites. NB. 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.

Maps showing the location of the monitoring sites are provided in GM Monitoring Locations. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Greater Manchester undertook non-automatic (passive) monitoring of NO_2 at 254 sites during 2016 Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in GM Monitoring Locations. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

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

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in the attached "tube results" document.

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.

In 2016 the Greater Manchester Air Quality Network (GMAQN) operated 17 NO_2 chemiluminescence monitors. The annual mean NO_2 results are provided in Table A.3 which details the results from 2012 to 2016 and Figure 3.1 and Figure 3.2 show the trends.

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 Bury roadside site was decommissioned by DEFRA as it did not meet EU site criteria, and was relocated in 2014 to the A56. No sites were closed in 2013-2016. Bury Radcliffe and Prestwich were re-commissioned in 2011. Bury Whitefield and Oldham Crompton way were commissioned in 2015 and 2014 respectively

Figure 3.1 and Figure 3.2 show that two of the highest polluting sites have stabilised over the last year, after showing slight reductions in 2015. Meanwhile, the Manchester Piccadilly site has just breached the 40 μg/m^3 threshold after falling below it last year, bringing the total number of locations above the air quality objective in 2016 up to five, all of which are in the AQMA. Manchester Oxford Road continued to record the highest concentration at 66 μg/m^3 (78.10% data capture). 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 is the second highest site with 49μg/m^3; compared to 2015 there has been a fall of 5 μg/m^3 in the roadside levels.

Eight other automatic sites are in the AQMA with concentrations ranging between 25 μg/m^3 to 46μg/m^3. For sites outside the AQMA, concentrations range from 16 μg/m^3 to 22 μg/m^3.

Table A.4 shows the number of hourly exceedences above 200 μg/m^3 with 99.8 percentile in brackets for some years. The hourly air quality objective was exceeded at one site (Manchester Oxford Road) with 90 exceedences.

The 99.8 percentile is a useful indicator to compare against the 200 μg/m^3 for sites with low data capture. If the 99.8 percentile is above 200 μg/m^3, then the hourly standard is likely to be exceeded. No sites have a 99.8 percentile above 200 μg/m^3 in 2016 supporting the above finding that the hourly standard is only exceeded at one site in Greater Manchester.

The investigation into the exceedence of Oxford Road concluded that the elevated number of exceedances identified in 2015/16 was the result of an increase in buses being stationary on Oxford Road adjacent to the monitoring site. This situation was the result of significant roadworks and road closures in the city centre and Mancunian Way during 2015/16, leading to additional buses being diverted past the monitoring site and

queuing back from traffic lights further along Oxford Road towards the city centre. A large proportion of the city centre diversions during 2015/16 were due to the Metrolink works, which have extended the tram network across the city and wider Greater Manchester area. This measure was one of the actions in the GM AQAP predicted to improve air quality in the future.

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 and the exceedances of the hourly objective have reduced; there were 4 occurrences in January 2017 (prior to the Bus Priority works), and no further exceedances at the time of writing. Monitoring continues at this location, and a further update will be provided in the ASR for 2017, but it has been determined that the existing AQMA should not be amended to include exceedances of the hourly NO_2 objective.

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, but there is an overall trend of declining concentrations at different site types(Figure 3.3). Table 3.1 shows the number of tubes over the national objective of 40 µg/m^3 in each Local Authority.

Figure 3.1 - Trends in Annual Mean NO_2 Concentrations Measured at Automatic Monitoring Sites Bury – Oldham.

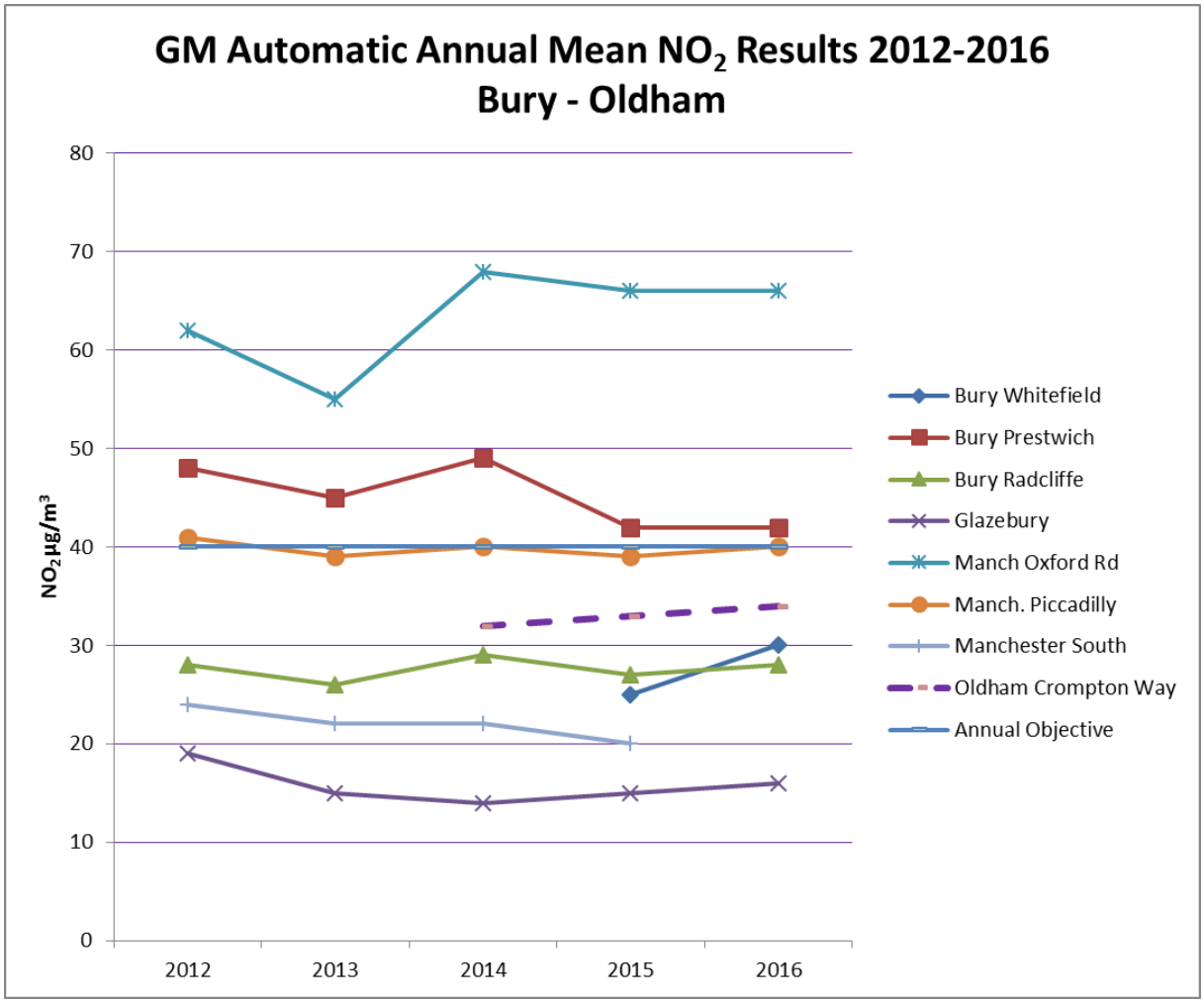
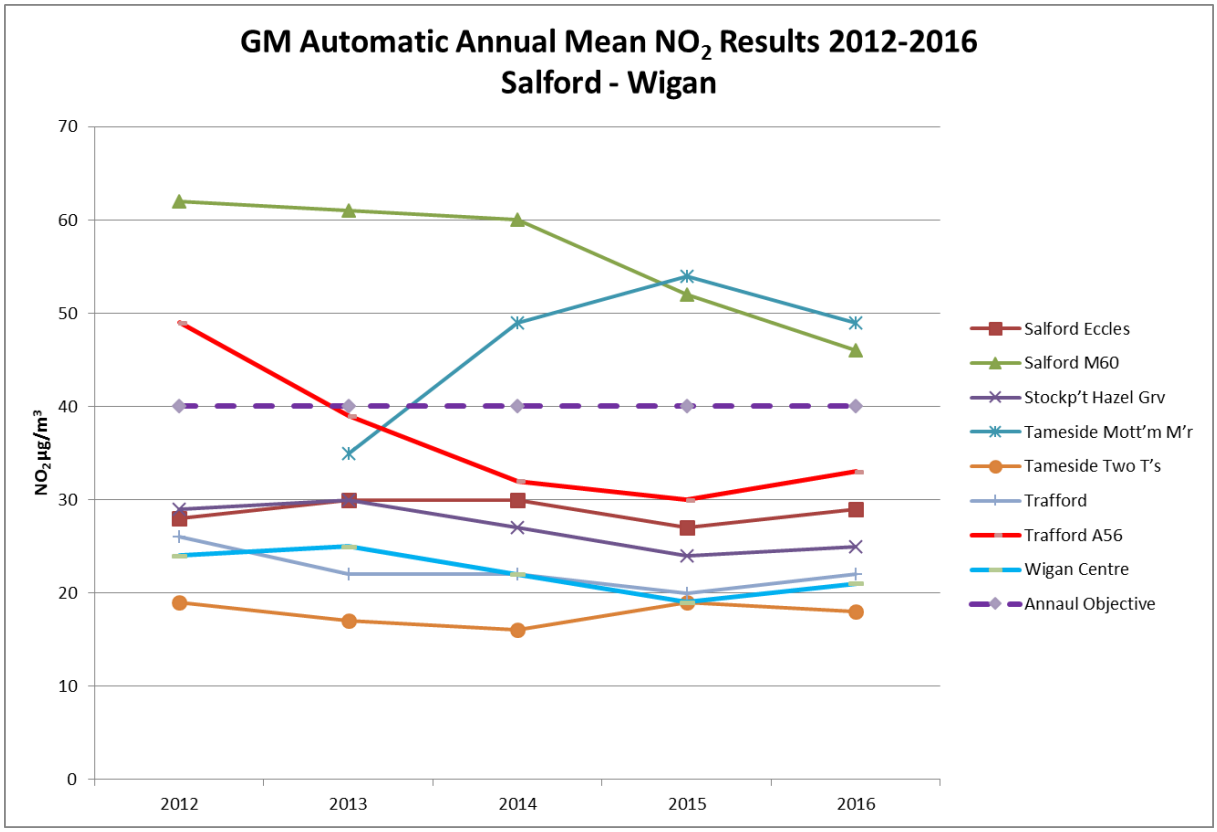


Figure 3.2 -Trends in Annual Mean NO_2 Concentrations Measured at Automatic Monitoring Sites Salford - Wigan



The results of NO_2 2016 Diffusion Tubes and annual mean concentration adjusted for bias are reported in the "Greater Manchester Monitoring Results" document due to the large number of tubes in the data set. Table 2.6 shows that 68 locations exceeded the air quality standard. All districts except Trafford recorded a location where the annual mean objective is exceeded.

Figure 3.3 - Trends in Annual Mean NO_2 Concentrations Measured at Diffusion Tube Monitoring Sites

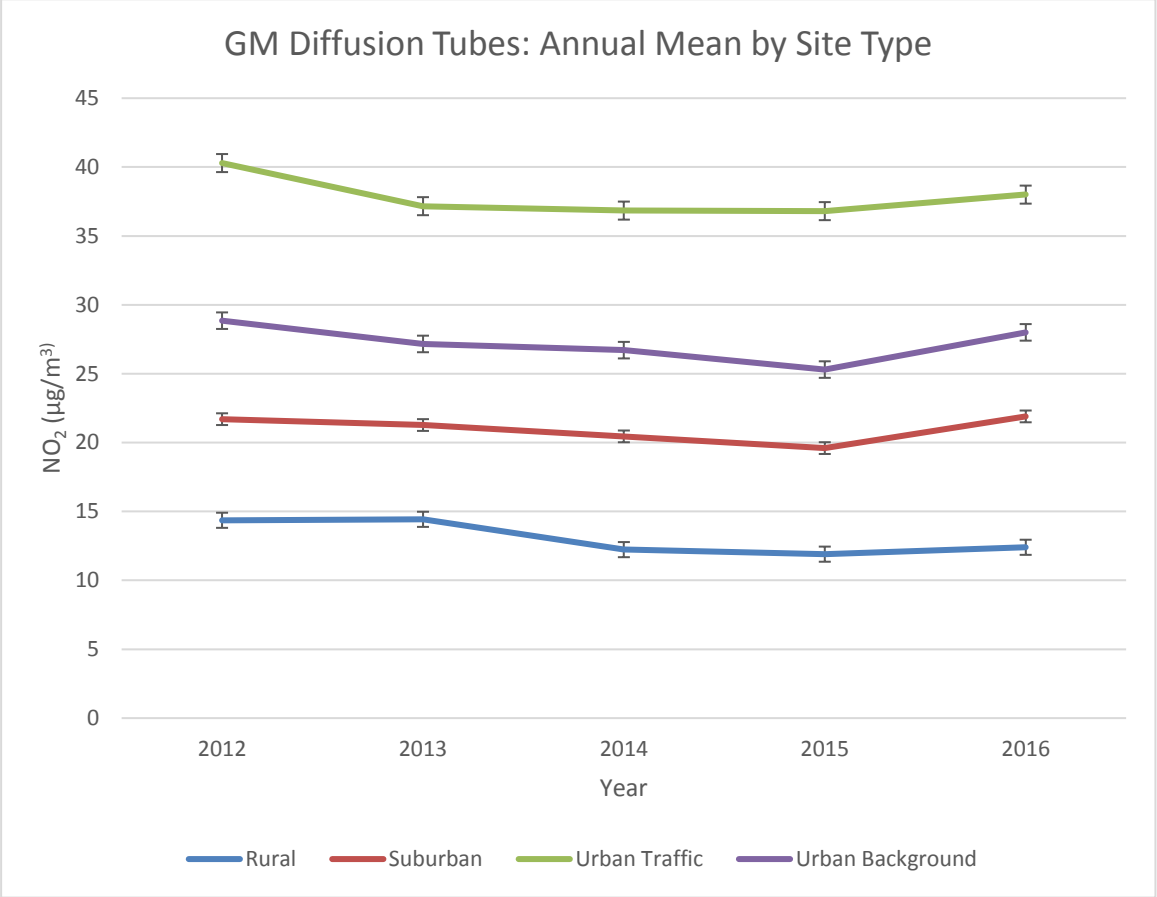


Table 3.1 - Number of NO_2 Diffusion Tubes over 40 µg/m^3

Local Authority	2016
Bolton	7
Bury	1
Manchester	17
Oldham	1
Rochdale	5
Salford	7
Stockport	6
Tameside	14
Trafford	0
Wigan	4
Total	62

3.2.2 Particulate Matter (PM_{10})

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

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

Table A.5 shows the annual mean PM_{10} for sites in Greater Manchester is well below the objective level, and as can be seen in Figure 3.4 and Figure 3.5. Reductions in concentrations have stabilised compared with last year's sharper reductions, and in some cases a small increase is evident. There are no sites that exceed the annual mean air quality objective.

As expected concentrations at Urban Traffic sites remain higher than other sites in the network. The highest annual mean concentration recorded was 27 µg/m^3 at an Urban Traffic location, compared with 13µg/m^3 at the site with the lowest annual meanconcentration.

Table A.6 summaries the results for the PM_{10} daily mean air quality objective; no site exceeded this objective.

Figure 3.4- Trends in Annual Mean PM_{10} Concentrations Measured at Automatic Monitoring Sites – Bury - Oldham

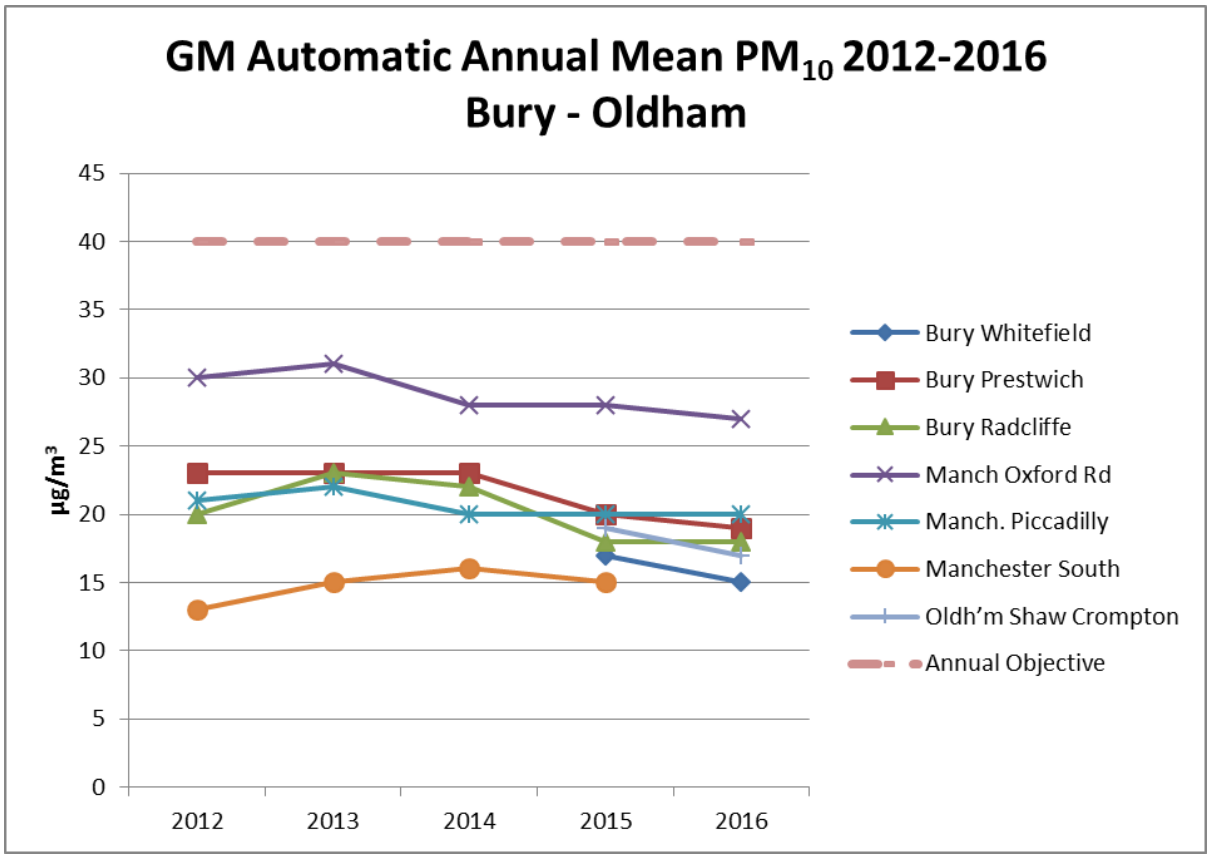
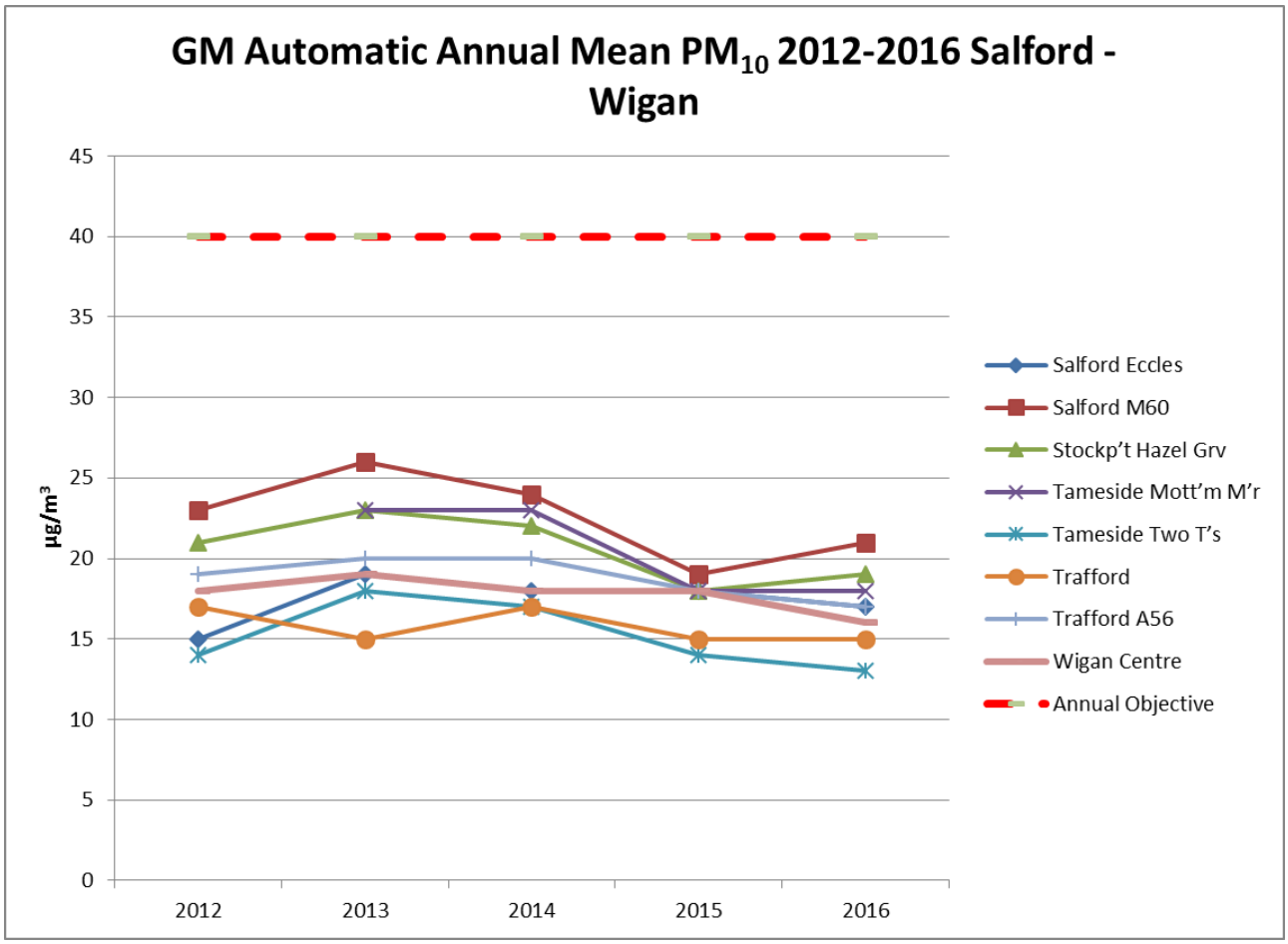


Figure 3.5 - Trends in Annual Mean PM_{10} Concentrations Measured at Automatic Monitoring Sites – Salford - Wigan

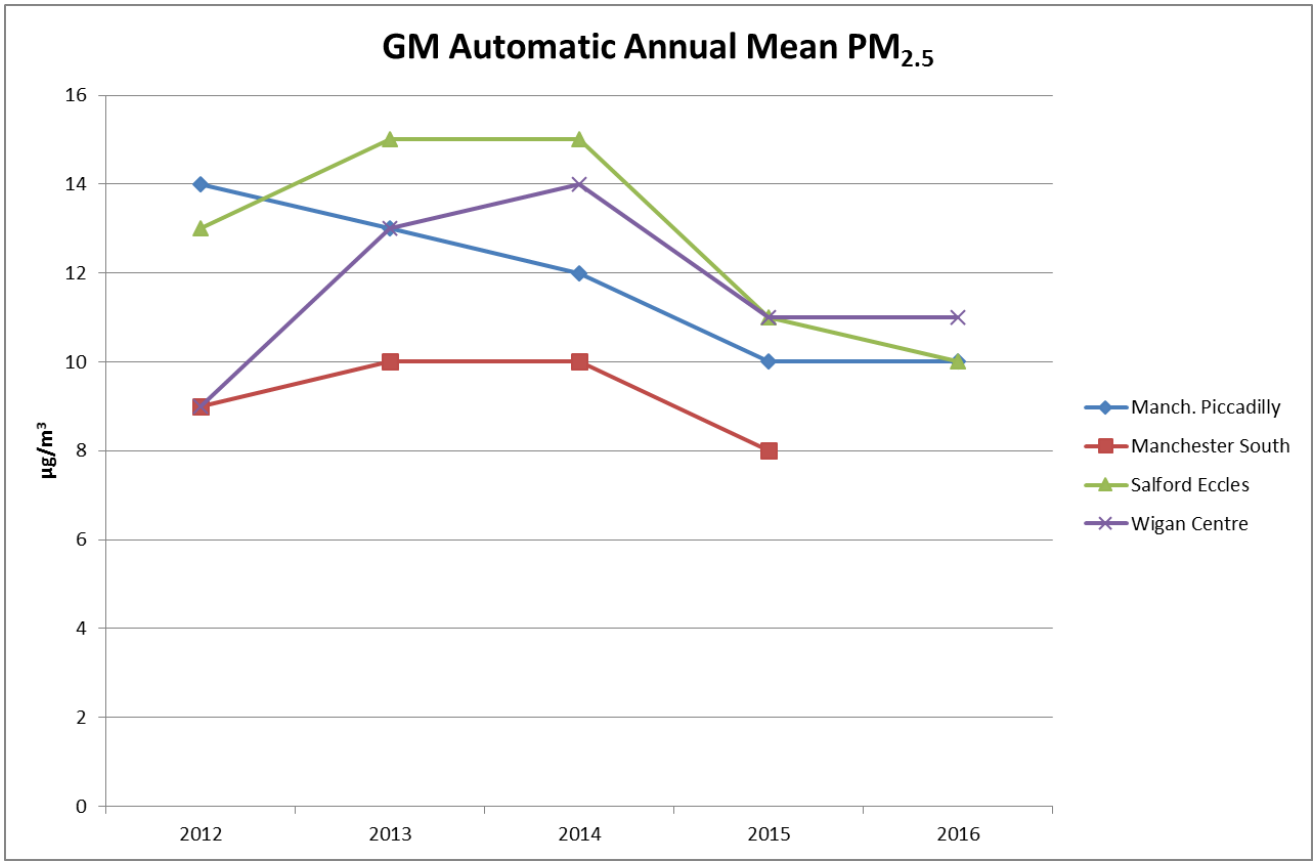


3.2.3 Particulate Matter ($PM_{2.5}$)

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

$PM_{2.5}$ is monitored at 4 sites in Greater Manchester. All these sites had been seeing a signficant downward trend since 2014, before leveling out or minimally increasing over 2016. (Figure 3.6)

Figure 3.6 - Trends in Annual Mean $PM_{2.5}$Concentrations Measured at Automatic Monitoring Sites



3.2.4 Sulphur Dioxide (SO_2)

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

SO_2 is monitored at 2 sites in Greater Manchester (Manchester Piccadilly and Manchester Sharston). Neither of these sites exceeded any of the SO_2 objectives.

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	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	24	7	3.5
BUR2	Bury Prestwich	Urban Traffic	381650	403222	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	15	2.5	1.5
BUR1	Bury Radcliffe	Urban Traffic	378190	407480	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	10	2.5	1.5
GLAZ	Glazebury	Rural Background	368759	396028	NO_2 O_3	N	Chemiluminescent & UV absorption	127	1377	3
MAN1	Manchester Oxford Rd	Urban Traffic	384233	397287	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	1	1	2
MAN3	Manchester Piccadilly	Urban Background	384310	398337	NO_2 O_3 PM_{10} $PM_{2.5}$ SO_2	Y	Chemiluminescent & TEOM	2	30	4
MAN8	Manchester South	Suburban Background	383904	385818	NO_2 O_3 SO_2 PM_{10} $PM_{2.5}$	N	Chemiluminescent & TEOM	30	15	2
MAHG	Manchester Sharston	Suburban Background	384179	386086	NO_2 O_3 SO_2 PM_{10} $PM_{2.5}$	N	Chemiluminescent, Photometric, Fluorescent & Partisol	35	6	2.7
CW	Oldham Crompton Way	Urban Traffic	393887	409191	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	10	1	1.5

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)
ECCL	Salford Eccles	Urban Industrial	377926	398728	NO_2 PM_{10} $PM_{2.5}$	Y	Chemiluminescent & TEOM/ FDMS	7	5	3.5
M60	Salford M60	Urban Traffic	374810	400855	NO_2 O_3 PM_{10}	Y	Chemiluminescent & UV absorption & BAM	85	20	3
STK5	Stockport Hazel Grv	Urban Traffic	391481	387637	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	33	4	2
TAM1	Tameside Mottram M'r	Urban Traffic	399719	395804	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	4	5	4
TAME	Tameside Two Trees Sch	Urban Background	393454	394330	NO_2 O_3 PM_{10}	N	Chemiluminescent & TEOM	0	53	3
TRAF	Trafford	Urban Background	378783	394726	NO_2 PM_{10} SO_2	N	Chemiluminescent & TEOM	60	98	2.5
TRF2	Trafford A56	Urban Traffic	379413	394014	NO_2 PM_{10}	Y	Chemiluminescent & TEOM	40	2	2.5
WIG5	Wigan Centre	Urban Background	357816	406024	NO_2 O_3 PM_{10}, $PM_{2.5}$	N	Chemiluminescent & TEOM	0	175	2.5

(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 the 254 non-automatic monitoring sites is detailed in the attached “GM Monitoring Results 2016” file.

Table A.3 - Annual Mean NO_2 Monitoring Results

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
						2012	2013	2014	2015	2016
Bury Whitefield	Bury	Urban Traffic	Automatic	N/A	94.10%	-	-	-	25	30
Bury Prestwich	Bury	Urban Traffic	Automatic	N/A	98.55%	**48**	**45**	**49**	**42**	**42**
Bury Radcliffe	Bury	Urban Traffic	Automatic	N/A	95.32%	28	26	29	27	28
Glazebury	Salford	Rural Background	Automatic	N/A	99.13%	19	15	14	15	16
Manch. Oxford Rd	Manchester	Urban Traffic	Automatic	N/A	78.10%	**62**	**55**	**68**	**66**	**66**
Manch. Piccadilly	Manchester	Urban Background	Automatic	N/A	94.85%	**41**	39	**40**	39	**40**
Manch. South	Manchester	Suburban Background	Automatic	N/A	N/A	24	22	22	20	-
Manch. Sharston	Manchester	Suburban Background	Automatic	N/A	84.86	-	-	-	-	23
Oldham Crompton Way	Oldham	Urban Traffic	Automatic	N/A	94.09%	-	-	32	33	34
Salford Eccles	Salford	Urban Industrial	Automatic	N/A	96.08%	28	30	30	27	29
Salford M60	Salford	Urban Traffic	Automatic	N/A	93.91%	**62**	**61**	60	**52**	**46**
Stockp't Hazel Grv	Stockport	Urban Traffic	Automatic	N/A	98.78%	29	30	27	24	25

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
						2012	2013	2014	2015	2016
Tameside Mott'm M'r	Tameside	Urban Traffic	Automatic	N/A	95.46%	**-**	35	**49**	**54**	**49**
Tameside Two T's	Tameside	Urban Background	Automatic	N/A	80.25%	19	17	16	19	18
Trafford	Trafford	Urban Background	Automatic	N/A	97.06%	26	22	22	20	22
Trafford A56	Trafford	Urban Traffic	Automatic	N/A	98.28%	**49**	39	32	30	33
Wigan Centre	Wigan	Urban Background	Automatic	N/A	89.98%	24	25	22	19	21

Notes: The full list of the 236 non-automatic monitoring sites in detailed in the attached "GM Tube Results" file.

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

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

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

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

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

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

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
						2012	2013	2014	2015	2016
Bury Whitefield	Bury	Urban Traffic	Automatic	N/A	94.10%	**-**	**-**	**-**	0	**0**
Bury Prestwich	Bury	Urban Traffic	Automatic	N/A	98.55%	0(151)	0(126)	0	0	0
Bury Radcliffe	Bury	Urban Traffic	Automatic	N/A	95.32%	0(131)	0(114)	0	0	0
Glazebury	Salford	Rural Background	Automatic	N/A	99.13%	0(71)	0	0	0	0
Manch. Oxford Rd	Manchester	Urban Traffic	Automatic	N/A	78.10%	13(181)	0(138)	14	**60**	**90**
Manch. Piccadilly	Manchester	Urban Background	Automatic	N/A	94.85%	0(101)	0(97)	2	1	0
Manch.r South	Manchester	Suburban Background	Automatic	N/A	-	0(109)	0(95)	0	0	-
Manch.r Sharston	Manchester	Suburban	Automatic	N/A	84.86%	-	-	-	-	0
Oldh'm Shaw Crompton	Oldham	Urban Traffic	Automatic	N/A	94.09%	-	-	0(301)	0(109)	0
Salford Eccles	Salford	Urban Industrial	Automatic	N/A	96.08%	2(151)	0(123)	0	0	0
Salford M60	Salford	Urban Traffic	Automatic	N/A	93.91%	8(191)	4(187)	0	3	0
Stockp't Hazel Grv	Stockport	Urban Traffic	Automatic	N/A	98.78%	0(111)	0(109)	0	0	0

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
						2012	2013	2014	2015	2016
Tameside Mott'm M'r	Tameside	Urban Traffic	Automatic	N/A	95.46%	-	0(141)	13(199)	8(189)	0
Tameside Two T's	Tameside	Urban Background	Automatic	N/A	80.25%	0(78)	0(80)	0	0	0
Trafford	Trafford	Urban Background	Automatic	N/A	97.06%	0(117)	0(86)	0	0	0
Trafford A56	Trafford	Urban Traffic	Automatic	N/A	98.28%	14(195)	7	0	0(107)	0
Wigan Centre	Wigan	Urban Background	Automatic	N/A	89.98%	0(97)	0(86)	0	0	0

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

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

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 90%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 - Annual Mean PM_{10} Monitoring Results

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
						2012	2013	2014	2015	2016
Bury Whitefield	Bury	Urban Traffic	Automatic	N/A	93.83%	-	-	-	17	15
Bury Prestwich	Bury	Urban Traffic	Automatic	N/A	99.62%	23	23	23	20	19
Bury Radcliffe	Bury	Urban Traffic	Automatic	N/A	90.51%	20	23	22	18	18
Manch. Oxford Rd	Manchester	Urban Traffic	Automatic	N/A	91.23%	30	31	28	28	27
Manch. Piccadilly	Manchester	Urban Background	Automatic	N/A	95.58%	21	22	20	20	20
Manch. South	Manchester	Suburban Background	Automatic	N/A	N/A	13	15	16	15	-
Manc. Sharsdon	Manchester	Suburban Background	Automatic	N/A	99.5%	-	-	-	-	13.6
Oldh'm Shaw Crompton	Oldham	Urban Traffic	Automatic	N/A	97.22%	-	-	-	19	17
Salford Eccles	Salford	Urban Industrial	Automatic	N/A	89.83%	15	19	18	18	17
Salford M60	Salford	Urban Traffic	Automatic	N/A	66.97%	23	26	24	19	21
Stockp't Hazel Grv	Stockport	Urban Traffic	Automatic	N/A	91.86%	21	23	22	18	19
Tameside Mott'm M'r	Tameside	Urban Traffic	Automatic	N/A	97.20%	-	23	23	18	18

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
						2012	2013	2014	2015	2016
Tameside Two T's	Tameside	Urban Background	Automatic	N/A	80.31%	14	18	17	14	13
Trafford	Trafford	Urban Background	Automatic	N/A	93.98%	17	15	17	15	15
Trafford A56	Trafford	Urban Traffic	Automatic	N/A	99.39%	19	20	20	18	17
Wigan Centre	Wigan	Urban Background	Automatic	N/A	87.25%	18	19	18	18	16

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

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

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

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

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

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
						2012	2013	2014	2015	2016
Bury Whitefield	Bury	Urban Traffic	Automatic	N/A	93.83%	-	-	-	6	1
Bury Prestwich	Bury	Urban Traffic	Automatic	N/A	99.62%	14	8	4	**6**	1
Bury Radcliffe	Bury	Urban Traffic	Automatic	N/A	90.51%	11	9	4	5	2
Manch. Oxford Rd	Manchester	Urban Traffic	Automatic	N/A	91.23%	28	21	18	25	16
Manch. Piccadilly	Manchester	Urban Background	Automatic	N/A	95.58%	11	7	5	3	3
Manch. South	Manchester	Suburban Background	Automatic	N/A	-	7	6	8	4	-
Manch. Sharston	Manchester	Suburban Background	Automatic	N/A	99.5%	-	-	-	-	0
Oldh'm Shaw Compton	Oldham	Urban Traffic	Automatic	N/A	97.22%	-	-	**5(28)**	11	1
Salford Eccles	Salford	Urban Industrial	Automatic	N/A	89.83%	6	6	6	5	2
Salford M60	Salford	Urban Traffic	Automatic	N/A	66.97%	16	19	**4(35)**	5	13
Stockp't Hazel Grv	Stockport	Urban Traffic	Automatic	N/A	91.86%	20	12	11	6	5

Site ID	Local Authority	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
						2012	2013	2014	2015	2016
Tameside Mott'm M'r	Tameside	Urban Traffic	Automatic	N/A	97.20%	-	0	3	3	0
Tameside Two T's	Tameside	Urban Background	Automatic	N/A	80.31%	1	3	0	1	0
Trafford	Trafford	Urban Background	Automatic	N/A	93.98%	2	0	1	2	0
Trafford A56	Trafford	Urban Traffic	Automatic	N/A	99.39%	3	1	3	5	0
Wigan Centre	Wigan	Urban Background	Automatic	N/A	87.25%	3	1	**1(26)**	1	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 90%, the 90.4th percentile of 24-hour means is provided in brackets.

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

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
					2012	2013	2014	2015	2016
Manch. Piccadilly	Urban Background	Automatic	N/A	83.73%	14	13	12	10	10
Manchester South	Suburban Background	Automatic	N/A	-	9	10	10	8	-
Manchester Sharston	Suburban Background	Automatic	N/A	77.6 %	-	-	-	-	8.2
Salford Eccles	Urban Industrial	Automatic	N/A	92.93%	13	15	15	11	10
Wigan Centre	Urban Background	Automatic	N/A	64.14%	9	13	14	11	11

(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 Technical Guidance LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A 8 - SO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	Number of Exceedances (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 Background	Automatic	N/A	78.62%	0	0	0
Manchester Piccadilly	Urban Background	Automatic	N/A	67.48%	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 90%, the relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2016

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

The full list of the 254 non-automatic monitoring sites is detailed in the attached “GM Monitoring Results 2016” file, due to the large number of tubes in the data set.

(1) See Appendix C for details on bias adjustment

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

Each of the 10 Greater Manchester authorities committed to undertaking a detailed air quality review and assessment in relation to road traffic. The detailed assessment was completed in September 2015 for the base year 2014, and confirmed that a new AQMA should be declared. It was decided to declare a single AQMA for the whole of Greater Manchester. The dispersion modelling report was submitted alongside this. The report describes using the Greater Manchester emissions dispersion model, referred to as GMEDIS, to produce emissions concentrations for a 2016 model year. The work was undertaken on behalf of the Greater Manchester Public Protection Partnership (GMPPP) and was funded by grants from Defra and the ten Greater Manchester local authorities. The model results will be used to support the work of the GMPPP and the GM local authorities in the discharge of their air quality duties under the Environment Act 1995. This report describes the modelling methodology to map the concentrations of NO_2 and particulates in Greater Manchester area. The model covers the entire of Greater Manchester with an area of approximately 1275 km^2.

Screening assessments of identified new or changed sources of pollution based on DMRB, industrial nomograms, biomass tools, etc. have been undertaken and have resulted in no changes to monitoring.

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. Results from the quality control schemes published on the LAQM website give the laboratory a good precision rating.

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 NO2.

A bias factor is calculated using a spread sheet provided by Ricardo Energy & Environment. 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 2016 is 0.91

Automatic NO_2 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 A1.7 list the Greater Manchester sites and their respective affiliation to the national network or the GMAQN.

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 Counties 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.

Appendix D: Map(s) of Monitoring Locations

All monitoring locations are detailed at:

GM Monitoring Locations.

Appendix E: Summary of Air Quality Objectives in England

Table E.1 - Air Quality Objectives in England

Pollutant	Air Quality Objective[2]	
	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

[2] 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
GM	Greater Manchester
GMCA	Greater Manchester Combined Authority

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