



## 2017 Air Quality Annual Status Report (ASR)

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

Date 19<sup>th</sup> September, 2017

## Telford and Wrekin Council

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## Executive Summary: Air Quality in Our Area

Telford and Wrekin Council have undertaken an annual status report which reviews all relevant data from 2016/17 obtained through diffusion tube monitoring.

This review has shown that overall, air quality within the borough of Telford and Wrekin shows very good compliance with AQ objectives, and that levels of pollutants within the Borough are relatively stable. This would indicate that all measures undertaken to ensure the wholesomeness of the air quality of the borough are currently working.

Historically, Telford and Wrekin Council have been able to monitor air quality through data provided by Ironbridge Power Station however this is no longer possible as the power station was decommissioned in December 2015.

To fulfil our statutory duties under Part IV of the Environment Act 1995, in 2016 we introduced a new air quality monitoring strategy which involves the use of diffusion tubes in 20 locations across the Borough in order to monitor the concentrations of NO<sub>2</sub>, predominantly being emitted from road traffic sources.

Using diffusion tube monitoring, we have been able to identify two areas within the borough, namely Watling Street and Coach Central, where air quality levels are considered to be a potential concern. The data gathered during this monitoring period has demonstrated that the AQ objectives have not been breached, however Telford and Wrekin Council are committed to ensure that a proactive approach to air quality is taken. This monitoring has identified the need to implement further air quality monitoring in these locations to attain a more detailed assessment of air quality within these locations, this will ensure that the most effective actions can be taken. Measures are already being introduced to improve air quality which currently involves the introduction of smart traffic signalling. Monitoring has ceased in areas that were identified to have very low NO<sub>2</sub> concentrations.

In light of the boroughs plans to continue increasing the number of homes and businesses within the Borough, an Air Quality Strategy has been produced which will see the continuation of diffusion tube monitoring for NO<sub>2</sub> across the borough (Appendix C). This is to ensure the continued wholesomeness of the air of the Borough.

No further assessments are required for any of the pollutants monitored within the Borough.

## **Air Quality in Telford and Wrekin Council**

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

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion<sup>3</sup>.

The borough of Telford and Wrekin is a predominantly rural area on the north-eastern edge of Shropshire. The borough has a population of 166,641 (2011 estimate, Office for National Statistics) covering 29,000 hectares with its major settlement being Telford, which incorporated the existing towns of Dawley, Madeley, Oakengates and Wellington upon its construction as a New Town. The market town of Newport is the boroughs second largest populated area.

The main sources of air pollution in Telford and Wrekin are emissions from busy roads. The M54 traverses the Borough across the main central urban area, and the majority of the main roads within the Borough are also focussed in this area, including the A41, the A518, the A5, A442, A4169, and the A4640.

There are a number of registered Part A processes, (12 A2 processes), 31 part B processes, 17 petrol stations, 6 dry cleaning installations, and 1 mobile plant within the Borough. There is a main railway line traversing the centre of the Borough, as well as an unused rail freight terminal.

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<sup>1</sup> Environmental equity, air quality, socioeconomic status and respiratory health, 2010

<sup>2</sup> Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

<sup>3</sup> Defra. Abatement cost guidance for valuing changes in air quality, May 2013

The table below outlines the work undertaken so far, the conclusions of the reports, and the summaries of any further action.

**Table 1.1 – Summaries of Reports**

Year	Outcomes	Summaries
1998	PR	Prediction of exceedances
1999	PR	Prediction of exceedances
2000	USA	Not significantly affected by emissions (CO, Benzene, 1,3-Butadiene, Pb, SO <sub>2</sub> , PM <sub>10</sub> ); any breaches will be negligible
2001	PR	Prediction of exceedances
2002	PR	Declaration of AQMA
2003	USA	Exceedances of SO <sub>2</sub> from Ironbridge Power Station, and of NO <sub>2</sub> from road traffic emissions in Ironbridge Gorge. Review of AQMAs determined there would be no exceedances by 2005.
2004	PR	Detailed assessment of NO <sub>2</sub> and SO <sub>2</sub> from Ironbridge Power Station and vehicular traffic. Objectives will be met in 2005 so no further work is necessary.
2005	PR	No exceedances of relevant air quality objectives, Revocation of AQMA
2006	USA	No exceedances of relevant air quality objectives
2007	PR	No exceedances of relevant air quality objectives
2008	PR	No exceedances of relevant air quality objectives
2009	USA	No exceedances of relevant air quality objectives
2011	PR	No exceedances of relevant air quality objectives (includes data from 2010)
2012	USA	No exceedances of relevant air quality objectives
2013	PR	No exceedances of relevant air quality objectives
2014	PR	No exceedances of relevant air quality objectives
2015	USA	No exceedances of relevant air quality objectives
2016	ASR	No exceedances of relevant air quality objectives

Telford and Wrekin do not have any AQMAs. Telford and Wrekin have an air quality strategy, it ensures that air quality is given the significance it deserves and enshrines the Council's commitment to ensure that new development within the Borough demonstrate zero impact.

## Actions to Improve Air Quality

Telford and Wrekin Council is committed to ensuring that the air quality within our borough remains excellent, as previous monitoring has indicated.

The current approach remains with regards to assessing planning applications, and to see if they meet the criteria for significance under “EPUK AQ Planning Guidance”. This states that significance is:

- Number of properties affected by slight, moderate or major air quality impacts and a judgement on the overall balance.
- Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.
- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. Tables 4 and 5 findings.
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased.
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced.
- Uncertainty, including the extent to which worst-case assumptions have been made.
- The extent to which an objective or limit value is exceeded, e.g. an annual mean NO<sub>2</sub> of 41 µg/m<sup>3</sup> should attract less significance than an annual mean of 51 µg/m<sup>3</sup>.

Telford and Wrekin Council have secured a funding to create and implement a Local Sustainable Transport plan and will continue to push for such funding in the future. Analysis of the Telford Strategic Transport Model (TSTM) has identified that over half the number of car trips in the AM peak hour are less than 10km in length with 22% being less than 5km. This confirms the potential for transfer to more sustainable forms of travel. The model has been used, in conjunction with the DfT Basic Local Authority Carbon Tool, to assess the likely carbon savings from both the key component and the large project bid. Information for the large project bid in Telford town centre will be provided by June 2016. The baseline number of car trips in the model area is 39,069 averaged over the morning and evening peak hours with an average speed of 48.6 km/hr. Total carbon emissions is 44,440 tonnes.

Increased Sustainable Transport Use - it is estimated that the key component element of the bid will achieve modal transfer of up to 10% based on the following evidence:

(1) Surveys undertaken as part of the development of the Telford Strategic Transport Model confirm the considerable scope for mode transfer in Telford. Over half the car trips in the AM peak hour are less than 10km in length with 22% less than 5km;

(2) A reduction of 9% in car travel was achieved in the Sustainable Travel Demonstration Towns over a five year period with investment of between £4.4m (Worcester) and £6.8m (Peterborough). The increase in bus trips was between 10 and 22%, walking 10-13% and cycling 26-30%. The percentage reduction in the number of car driver trips was greater, the shorter the trip;

(3) A personal travel planning project carried out by Sustrans in Gloucester involving 4360 households achieved a 12% shift to sustainable modes for investment of £160k; The Cycling Demonstration Towns programme shows an average increase in cycling across all six towns of 27% and a BCR of 3+. The TSTM has been used to assess the implications of a 10% modal shift in terms of the baseline data set out in B2 above. The number of car trips will reduce from 39,069 to 35,005 averaged over the morning and evening peak hours. Average speed will increase from 48.6 km/hr to 55 km/hr. Carbon Savings - The TSTM has also been used, in conjunction with the Carbon Toolkit to assess the carbon impact of a 10% modal shift. The key component bid will reduce the baseline figure from 44,440 tonnes to 40,140 tonnes. The annual saving is estimated £126,593 at 2002 prices based on TUBA valuations of £30.29 per tonne.

In light of 2016 diffusion tube monitoring results, Telford and Wrekin Council are already taking the relevant steps to address the two areas identified as having poorer air quality than other areas in the borough. To demonstrate this, the council's Public Protection Department have been working closely with the Highways department to introduce smart traffic lights at the Watling street junction to improve traffic flow and reduce engine idling (Table 2.2). This will be monitored through the introduction of an additional five diffusion tubes within this area which will be the key performance indicator of the success of this measure.

The council have also introduced additional diffusion tubes at four locations that represent relevant exposure in close proximity to Coach Central, where NO<sub>2</sub>

concentrations were identified as some of the highest in the borough. This is the case, as after liaising with DEFRA, we understood that the diffusion tube location located at Coach Central in 2015/2016 monitoring did not represent relevant exposure based the AQ Objectives. However, this tube has been left in place to monitor any impact on air quality from current new development within the area.

## Conclusions and Priorities

Telford and Wrekin’s priorities for the coming year are to continue diffusion tube monitoring for NO<sub>2</sub> in order to continue to build a clearer picture on the current Air Quality within Telford and Wrekin. 2016/2017 monitoring will however extend to new locations where last year’s monitoring provided an indicative idea of poorer air quality. This is to provide a more robust assessment of the extent of air quality in these areas so as to justify any future action that may be required. These additional nine locations will be referred to as ‘new locations’ in table 1.2 as well as a justification for monitoring.

For the continuation of previous monitoring locations, to ensure that the diffusion tubes have been appropriately sited road traffic count data has been used to determine which remain the busiest roads, and where the nearest relevant receptors are. The busiest roads (excluding the M54 and slip roads) are identified in table 1.2.

**Table 1.2 – locations of the busiest roads as monitored by Telford & Wrekin Council**

Tube No.	Location	Justification	Status
1	B4373 Mossey Green Way	M54, B4373	Continued in 2017 monitoring
-	Manor Rise	A5223	Discontinued from further monitoring
2	New Road	Wrockwardine Wood Way	Continued in 2017 monitoring
3	Checkley Lane	A4640	Continued in 2017 monitoring
-	Mercia Drive	A5523	Discontinued from further monitoring
4	Apley Avenue	Apley Avenue	Continued in 2017 monitoring
5	Dudmaston	M54	Continued in 2017 monitoring
6	Shifnal Road	M54	Continued in 2017 monitoring
-	Boscobel Close	A442	Discontinued from further monitoring
7	Summerfield Road	A442	Continued in 2017 monitoring
8	Horton Road	A518	Continued in 2017 monitoring
9	Waverley	B4373	Continued in 2017 monitoring
10	Madeley Hill	Roundabout at foot of steep climb on busy junction	Continued in 2017 monitoring
11	Coach Central	Southwater Development, canyon	Continued in 2017 monitoring
12	Richmond Avenue	Urban Background	Continued in 2017 monitoring

## Telford and Wrekin Council

13	Barrack Lane	A518	Continued in 2017 monitoring
14	Newport Car Park	Newport Centre	Continued in 2017 monitoring
15	Newdale Lawley Junction	Lawley Development	Continued in 2017 monitoring
-	Oxlip Close	A4640	Discontinued from further monitoring
16	Watling Street (outside swan)	B5061 Cross Roads	Continued in 2017 monitoring
17	Mill Bank	B5061 Cross Roads	New monitoring location 2017
18	Holly Head Road	B5061 Cross Roads	New monitoring location 2017
19	Dawley Road	B5061 Cross Roads	New monitoring location 2017
20	Watling Street/Regent Street Junc	B5061 Cross Roads	New monitoring location 2017
21	Watling Street	B5061 Cross Roads	New monitoring location 2017
22	Withywood Drive	Southwater Development, canyon	New monitoring location 2017
23	Lawnswood	Southwater Development, canyon	New monitoring location 2017
24	Deercote (top)	Southwater Development, canyon	New monitoring location 2017
25	Deercote (bottom)	Southwater Development, canyon	New monitoring location 2017

## Local Engagement and How to get involved

For further information please see the information on Telford and Wrekin's website:

[http://www.telford.gov.uk/info/20150/pollution/104/air\\_quality](http://www.telford.gov.uk/info/20150/pollution/104/air_quality)

Or contact us by phone on 01952 381818

# Table of Contents

<b>Executive Summary: Air Quality in Our Area</b> .....	<b>i</b>
Air Quality in Telford and Wrekin Council.....	ii
Actions to Improve Air Quality.....	iii
Conclusions and Priorities.....	vi
Local Engagement and How to get Involved.....	vi
<b>1 Local Air Quality Management</b> .....	<b>1</b>
<b>2 Actions to Improve Air Quality</b> .....	<b>2</b>
2.1 Air Quality Management Areas.....	2
2.2 Progress and Impact of Measures to address Air Quality in Telford and Wrekin	
2.3 PM <sub>2.5</sub> – Local Authority Approach to Reducing Emissions and/or Concentrations .....	5
<b>3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance</b> .....	<b>6</b>
3.1 Summary of Monitoring Undertaken.....	6
3.1.1 Automatic Monitoring Sites.....	6
3.1.2 Non-Automatic Monitoring Sites.....	6
3.2 Individual Pollutants.....	6
3.2.1 Nitrogen Dioxide (NO <sub>2</sub> ).....	7
3.2.2 Particulate Matter (PM <sub>10</sub> ).....	7
3.2.3 Particulate Matter (PM <sub>2.5</sub> ).....	7
3.2.4 Sulphur Dioxide (SO <sub>2</sub> ).....	<b>Error! Bookmark not defined.</b>
<b>Appendix A: Monitoring Results</b> .....	<b>8</b>
<b>Appendix B: Full Monthly Diffusion Tube Results for 2016</b> .....	<b>12</b>
<b>Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC</b> .....	<b>15</b>
<b>Bibliography</b> .....	20-21
<b>Scientific basis</b> .....	23-31
<b>Appendix D: Map(s) of Monitoring Locations and AQMAs</b> .....	<b>31</b>
<b>Appendix E: Summary of Air Quality Objectives in England</b> .....	<b>32</b>
<b>Glossary of Terms</b> .....	<b>33</b>
<b>References</b> .....	<b>34</b>

## List of Tables

Table 1.1 – Summaries of Reports.....	iii
---------------------------------------	-----

**Telford and Wrekin Council**

Table 1.2 – Locations of Busiest Roads ..... vi-vii  
Table 2.1 – Declared Air Quality Management Areas.....3  
Table 2.2 – Progress on Measures to Improve Air Quality .....4  
Table 3.1 – Work undertaken so far ..... 6-7

## 1 Local Air Quality Management

This report provides an overview of air quality in Telford and Wrekin Council during 2017. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

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

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

## 2 Actions to Improve Air Quality

### 2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely to be an 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.

Telford and Wrekin Council currently does not have any AQMAs. For reference, a map of Telford and Wrekin Council's monitoring locations is available in Appendix D. However, since the continuation of monthly diffusion tube monitoring in 2016, two locations within the Borough were identified as areas of concern and made the Council consider the future possibility of declaring an AQMA if actions are not taken to manage air quality or those not taken are effective. Although there were no exceedances of the relevant National AQO, further monitoring efforts have been introduced to understand the extent of the issue and also as an indicator as to whether any implemented actions to manage air quality are effective.

Since the decommission of UK Surface Mines Ltd at Huntingdon Lane, which was an operation permitted by the Council where a condition was to monitor for Sulphur and Particulates, the Council do not have any data on these pollutants. However, the graph shown within the 2016 ASR suggested that between 2007 and 2013, the levels of PM<sub>2.5</sub> had been steadily decreasing.

Telford and Wrekin Council are however committed to lower the levels of PM<sub>2.5</sub> and have introduced initiatives that we hope will lead to the lowering of the levels these measures are identified in Table 2.2. The Council will continue to liaise with our Public Health colleagues at the council to develop further schemes and strategies which will aim to lower levels of PM<sub>2.5</sub> within the borough and improve the health and wellbeing of the population of Telford and Wrekin.

**Table 2.1 – Declared Air Quality Management Areas**

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
N/A	N/A	N/A	N/A	N/A

## 2.2 Progress and Impact of Measures to address Air Quality in Telford and Wrekin

Telford and Wrekin Council has taken forward a number of measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Air Quality Strategy (Appendix C).

## Telford and Wrekin Council

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress Date
1	Ironbridge Park and Ride	Alternatives to private vehicle use	Bus based Park & Ride	Telford and Wrekin Council	Fully Implemented	Fully Implemented	Amount of people using the service	N/A	The scheme completed being well
2	Telford and Wrekin Council Journey Share	Alternatives to private vehicle use	Car & lift sharing schemes	Telford and Wrekin Council	Fully Implemented	Fully Implemented	Amount of people using the service	N/A	The scheme completed being well
3	Sustainable Traffic Management Plan	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Telford and Wrekin Council	The plan has been completed and a grant has been received to implement the plan.	This is being implemented in a staged approach	N/A	N/A	So far the has implemented the South Shared scheme
4	Watling Street Signal Upgrades	Traffic Management	Traffic Signals and Technology	Telford and Wrekin Council	Fully implemented	In progress	Reduction in NO2 emissions	N/A	The improvement to traffic signals link these and be demand reduction is currently delivered
5	Coach Central	Traffic Management	Re-allocation of road space	Telford and Wrekin Council	Early stage development	Not started	Reduction in NO2 emissions	N/A	Early consultation through

Table 2.2. More detail on these measures can be found in Telford and Wrekin Council's

## Telford and Wrekin Council

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

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Ironbridge Park and Ride	Alternatives to private vehicle use	Bus based Park & Ride	Telford and Wrekin Council	Fully Implemented	Fully Implemented	Amount of people using the service	N/A	The scheme is completed and is being well used.	N/A	The Ironbridge park and ride scheme aims to lower the amount of vehicle movements within the Ironbridge Gorge
2	Telford and Wrekin Council Journey Share	Alternatives to private vehicle use	Car & lift sharing schemes	Telford and Wrekin Council	Fully Implemented	Fully Implemented	Amount of people using the service	N/A	The scheme is completed and is being well used.	N/A	Aims to reduce the number of Council staff driving their car to work and encourage car sharing thus lowering emissions from vehicles.
3	Sustainable Traffic Management Plan	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Telford and Wrekin Council	The plan has been completed and a grant has been received to implement the plan.	This is being implemented in a staged approach	N/A	N/A	So far the project has implemented the Southwater Shared Space scheme.	Implemented	The Sustainable Traffic Management Plan aims to reduce the impact of vehicle movements on air quality by introducing schemes such as shared space schemes etc.
4	Watling Street Signal Upgrades	Traffic Management	Traffic Signals and Technology	Telford and Wrekin Council	Fully implemented	In progress	Reduction in NO <sub>2</sub> emissions	N/A	The improvements to traffic signals to link these together and be more demand responsive is currently being delivered	July 2017	Aim is to allow more efficient vehicle movement at the Watling Street Junctions to reduce engine idling
5	Coach Central	Traffic Management	Re-allocation of road space	Telford and Wrekin Council	Early stage development	Not started	Reduction in NO <sub>2</sub> emissions	N/A	Early consideration through CTAAP	Not identified	Potential for further traffic reduction along Coach Central in order to reduce vehicle emissions.

## 2.3 PM<sub>2.5</sub> – 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<sub>2.5</sub> (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that PM<sub>2.5</sub> has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

DEFRA maps indicate an average level of 9.33µm<sup>3</sup> for 2015 (latest available data from DEFRA) this is well below the limit values of 40µm<sup>3</sup> however, Telford and Wrekin Council are committed to lower the levels of PM<sub>2.5</sub> and have introduced initiatives that we hope will lead to the lowering of the levels these measures are identified in Table 2.2. Over the next 12 months we will be liaising further with our Public Health and Highways colleagues at the council to develop further schemes and strategies which will aim to lower levels of PM<sub>2.5</sub> within the borough and improve the health and wellbeing of the population of Telford and Wrekin.

## 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

There is currently no automatic air quality monitoring infrastructure in place within the Borough.

#### 3.1.2 Non-Automatic Monitoring Sites

Telford and Wrekin Council undertook non- automatic (passive) monitoring of NO<sub>2</sub> at 20 sites during 2016. **Error! Reference source not found.** in Appendix A shows the details of the sites. 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

**Table 3.1 - Work undertaken so far, the conclusions of the reports and the summaries of any further action.**

Year	Outcomes	Summaries
1998	PR	Prediction of exceedances
1999	PR	Prediction of exceedances
2000	USA	Not significantly affected by emissions (CO, Benzene, 1,3-Butadiene, Pb, SO <sub>2</sub> , PM <sub>10</sub> ); any breaches will be negligible
2001	PR	Prediction of exceedances
2002	PR	Declaration of AQMA
2003	USA	Exceedances of SO <sub>2</sub> from Ironbridge Power Station, and of NO <sub>2</sub> from road traffic emissions in Ironbridge Gorge. Review of AQMAs determined there would be no exceedances by 2005.
2004	PR	Detailed assessment of NO <sub>2</sub> and SO <sub>2</sub> from Ironbridge Power Station and vehicular traffic. Objectives will be met in 2005 so no further work is necessary.

## Telford and Wrekin Council

2005	PR	No exceedances of relevant air quality objectives, Revocation of AQMA
2006	USA	No exceedances of relevant air quality objectives
2007	PR	No exceedances of relevant air quality objectives
2008	PR	No exceedances of relevant air quality objectives
2009	USA	No exceedances of relevant air quality objectives
2011	PR	No exceedances of relevant air quality objectives (includes data from 2010)
2012	USA	No exceedances of relevant air quality objectives
2013	PR	No exceedances of relevant air quality objectives
2014	PR	No exceedances of relevant air quality objectives
2015	USA	No exceedances of relevant air quality objectives
2016	ASR	No exceedances of relevant air quality objectives

### 3.2.1 Nitrogen Dioxide (NO<sub>2</sub>)

Table A. in Appendix A compares the ratified and adjusted monitored NO<sub>2</sub> annual mean concentrations for the past 5 years with the air quality objective of 40µg/m<sup>3</sup>.

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B.

### 3.2.2 Particulate Matter (PM<sub>10</sub>)

Currently, Telford and Wrekin Council do not monitor for PM<sub>10</sub> or PM<sub>2.5</sub>.

### 3.2.3 Particulate Matter (PM<sub>2.5</sub>)

Currently, Telford and Wrekin Council do not monitor for PM<sub>10</sub> or PM<sub>2.5</sub>.

### 3.2.4 Sulphur Dioxide (SO<sub>2</sub>)

Currently, Telford and Wrekin Council do not monitor for PM<sub>10</sub> or PM<sub>2.5</sub>..

## Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) <sup>(1)</sup>	Distance to kerb of nearest road (m) <sup>(2)</sup>	Tube collocated with a Continuous Analyser?	Height (m)
DT1	Newport Car Park TF10 7DS	Urban background	374616	319182	NO <sub>2</sub>	NO	13.14	2.60	NO	2.52
DT2	Barrack Lane TF10 9ER	Urban background	373115	316587	NO <sub>2</sub>	NO	19.18	2.06	NO	2.34
DT3	Oxlip Close TF2 8RT	Urban background	371301	313583	NO <sub>2</sub>	NO	5.45	1.60	NO	2.46
DT4	Richmond Avenue TF2 7EF	Urban background	369553	312682	NO <sub>2</sub>	NO	6.35	1.34	NO	2.68
DT5	New Road Wrockwardine Wood TF2 7AA	Urban background	369922	312224	NO <sub>2</sub>	NO	23.14	0	NO	2.40
DT6	Horton Road TF2 6PD	Urban background	368627	312855	NO <sub>2</sub>	NO	2.14	0.40	NO	2.57
DT7	Sommerfield Road TF1 5DP	Urban background	368380	312211	NO <sub>2</sub>	NO	18.07	1.77	NO	2.36
DT8	Mercia Drive TF1 6YJ	Urban background	366161	312304	NO <sub>2</sub>	NO	15.30	0.50	NO	2.48
DT9	Apley Avenue TF1 3PN	Urban background	364997	312434	NO <sub>2</sub>	NO	41.42	2.50	NO	2.40
DT10	Watling Street TF1 2NH	Urban background	365825	311094	NO <sub>2</sub>	NO	5.36	2.26	NO	2.54
DT11	Manor Rise TF1 2ND	Urban background	366723	310821	NO <sub>2</sub>	NO	11.27	2.42	NO	2.40
DT12	Mossey Green Way TF2 0DL	Urban background	368594	310130	NO <sub>2</sub>	NO	25.04	1.46	NO	2.44

## Telford and Wrekin Council

DT13	Shifnal Road TF2 9NN	Urban background	371226	309402	NO <sub>2</sub>	NO	32.98	1.48	NO	2.47
DT14	Checkley Lane TF2 9UD	Urban background	371343	311136	NO <sub>2</sub>	NO	16.77	1.00	NO	2.59
DT15	Newdale/Lawley Junction TF4 2SG	Urban background	367412	308780	NO <sub>2</sub>	NO	11.22	1.00	NO	2.54
DT16	Dudmaston TF3 2DG	Urban background	370900	308536	NO <sub>2</sub>	NO	7.10	0.50	NO	2.51
DT17	Coach Central TF3 4JQ	Urban centre	369817	308676	NO <sub>2</sub>	NO	*Does not represent public exposure	1.28	NO	2.66
DT18	Boscobel Close TF3 1QQ	Urban background	370949	306311	NO <sub>2</sub>	NO	7.69	1.75	NO	2.45
DT19	Waverley TF7 5LU	Urban background	368941	304766	NO <sub>2</sub>	NO	4.27	0.49	NO	2.33
DT20	Kemberton/Madeley TF7 4BH	Urban background	370016	304570	NO <sub>2</sub>	NO	23.52	1.89	NO	2.43

Table A.2 – Annual Mean NO<sub>2</sub> Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) <sup>(1)</sup>	Valid Data Capture 2016 (%) <sup>(2)</sup>	Bias-adjusted NO <sub>2</sub> Annual Mean Concentration (µg/m <sup>3</sup> ) based on 0.92% correction* <sup>(3)</sup>				
					2012	2013	2014	2015	2016
DT1	Urban	Diffusion Tubes	90	90	No Data	No Data	No Data	No Data	18.9
DT2	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	24.56
DT3	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	13.89
DT4	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	16.55
DT5	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	17.89
DT6	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	16.68
DT7	Urban	Diffusion Tubes	90	90	No Data	No Data	No Data	No Data	19.08
DT8	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	13.96
DT9	Urban	Diffusion Tubes	90	90	No Data	No Data	No Data	No Data	24.24
DT10	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	34.62
DT11	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	15.61
DT12	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	30.14
DT13	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	25.46
DT14	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	21.46

## Telford and Wrekin Council

DT15	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	17.17
DT16	background	Diffusion Tubes	90	90	No Data	No Data	No Data	No Data	18.3
DT17	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	36.35
DT18	background	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	16.22
DT19	Urban	Diffusion Tubes	100	100	No Data	No Data	No Data	No Data	13.35
DT20	background	Diffusion Tubes	90	90	No Data	No Data	No Data	No Data	17.13

Diffusion tube data has been bias corrected (confirm by selecting in box)

Annualisation has been conducted where data capture is <75% (confirm by selecting in box)

If applicable, all data has been distance corrected for relevant exposure (confirm by selecting in box)

### Notes:

Exceedances of the NO<sub>2</sub> annual mean objective of 40µg/m<sup>3</sup> are shown in **bold**.

NO<sub>2</sub> annual means exceeding 60µg/m<sup>3</sup>, indicating a potential exceedance of the NO<sub>2</sub> 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.

**\* The bias-adjustment factor is that based on National Bias Adjustment Factors spreadsheet outlined by DEFRA relevant at the time of adjustment, which can be located here <https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html>**

The data in Table A.2 has been annualised using data from Aston Hill and Walsall Wood automatic monitoring stations.

## Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO<sub>2</sub> Monthly Diffusion Tube Results - 2016

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (+0.02) and Annualised <sup>(1)</sup>	Distance Corrected to Nearest Exposure (Meters) <sup>(2)</sup>
DT1					18.7784	20.46392	19.05202	0	21.5069	18.47086	26.81351	31.628		18.9	
DT2					18.44608	19.22547	15.08104	13.74024	65.70779	18.32825	26.49674	29.02185		24.56	
DT3					11.33307	10.1339	9.011097	8.745153	12.54984	13.35677	20.73015	27.16422		13.89	
DT4					14.09549	13.89417	10.41026	11.15456	16.37297	16.56494	23.34432	30.40148		16.55	
DT5					20.6503	16.64555	10.80064	12.43059	15.29427	21.09014	23.15527	27.85125		17.89	
DT6					14.27434	13.31562	11.52905	11.5235	17.22652	15.68932	24.63553	29.19455		16.68	
DT7					19.62787	18.41016	17.69526	0	21.10388	20.63081	26.83384	33.94763		19.08	
DT8					12.65879	11.51588	7.234904	9.537272	12.42057	16.8825	19.00223	24.36218		13.96	

**Telford and Wrekin Council**

DT9					32.7199 5	25.03194	0	22.30702	26.91819	30.176 47	29.97 587	42.194 81		24.24	
DT10					35.6939 8	38.62169	28.76556	29.67776	38.12361	32.280 28	40.59 371	49.988 46		34.62	
DT11					13.5821 6	12.66613	8.776294	11.3215	14.93528	18.284 47	20.84 033	27.606 07		15.61	
DT12					30.9292 8	28.74595	23.45837	21.1188	29.74083	28.421 34	40.09 573	52.157 05		30.14	
DT13					20.4209 7	23.63161	22.91702	23.62783	24.27616	24.212 2	33.02 078	41.785 08		25.46	
DT14					24.9204 9	19.84968	11.81796	12.69746	21.62279	23.277 36	27.76 526	37.106 79		21.46	
DT15					15.6308 6	13.62584	10.14298	11.41728	17.50709	18.406 25	26.66 609	32.918 75		17.71	
DT16					25.0913 1	0	9.815498	13.21298	19.91575	23.243 91	26.70 431	33.524 25		18.3	
DT17					33.1131 4	34.2442	32.98522	35.22602	40.20033	32.984 9	43.81 466	56.202 18		36.35	
DT18					15.7861 6	12.59236	8.464038	9.752376	15.91934	17.477 02	21.71 265	31.663 31		16.22	
DT19					13.3542 3	10.75963	6.365713	8.55604	11.88434	15.473 59	16.73 057	25.210 61		13.35	
DT20					25.9744	0	15.6983	17.41301	23.69772	19.683 22	0	38.861 84		17.13	

- LoDT19cal bias adjustment factor used (confirm by selecting in box)
- NationalDT20I bias adjustment factor used (confirm by selecting in box)
- Annualisation has been conducted where data capture is <75% (confirm by selecting in box)

**Notes:**

Exceedances of the NO<sub>2</sub> annual mean objective of 40µg/m<sup>3</sup> are shown in **bold**.

NO<sub>2</sub> annual means exceeding 60µg/m<sup>3</sup>, indicating a potential exceedance of the NO<sub>2</sub> 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.

The data in table B.1 shows the annual monitoring results obtained through diffusion tube monitoring in 2016-17. The overall results indicate that the borough has excellent air quality in relation to the National AQO and those limits set out in the ambient air quality directive (2008/50/EC), with 80% of locations having an annual NO<sub>2</sub> concentration of under 30 µg/m<sup>3</sup>. There were however two areas of concern, namely Watling Street and Coach Central. \* Box 1.1. DEFRA TG16 states that the National AQO do not apply for an annual mean averaging period at kerbside locations where public exposure is expected to be short-term which the monitoring location at Coach Central represents. This location will however continue to be monitored in order to understand any impact on air quality of nearby development. Watling Street does however meet the relevant exposure criteria outlined in Box 1.1 which is why the Council are introducing further monitoring efforts in this location to understand the extent of the issue.

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

## Telford & Wrekin Council Air Quality Strategy

### Contents

<b>Legislative Context</b> .....	<b>18</b>
Environment Act 1995 .....	18
IPPC .....	18
Clean Air Act 1993 .....	18
Town and Country Planning Act 1990 .....	18
<b>Scientific Basis</b> .....	<b>18</b>
<b>Air Quality Monitoring in Telford</b> .....	<b>19</b>
<b>Approaches to Maintaining Air Quality</b> .....	<b>20</b>
<b>Recommendations</b> .....	<b>20</b>
<b>Bibliography</b> .....	<b>20-21</b>
<b>Appendix 1</b> .....	<b>25</b>
<b>Introduction</b> .....	<b>28</b>
<b>Legislative Drivers</b> .....	<b>28</b>
European Union .....	28
Environment Act .....	28
Environmental Protection and Clean Air Acts .....	28
Relevant Regulations.....	28
Government Policy .....	29
Local Policy.....	29
Environmental Health .....	29
Planning .....	29
Public Health.....	29
<b>Scientific Drivers</b> .....	<b>Error! Bookmark not defined.</b>
Toxicological Basis .....	<b>Error! Bookmark not defined.</b>
Chemical Fate & transport .....	30
<b>Authoritative Bodies Statements</b> .....	<b>31</b>
COMEAP .....	31
WHO .....	31
EHC .....	31
IARC .....	31
USEPA .....	32
<b>Telford and Wrekin Council</b>	
LAQM Annual Status Report 2016 17	
<b>COMEAP Calculations</b> .....	<b>32</b>

**Conclusions** ..... 32  
Location of diffusion tubes ..... 32  
**Bibliography** ..... 38  
Figure 1 Map of Previous Locations of Diffusion Tubes..... 20

## **Legislative Context**

The Acts mentioned below are the main legislative drivers that govern how air quality is improved and maintained; some of which stem from EU Directives and are transposed in Acts and Regulations. All these Acts enable Councils to ensure that the air within their Boroughs is clean and not likely to cause illnesses.

### **Environment Act 1995**

The Environment Act 1995 introduced a regime for the monitoring of air quality by Councils within their areas for the monitoring of select pollutants, and to then report this monitoring back to DEFRA with comments on any exceedances of air quality objectives (AQOs) for the select pollutants. If there were any exceedances, then the Local Authority are required to declare an Air Quality Management Area (AQMA) and set out how they will reduce the levels of the select pollutants to below the AQOs.

### **IPPC**

The Integrated Pollution Prevention and Control Act was implemented as a way to reduce pollution from larger industrial installations, and it implements the EU Directive 2008/1/EC. It covers a number of different industries, some of which are regulated by the Council, and others by the Environment Agency. The industries are managed by having permits that contain emission limit values, as well as other conditions relating to energy efficiency, waste minimisation, and prevention of accidental emissions based on the application of Best Available Technique (BAT). A number of other EU Directives are also implemented via this regime, including the Waste Incineration Directive, the Industrial Emissions Directive and the Solvent Emissions Directive.

### **Clean Air Act 1993**

The Clean Air Act was implemented to reduce pollution from smoke, grit and dust. It also empowers Councils to declare Smoke Control Areas, where it is an offence to use an unapproved fireplace or fuel. The origins of the 1993 act lay back in 1956 with an amendment in 1968. DEFRA are currently consulting on reviewing the Act and its provisions.

### **Town and Country Planning Act 1990**

Air Quality is a material consideration under the Act and Local Planning Authorities must take account of it when determining applications. It is managed by the submission of reports prior to planning, or to fulfil conditions that have been placed on planning permissions. These reports are vetted (usually) by Environmental Health on behalf of the Local Planning Authority. There are a number of other Acts that impact on air quality, and these include the Road Traffic Reductions Act 1997 and the Road Traffic Reduction (National Targets) Act 1998.

### **Scientific Basis**

It has been known since ancient times that air pollution can cause significant impacts to human health. Lao Tzu was concerned with anthropogenic effects on air, and there was a Roman law in York that regulated emissions from a number of activities (Sportisse, 2010). Further work and laws were done during the medieval period, and John Evelyn's book Fumifugium was published in 1648.

It was the infamous smogs of the 1950s that particularly reinforced in the UK that more needed to be done to improve the air in the country.

However, it wasn't until 1998 that one of the Government's advisory bodies, the Committee on the Medical Effects of Air Pollution (COMEAP) first undertook an assessment of the mortality effects of long-term exposure to particulate matter in the UK. This was updated in 2010 using updated exposure information and epidemiology. It is important to note that the document measures the effects in years lost or gained; as everyone eventually dies no lives are saved by reducing environmental exposure. Within the report, they concluded the following:

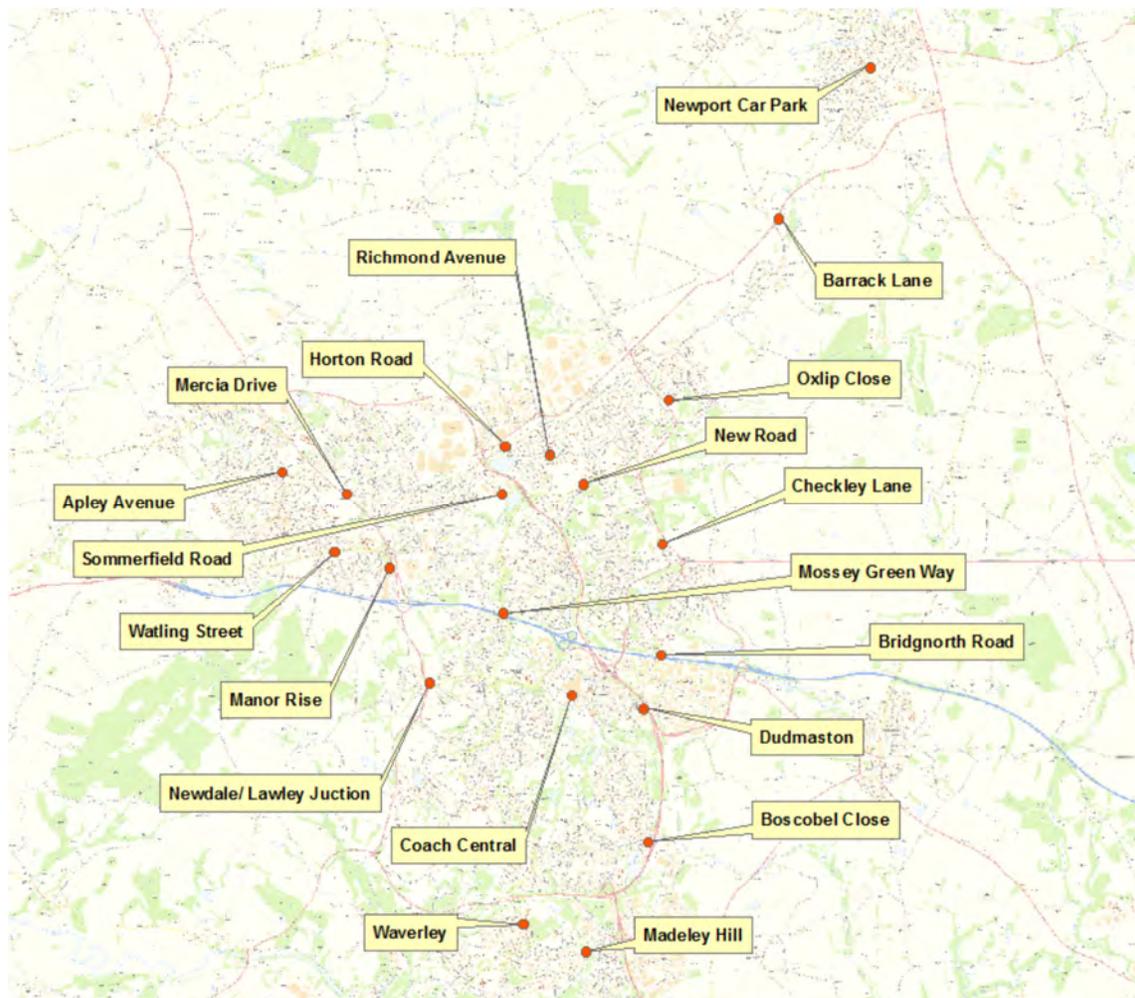
1. Removing all anthropogenic ('human-made') particulate matter air pollution (measured as PM<sub>2.5</sub>) could save the UK population approximately 36.5 million life years over the next 100 years and would be associated with an increase in UK life expectancy from birth, i.e. on average across new births, of six months. This shows the public health importance of taking measures to reduce air pollution.
2. A policy which aimed to reduce the annual average concentration of PM<sub>2.5</sub> by 1µg/m<sup>3</sup> would result in a saving of approximately 4 million life years or an increase in life expectancy of 20 days in people born in 2008.
3. The current (2008) burden of anthropogenic particulate matter air pollution is, with some simplifying assumptions, an effect on mortality in 2008 equivalent to nearly 29,000 deaths in the UK at typical ages and an associated loss of total population life of 340,000 life-years. The burden can also be represented as a loss of life expectancy from birth of approximately six months.
4. The uncertainties in these estimates need to be recognised: they could vary from about a sixth to double the figures shown. (COMEAP, 2010). In August 2012, COMEAP (COMEAP, 2012) released a statement on estimating the mortality burden of particulate air pollution at the local level. This provides the Council the tools with which they can calculate the mortality burden of air pollution on the local population. The carcinogenic effects of air pollution are outlined in a report from the World Health Organisation's (WHO) International Agency for Research on Cancer (IARC) (Straif, *et al.*, 2013).

### **Air Quality Monitoring in Telford**

For a large number of years, air quality was monitored in the area of Telford & Wrekin via diffusion tube monitoring at locations across the Borough. These were monitored for Nitrogen Oxides on a monthly basis. This has been supplemented by further work by the Council; for instance in 200X an Air Quality Management Area (AQMA) was declared by the Council for an area of Ironbridge due to vehicle emissions, as well as emissions from the power station. Subsequent monitoring showed that there was no exceedance of the relevant air quality objective, and so the AQMA was rescinded. Monitoring within the Borough has been augmented by two permitted processes; the first is the power station itself that has an automatic monitoring system for emissions of nitrogen oxides and sulphur dioxide. The second is automatic monitoring that is undertaken by UK Coal Surface Mines Ltd. at the open cast colliery in the south eastern area of the Borough. This monitors for particulates.

Due to the budgetary constraints brought about by the Comprehensive Spending Review in 2010, diffusion tube monitoring ceased as a cost-saving. It was determined to rely upon modelling from reports submitted to fulfil planning conditions. However, it is now felt that this is a rather circular form of proving compliance, and so it is considered necessary to bring back diffusion tube monitoring. However, funds for this would be required for sampling and officer time, and it is thought that either Section 106 funding or CIL via the planning process would be appropriate to enable the Council to monitor the long-term impact of development within the Borough.

**Figure 1: Map of Previous Locations of Diffusion Tubes**



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## Approaches to Maintaining Air Quality

Given the importance of air quality within the Borough, it is ideal to maintain, or improve, the quality of the air the residents of Telford are exposed too. The current approach is to assess planning applications, and to see if they meet the criteria for significance under “EPUK AQ Planning Guidance”.

This states that significance is:

- Number of properties affected by slight, moderate or major air quality impacts and a judgement on the overall balance.
- Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.
- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. Tables 4 and 5 findings.
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased.
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced.
- Uncertainty, including the extent to which worst-case assumptions have been made.
- The extent to which an objective or limit value is exceeded, e.g. an annual mean NO<sub>2</sub> of 41 µg/m<sup>3</sup> should attract less significance than an annual mean of 51 µg/m<sup>3</sup>.
- 

One approach is to adopt a Low Emissions Zone strategy. This recognises that certain pollutants have health impacts no matter what the level in the air we breathe, and so that people who increase the levels of pollution are required to pay to assist the Council in mitigating their presence. Whilst this recognises the polluter pays principle that is the cornerstone of most modern environmental pollution in English law, it also runs the risk of undermining development, the cornerstone of the Councils strategy for driving growth within the Borough. One of the Councils corporate aims is to improve the health and well-being of communities, and this would be an important aspect of achieving that aim.

## Recommendations

To continue to use diffusion tube monitoring to and appropriately address any locations where air quality is poorer than that witnessed within other areas of the borough.

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## Justification for Diffusion Tube Monitoring

### Contents

<b>Legislative Context .....</b>	<b>17-20</b>
Environment Act 1995 .....	17
IPPC .....	17
Clean Air Act 1993 .....	17
Town and Country Planning Act 1990 .....	17
<b>Scientific Basis .....</b>	<b>17- 18</b>
<b>Air Quality Monitoring in Telford .....</b>	<b>18-19</b>
<b>Approaches to Maintaining Air Quality .....</b>	<b>20</b>
<b>Recommendations .....</b>	<b>20</b>
<b>Bibliography .....</b>	<b>20-</b>
<b>21</b>	
<b>Introduction .....</b>	<b>23</b>
<b>Legislative Drivers .....</b>	<b>23</b>
European Union .....	23
Environment Act .....	23
Environmental Protection and Clean Air Acts .....	24
Relevant Regulations.....	24
Government Policy .....	24
Local Policy.....	24
Environmental Health .....	24
Planning .....	24
Public Health.....	25
<b>Scientific Drivers .....</b>	<b>25</b>
Toxicological Basis .....	<b>25</b>
Chemical Fate & transport .....	26
<b>Authoritative Bodies Statements .....</b>	<b>26-28</b>
COMEAP .....	26
WHO .....	27
EHC .....	27
IARC .....	27
USEPA .....	28
<b>COMEAP Calculations .....</b>	<b>28</b>
<b>Conclusions .....</b>	<b>28</b>

Location of diffusion tubes ..... 28  
 Bibliography ..... 31

**Introduction**

This report will set out the rationale as to why the Council will start to undertake diffusion monitoring again. Until March 2011, Telford & Wrekin Council undertook diffusion tube monitoring throughout the Borough to ensure that levels of nitrogen dioxide remained below the relevant Air Quality Objective (AQO). In agreement with DEFRA, it was decided to cease this monitoring. This meant that the Council relied on automatic monitoring stations at Huntington and Aqueduct from the opencast colliery and power station respectively, as well as evaluations of air quality submissions for the fulfilment of planning conditions. However, the opencast colliery has now closed and monitoring has ceased, and the power station is scheduled to close in 2015. This would mean that from 2015 there will be no air quality monitoring infrastructure in place within the Borough. As such, the Council would not be able to undertake its statutory obligations as set out below.

**Legislative Drivers**

There is a historical legacy of air quality legislation in England. The first known law was during the days of the Roman Empire, when a local law regulated local emissions from certain processes (Sportisse, 2008). In 1272, Edward I banned the use of sea coal by his castles, and banned its use in London in 1306. By 1390 Richard I had regulated its use in London. By the time of The Restoration it was well recognized that “smoak” was detrimental to the quality of the air, as demonstrated in Fumifugium by John Evelyn in 1661. However, it wasn’t until the 1950s when smog’s killed thousands of people that the first Clean Air Act was introduced to regulate the burning of coal. This had been preceded by the first of the Alkali Acts of 1863 which was created to limit the emissions of hydrochloric and sulphuric acids to atmosphere, with an Inspectorate created in 1874. The 1863 Act was subsequently amended by the Alkali, &c. Works Regulation Act of 1881, which was extended by the Alkali, &c. Works Regulation Act of 1882. This final act was repealed by the Alkali, &c. Works Regulations Act of 1906 which existed until it was replaced by the Environmental Protection Act 1990.

**European Union**

European Union legislation forms the framework for current English law with regards to Air Quality. Directive 96/62/EC relates to ambient air quality assessment and management, and sets limits against which concentrations of substances in the atmosphere can be evaluated. These limits were adopted into English Law in the Air Quality Standards Regulations 2010 No. 1001 as Air Quality Objectives (AQOs).

**Environment Act**

In England, the current legislative driver for monitoring air quality is the Environment Act 1995. Part IV of the Environment Act 1995 sets out the responsibilities of Local Authorities. Section 82 sets out the requirement for local authorities to undertake reviews. Sub-section 1 relates to the annual review undertaken by the Council and

submitted to DEFRA for their assessment. Sub-section 2 requires the Council to assess air quality data and evaluate it in light of the AQOs. Sub-section 3 tells the Council what it should do if it identifies any breaches of AQOs. Following Sections set out the Councils responsibilities with regards to what to do if there are any breaches of relevant AQOs (declare the area of the exceedance(s) as an Air Quality Management Area (AQMA)), and what is required to be done once an AQMA has been declared.

## **Environmental Protection and Clean Air Acts**

The Environmental Protection Act 1990 covers nuisance from smoke, fumes or dust. The Clean Air Act 1993 covers emissions of dark smoke, dust and grit from boilers and chimney stacks. Sections 14 and 15 relate to the applications for the heights of chimneys to boilers.

## **Relevant Regulations**

The Air Quality Standards Regulations 2010 No. 1001 provides the AQOs as specified in the Act. Part 4 relates to the national exposure reduction for PM2.5.

## **Government Policy**

Government Policy is set out in the Air Quality Strategy for England, Wales, Scotland and Wales (DEFRA, 2007). The strategy sets out air quality objectives and policy options to improve air quality in the UK.

## **Local Policy**

There is no local policy as such; Telford & Wrekin Council operates within all the legislative requirements that are expected of them. For more information, please see the relevant sections below. However, in recognising the lack of a local policy, the Public Protection department are currently producing an air quality strategy which will address how the Council intends to maintain the excellent standard of air quality within the Borough.

## **Environmental Health**

The Public Protection Department at Telford & Wrekin Council are responsible for fulfilling the Councils objectives under the Environment Act 1995. Until March 2011, the department was responsible for the placement and analysis of diffusion tubes throughout the Borough. It also produces the air quality progress reports and updating and screening assessments as required under the Environment Act. It is also responsible for enforcing the Clean Air Act 1993, and assesses any chimney height (D1) applications. The Public Protection Department is also responsible for enforcing the Environmental Permitting Regulations which relates to the release of industrial emissions to air. The Environment Agency

## **Planning**

Air quality is a material consideration under the Town and Country Planning Act, and the Governments National Planning Policy Framework sets out how it expects Councils to evaluate applications with regards to air quality. The Council has a Local Planning Policy which details how planning applications will be evaluated. Policy CS13 relates to air quality. The Public Protection department evaluates any reports

submitted either pre-application, or for the fulfilment of any planning conditions, on behalf of the Local Planning Authority.

## Public Health

The Public Health Department of Telford & Wrekin Council are responsible for the Joint Strategic Needs Assessment (JSNA), which is a statutory responsibility under the Health and Social Care Act (2012). There is also an obligation to report on objectives under the Public Health Outcomes Framework. One of these relates to air quality. Under Section 3; Health Protection, Indicator 3.01 is the fraction of mortality attributable to particulate air pollution. In 2010, this was calculated as 4.8 for the Borough, against an England average of 5.6, and 4.4 against an England average of 5.1 in 2012.

## Scientific Basis

### Toxicological Basis

It has been known for a significant period of time that exposure to poor quality air affects human health. It was not until the mid-1950's that the causes and mechanisms of the process were determined. As with most substances, the risk is related to the dose, although it is recognised that for some substances, there is a risk at any exposure. An example of this is PM2.5. It has been shown that current levels of PM2.5 exposure possess "chronic, adverse effects on pulmonary development of children" (Gauderman, et al., 2004). It does this via a number of mechanisms, including inhibiting cell growth by reducing proliferation and/or causing cell death (Longhin, et al., 2013). Experiments by Longhin, et al. (2013) show that exposure to winter air from Milan causes severe aberrations in mitotic spindles, increased presence of reactive oxygen species and DNA damage *in vitro* pre-mitosis (G2) phase, and could likely account for some of the effects caused via PM2.5 exposure. It has also been shown that exposure at 25 mg/cm<sup>2</sup> PM2.5 Milan winter air for 20 hours results in cell death by apoptosis in human bronchial epithelial cells (Gualtieri, et al., 2011).

Studies in mice show that exposure to PM2.5 has been associated with an increased risk of heart disease, insulin resistance and diabetes. Exposure to a high fat diet may exacerbate these risks (Potera, 2014).

Nitrogen Dioxide (NO<sub>2</sub>) is also a major driver with regards to health issues from air pollution. For instance (Han, et al., 2013) show that exposure to NO<sub>2</sub> induces DNA strand breakage and the formation of DNA-Protein cross-links in the cells of various organs (brain, lung, liver, spleen, kidney and heart), and as such is a systemic genotoxin.

NO<sub>2</sub> enters the lungs and is metabolised into reactive oxygen and nitrogen species. These have a direct effect on the lungs inflammatory response. This has been positively correlated with asthma severity, disease exacerbation and risk of death (Ather, et al., 2014).

## Chemical Fate & transport

The intricacies of the fate and transport of harmful substances in the environment are myriad. Of particular importance are the compositions of the substances themselves. For instance, PM<sub>2.5</sub> is composed of a near infinite combination of substances; it is soot (combustion particles in a spherical carbon form) with diameters ranging from 20-30 nm. The small diameters of these particles provide a relatively high surface area which facilitates the adsorption of various other particles, including metals, organic compounds and biological components including bacterial endotoxins (Longhin, et al., 2013). Other ingredients can be sea salt. Nitrogen is emitted to the atmosphere in a number of forms, from a number of processes. For example, denitrification of soils or the oceans releases nitrogen in the form of nitrogen and nitrogen dioxide in small quantities, whereas the burning of fossil fuels releases nitrogen oxide. Crops, livestock, and forests all emit nitrogen in the form of ammonia (Fowler, et al., 2014). These compounds then go through complex chemical processes in the atmosphere where they are converted to nitrogen dioxide. For instance, nitric oxide is converted to nitrogen dioxide by oxidation. Other reactions involve the change from nitrogen compound to ozone using sunlight and carbon

The remaining species that are largely present in the atmosphere are:

- Sulphur dioxide;
- Ozone;
- Heavy metals;
- Mercury;
- Aerosols composed of a mixture of sulphates, ammonia, nitrate, organic matter, dust, sea salt and water;
- Radionuclides;
- Greenhouse gases;
- Carbon monoxide, and
- Persistent organic pollutants

There is a complex interaction between all these and other chemicals in the atmosphere, sunlight and lightning that leads to transformations that make them available for inhalation, and most of them have health effects.

## Authoritative Bodies Statements

### COMEAP

In 1998, one of the Governments advisory bodies, the Committee on the Medical Effects of Air Pollution (COMEAP) undertook an assessment of the mortality effects of long-term exposure to particulate matter in the UK. This was updated in 2010 using updated exposure information and epidemiology. It is important to note that the document measures the effects in years lost or gained; as everyone eventually dies no lives are saved by reducing environmental exposure.

Within the report, they concluded the following:

1. Removing all anthropogenic ('human-made') particulate matter air pollution (measured as PM<sub>2.5</sub>) could save the UK population approximately 36.5 million

life years over the next 100 years and would be associated with an increase in UK life expectancy from birth, i.e. on average across new births, of six months. This shows the public health importance of taking measures to reduce air pollution.

2. A policy which aimed to reduce the annual average concentration of PM<sub>2.5</sub> by 1µg/m<sup>3</sup> would result in a saving of approximately 4 million life years or an increase in life expectancy of 20 days in people born in 2008.
3. The current (2008) burden of anthropogenic particulate matter air pollution has, with some simplifying assumptions, an effect on mortality in 2008 equivalent to nearly 29,000 deaths in the UK at typical ages and an associated loss of total population life of 340,000 life-years. The burden can also be represented as a loss of life expectancy from birth of approximately six months.
4. The uncertainties in these estimates need to be recognised: they could vary from about a sixth to double the figures shown. (COMEAP, 2009)

## **EHC**

There is no specific EHC for air pollution, although there are two for Nitrogen Oxides; (WHO, 1977) and (WHO, 1997). (WHO, 1997) concludes that nitrogen oxides can reach concentrations in ambient and indoor air that may affect human health. Chronic exposure to nitrogen oxides is associated with respiratory illness. They recommend a long-term guidance value of 40 µg/m<sup>3</sup> as posing an increased risk of respiratory illness in children.

## **IARC**

IARC is the specialized cancer agency of the WHO. (IARC, 1989) evaluated diesel and gasoline exhausts, and concluded that Diesel engine exhaust was a Group 2A carcinogen (probably carcinogenic to humans) and that gasoline exhaust was a Group 2B carcinogen (possibly carcinogenic to humans). (IARC, 1987) evaluated the risks to human health from soot. This was a supplemental report updating an evaluation from 1985. They concluded that 'soots' were a Group 1 carcinogen (are carcinogenic to humans)

## **USEPA**

The USEPA are an equivalent in the US of the Environment Agency in England and Wales. They have world renowned research arms that study many different forms of the toxicology of substances. For instance, the IRIS programme produces reference doses (via ingestion) and reference concentrations (via inhalation) for substances. For instance, there was a reference dose for nitrogen dioxide, although this has been withdrawn.

The USEPA also produces National Ambient Air Quality Standards (NAAQS) for a number of substances, including carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulphur dioxide. They note the principal effects of carbon monoxide are reducing the delivery of oxygen to organs, and death; of lead being adverse effects on the nervous system, kidney function, immune, reproductive, developmental and the cardiovascular systems. The principal effects of nitrogen dioxide are respiratory effects including airway inflammation, and increased

symptoms in asthmatics. The principal effects of particulate matter can include premature death in people with lung and heart disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function and increased respiratory symptoms such as coughing or difficulty breathing. The principal effects of sulphur dioxide are adverse respiratory effects such as bronchoconstriction, and elevated ventilation rates in asthmatics.

## COMEAP Calculations

(COMEAP, 2012) recommended that an approach be developed by the then Health Protection Agency to enable local authorities to easily calculate the burden of long term particulate exposure on the health of citizens within the borough. This approach is still awaiting development.

## Conclusions

### Location of diffusion tubes

Below is a table showing all monitoring locations for 2017/18 diffusion tube monitoring. Note that Tube No's 20, 21, 22, 23, 24 and 25 are all new monitoring locations. Although 2016 monitoring locations were based on road traffic count data, the 9 new locations are being monitored as a result of 2016 monitoring data suggesting poorer air quality. It is therefore a direct response to such monitoring data.

Tube No.	Location	Justification
1	B4373 Mossey Green Way	M54, B4373
2	New Road	Wrockwardine Wood Way
3	Checkley Lane	A4640
4	Apley Avenue	Apley Avenue
5	Dudmaston	M54
6	Shifnal Road	M54
7	Sommerfield Road	A442
8	Horton Road	A518
9	Waverley	B4373
10	Madeley Hill	Roundabout at foot of steep climb on busy junction
11	Coach Central	Southwater Development, canyon
12	Richmond Avenue	Urban Background
13	Barrack Lane	A518
14	Newport Car Park	Newport Centre
15	Newdale Lawley Junction	Lawley Development
16	Watling Street 1	B5061 Cross Roads
17	Watling Street 2	B5061 Cross Roads
18	Mill Bank	B5061 Cross Roads
19	Holyhead Road	B5061 Cross Roads
20	Dawley Road	B5061 Cross Roads
21	Watling Street/Regent Street Junction	B5061 Cross Roads
22	Deercote (top)	Southwater Development, canyon
23	Deercote (bottom)	Southwater Development, canyon

24	Waverley	Southwater Development, canyon
25	Lawnswood	Southwater Development, canyon

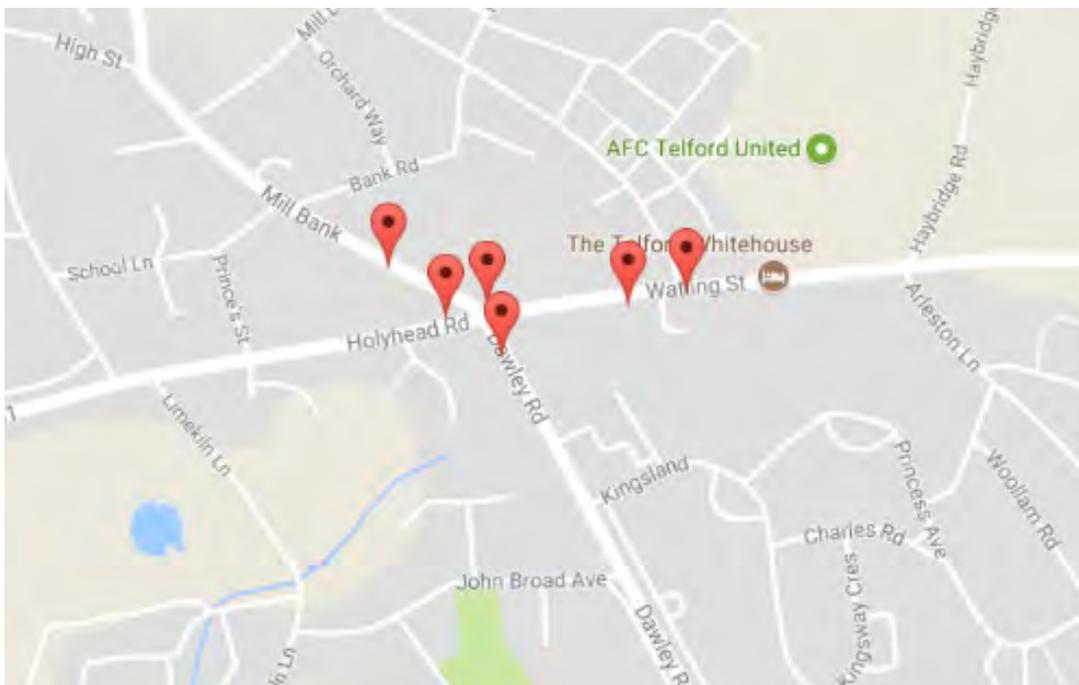
A map illustrating additional monitoring locations at Watling Street, Holyhead road, Mill Bank and Dawley Road in light of high concentrations identified during the previous year’s monitoring. The area has been flooded with additional tubes in order to understand the extent of the concentrations identified at Watling Street. Due to very low concentrations, the Council has ceased monitoring in the following locations;

- Oxlip Close;
- Mercia Drive;
- Manor Rise; and
- Boscobel Close.

An additional 9 diffusion tubes have been introduced at the two locations identified as having the highest concentrations, namely Coach Central and Watling Street which are shown in Map’s A and B below. Map A illustrates the additional monitoring locations at Watling Street with the introduction of 5 new tubes at Watling Street ‘2’, Mill Bank, Holyhead Road, Dawley Road and Watling Street/Regent Street Junction.

Map B illustrates additional monitoring locations at Deercote, Withywood Drive and Lawnswood in light of high concentrations identified during the previous year’s monitoring. The area has been ‘flooded’ with additional tubes in order to understand the extent of the concentrations identified at Coach Central and if these concentrations are experienced in the immediate area which represent relevant exposure.

Map A – Additional 5 locations introduced to support 2016 data from Watling Street (outside swan) in order to provide more dispersed monitoring of B5061 Cross Roads.



Map B – Additional 4 monitoring locations introduced to support the 2016 data from the Coach Central tube in order to provide more dispersed monitoring of Southwater Development canyon.



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

The map below illustrates all monitoring locations for the continuation of diffusion tube monitoring 2017.



## Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective <sup>4</sup>	
	Concentration	Measured as
Nitrogen Dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup> not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m <sup>3</sup>	Annual mean
Particulate Matter (PM <sub>10</sub> )	50 µg/m <sup>3</sup> , not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m <sup>3</sup>	Annual mean
Sulphur Dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup> , not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m <sup>3</sup> , not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m <sup>3</sup> , not to be exceeded more than 35 times a year	15-minute mean

<sup>4</sup> The units are in microgrammes of pollutant per cubic metre of air (µg/m<sup>3</sup>).

## 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 <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
PM <sub>10</sub>	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
PM <sub>2.5</sub>	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO <sub>2</sub>	Sulphur Dioxide

## References

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