# 2016 Air Quality Annual Status Report (ASR)

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

Date 30th June, 2016

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| Date | 30th June 2016 |

# Executive Summary: Air Quality in Our Area

Telford and Wrekin Council have undertaken an annual status report which reviews all relevant data from 2015/16. It should be noted that since the last Air Quality report the Ironbridge Power Station has ceased operations.

This review has shown that the 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. They also show that emissions from Ironbridge Power Station have decreased with time, and that the Powerstation has now ceased operations.

This would indicate that all measures undertaken to ensure the wholesomeness of the air quality of the Borough are currently working.

An Air Quality Strategy has been produced, in light of the Boroughs plans to increase the numbers of homes and businesses within the Borough and to introduce diffusion Tube monitoring for $NO_2$ 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: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

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

The 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, (7 A1 and 11 A2 processes), 41 part B processes, 18 petrol stations, 6 dry cleaning installations and 4 small waste oil burners within the Borough. There is a main railway line traversing the centre of the Borough, as well as an unused rail freight terminal. A branch line to this supplies the Ironbridge Power Station. The Power Station at Ironbridge was also a source of emissions up until the end of 2015, although it is situated outside the Borough.

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

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

**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, $SO_2$, $PM_{10}$); any breaches will be negligible |
| 2001 | PR | Prediction of exceedances |
| 2002 | PR | Declaration of AQMA |
| 2003 | USA | Exceedances of $SO_2$ from Ironbridge Power Station, and of $NO_2$ from road traffic emissions in Ironbridge Gorge. Review of AQMAs determined there would be no exceedances by 2005. |
| 2004 | PR | Detailed assessment of $NO_2$ and $SO_2$ 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 |

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, enshrines the Council's commitment to ensure that new development within the Borough demonstrate zero impact.

## Actions to Improve Air Quality

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 exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence 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 NO2 of 41 µg/$m^3$ should attract less significance than an annual mean of 51 µg/$m^3$.

Telford and Wrekin Council have secured a funding to create and implement a Local Sustainable Transport plan. 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.

## Local Priorities and Challenges

Telford and Wrekin's priorities for the coming year are to begin diffusion tube monitoring for $NO_2$ to build a clearer picture on the current Air Quality within Telford and Wrekin. To ensure that the diffusion tubes have been appropriately sited road traffic count data has been used to determine which are 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. | Barcode Number | Lamppost Number | Location | Justification |
|---|---|---|---|---|
| 1 | 19 | | B4373 Mossey Green Way | M54, B4373 |
| 2 | 7 | | Manor Rise | A5223 |
| 3 | 14 | | New Road | Wrockwardine Wood Way |
| 4 | 18 | | Checkley Lane | A4640 |
| 5 | 10 | | Mercia Drive | A5523 |
| 6 | 9 | | Apley Avenue | Apley Avenue |
| 7 | 4 | | Dudmaston | M54 |
| 8 | 20 | | Shifnal Road | M54 |
| 9 | 3 | | Boscobel Close | A442 |
| 10 | 11 | | Sommerfield Road | A442 |
| 11 | 12 | | Horton Road | A518 |
| 12 | 2 | | Waverley | B4373 |
| 13 | 1 | | Madeley Hill | Roundabout at foot of steep climb on busy junction |
| 14 | 5 | | Coach Central | Southwater Development, canyon |
| 15 | 13 | | Richmond Avenue | Urban Background |
| 16 | 16 | | Barrack Lane | A518 |
| 17 | 17 | | Newport Car Park | Newport Centre |
| 18 | 6 | | Newdale Lawley Junction | Lawley Development |
| 19 | 15 | | Oxlip Close | A4640 |
| 20 | 8 | | Watling Street | B5061 Cross Roads |

## 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

Or contact us by phone on 01952 381818

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# 1 Local Air Quality Management

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

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an 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 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 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 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 monitored for Nitrogen Oxides on a monthly basis. This has been supplemented by further work by the Council; for instance in 2004 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 had an automatic monitoring system for emissions of nitrogen oxides and sulphur dioxide. The second is automatic monitoring that was undertaken by UK Coal Surface Mines Ltd. at the open cast colliery in the south eastern area of the Borough. This monitored 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.

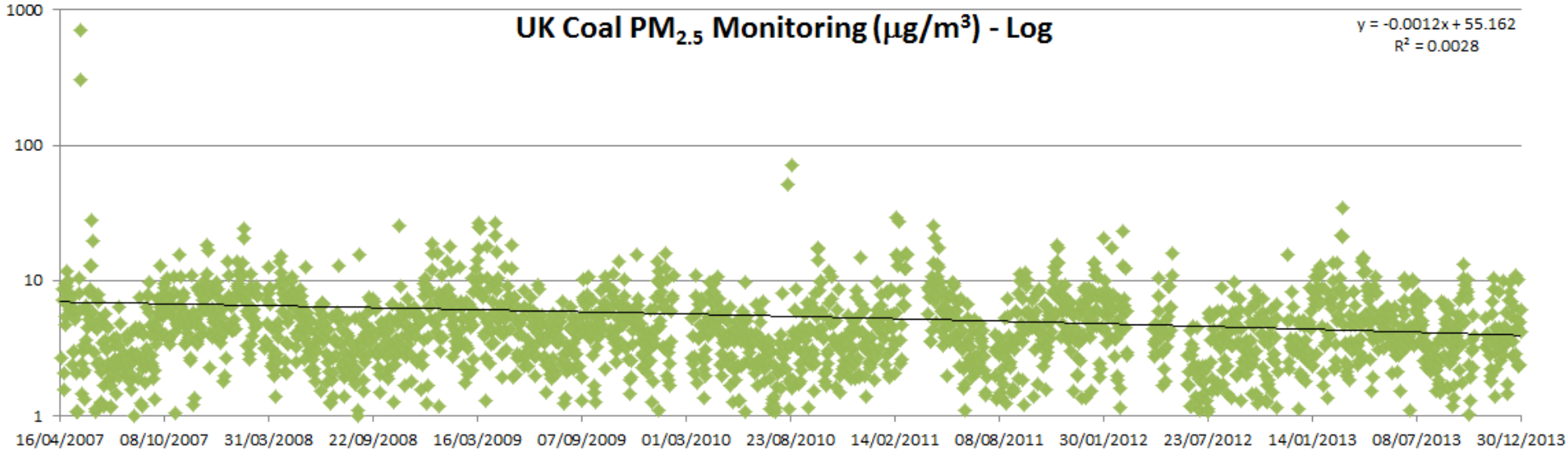
One approach is to adopt a Low Emissions Zone strategy. This recognises that certain pollutants have health impacts no matter what the level in the air we breathe, and so that people who increase the levels of pollution are required to pay to assist

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.

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. 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 and power station have now closed and monitoring has ceased. This means that currently there is no air quality monitoring infrastructure in place within the Borough. As such, the Council have decided to once again begin diffusion tube monitoring within the borough, to ensure the back ground levels of air pollution do not rise and to undertake the Council's statutory obligations for air quality monitoring. A copy of Telford and Wrekin's Air Quality Strategy can be seen in Appendix C this includes details on the diffusion tube monitoring locations, this monitoring began in April 2016.

Monitoring for Particulate Matter in Telford and Wrekin was carried out by UK Coal in order to fulfil a condition on their environmental permit with regards to their open-cast colliery at Huntington Lane, issued by the Council between 2007 and 2013. This station monitored $PM_{10}$, $PM_{2.5}$ and $PM_{1}$. Monitoring for PM ceased when the open-cast colliery closed in 2013. Data gathered during this period showed that levels of PM2.5 were decreasing over time, graph 1 below demonstrates this.




Graph 1 shows the levels of $PM_{2.5}$ decreasing over the monitoring period from 2007 – 2013.

Since the closure of the open-cast coal mine Telford and Wrekin Council have not been monitoring for $PM_{2.5}$ levels. Telford and Wrekin Council are committed to lower the levels of $PM_{2.5}$ 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 with our Public Health colleagues at the council to develop further schemes and strategies which will aim to lower levels of $PM_{2.5}$ 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 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 Telford and Wrekin Council's Air Quality Strategy (Appendix C).

## 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. |

## 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 to Date | Estimated Completion Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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. | Unknown | 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. |

## 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.

DEFRA maps indicate an average level of 9.33$\mu m^3$ for 2015 this is well below the limit values of 40$\mu m^3$ however, Telford and Wrekin Council are committed to lower the levels of $PM_{2.5}$ 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 with our Public Health colleagues at the council to develop further schemes and strategies which will aim to lower levels of $PM_{2.5}$ 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

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

Telford and Wrekin undertook automatic (continuous) monitoring at 2 sites during 2015. Table A.1 in Appendix A shows the details of the sites.

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

Until the end of last year 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 and power station have now closed and monitoring has ceased. This means that currently there is no air quality monitoring infrastructure in place within the Borough.

### 3.1.2 Non-Automatic Monitoring Sites

Up until March 2011 Telford & Wrekin Council operated diffusion tubes for nitrogen dioxide at 12 locations within the authority. These included four triplicate tubes site located at various points across the Borough to enable the Council to have confidence in the precision of the results, as well as one blank tube that is analysed. For various reasons, Telford and Wrekin Council decided that it would no longer rely upon diffusion tube monitoring to assess the air quality within the Borough. After consultation with DEFRA (who ratified this decision), diffusion tube monitoring was ceased after March 2011. However Telford and Wrekin Council have begun diffusion tube monitoring in April 2016.

## 3.2 Individual Pollutants

There are currently two automatic monitoring stations within the Borough. These are utilised by E.ON and monitor emissions from the Ironbridge Power Station to fulfil a condition on their environmental permit, issued via the Environment Agency. The information from these stations is shared with the Council. These stations monitor $SO_2$, NO, and $NO_2$.

Table 3.1 below outlines the 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, $SO_2$, $PM_{10}$); any breaches will be negligible |
| 2001 | PR | Prediction of exceedances |
| 2002 | PR | Declaration of AQMA |
| 2003 | USA | Exceedances of $SO_2$ from Ironbridge Power Station, and of $NO_2$ from road traffic emissions in Ironbridge Gorge. Review of AQMAs determined there would be no exceedances by 2005. |
| 2004 | PR | Detailed assessment of $NO_2$ and $SO_2$ 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 |

### 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/$m^3$.

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. There were no exceedances of the air quality objectives.

### 3.2.2 Particulate Matter ($PM_{10}$)

Currently we do not monitor for $PM_{10}$.

### 3.2.3 Particulate Matter ($PM_{2.5}$)

Currently we do not monitor for $PM_{2.5}$.

### 3.2.4 Sulphur Dioxide ($SO_2$)

Table A.8 in Appendix A compares the ratified continuous monitored $SO_2$ concentrations for year 2015 with the air quality objectives for $SO_2$. There were no exceedances of the air quality 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| AM1 | Telford Aqueduct | Urban Background | 369000 | 305800 | $SO_2$, NO, $NO_2$ | N | Fluorescence ($SO_2$), chemiluminescence (NO, $NO_2$) | 25.2 | 55.5 | 2 |
| AM1 | Telford School | Urban background | 368200 | 304000 | $SO_2$, NO, $NO_2$ | N | Fluorescence ($SO_2$), chemiluminescence (NO, $NO_2$) | 15 | 130 | 15 |

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

(2) N/A if not applicable.

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

| Site ID | Site Name | Site Type | X OS Grid Ref | Y OS Grid Ref | Pollutants Monitored | In AQMA ? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube collocated with a Continuous Analyser? | Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

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

(2) N/A if not applicable.

## Table A.3 – Annual Mean $NO_2$ Monitoring Results

| Site ID | Site Type | Monitoring Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2015 (%) (2) | $NO_2$ Annual Mean Concentration (µg/m$^3$) (3) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| AM1 | Urban Background | Automatic | 86 | 86 | 13 | 8(45) | 7 | 7 | 9 |
| AM2 | Urban Background | Automatic | 99 | 99 | 9 | 13 | 12 | 12 | 9 |

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

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

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

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

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per 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 | Site Type | Monitoring Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2015 (%) (2) | $NO_2$ 1-Hour Means > 200µg/m$^3$ (3) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| AM1 | Roadside | Automatic | 86 | 86 | 0 | 0 (25%) (45) | 0 (56%) (36) | 0 | 0 (82%) (66) |
| AM2 | Urban Background | Automatic | 99 | 99 | 0 | 0 | 0(89%) (60) | 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 99.8$^{th}$ percentile of 1-hour means is provided in brackets.

## Table A.5 – Annual Mean $PM_{10}$ Monitoring Results

| Site ID | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2015 (%) (2) | $PM_{10}$ Annual Mean Concentration (µg/m$^3$) (3) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

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 | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2015 (%) (2) | $PM_{10}$ 24-Hour Means > 50µg/m$^3$ (3) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

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 90.4$^{th}$ percentile of 24-hour means is provided in brackets.

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

| Site ID | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2015 (%) (2) | $PM_{2.5}$ Annual Mean Concentration (µg/m$^3$) (3) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

(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 | Valid Data Capture for monitoring Period (%) (1) | Valid Data Capture 2014 (%) (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$^3$) |
| AM1 | Urban Background | 82 | 82 | 0 | 0 | 0 |
| AM2 | Urban Background | 99 | 99 | 0 | 0 | 0 |

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

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

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

(3) If the period of valid data is less than 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

| Site ID | $NO_2$ Mean Concentrations ($\mu g/m^3$) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Mean | |
| | | | | | | | | | | | | | Raw Data | Bias Adjusted (1) |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

(1) See Appendix C for details on bias adjustment

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

## Telford & Wrekin Council Air Quality Strategy

### Contents

## 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 if the country.

However, it wasn't until 1998 that one of the Governments 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 $PM_{2.5}$) 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 $PM_{2.5}$ by 1µg/$m^3$ 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.

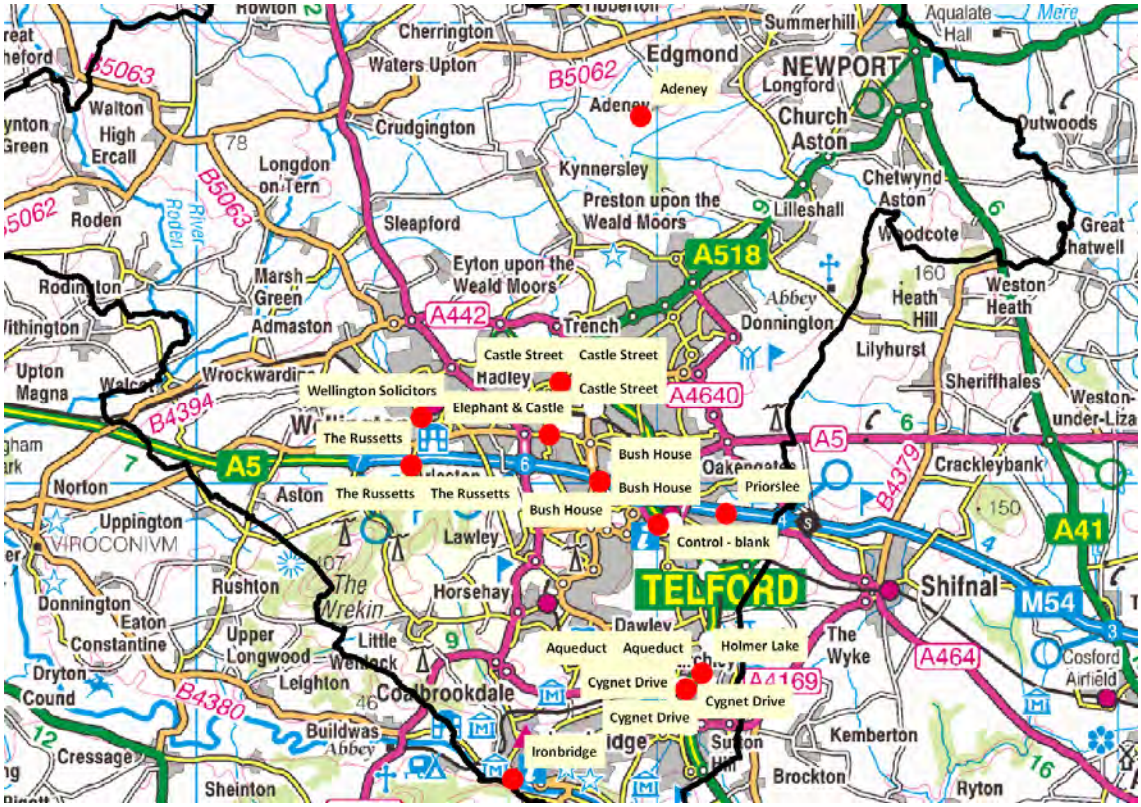
The carcinogenic effects of air pollution are outlined in a report from the World Health Organisations (WHO) International Agency for Research on Cancer (IARC) (Straif, et al., 2013).

## Air Quality Monitoring in Telford

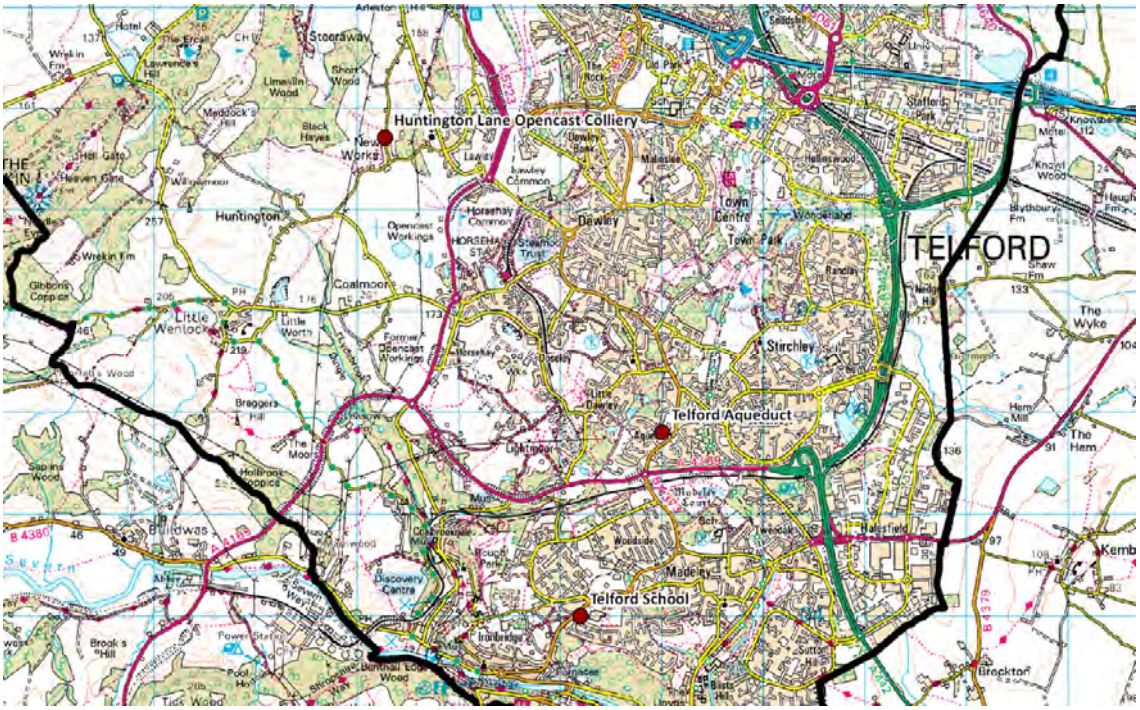
For a large number of years, air quality was monitored in the area of Telford & Wrekin via diffusion tube monitoring at locations across the Borough. These monitored for Nitrogen Oxides on a monthly basis. This has been supplemented by further work by the Council; for instance in 200X an Air Quality 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



## Figure 2 Map of Location of Automatic Monitoring Locations




Insert OS © bit

## 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 exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence 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 NO2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$.

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

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. 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. Recommendations have been made to once again begin diffusion tube monitoring within the borough, to ensure the back ground levels of air pollution do not rise and to undertake the Council's statutory obligations for air quality monitoring. Appendix 1 contains justifications for diffusion tube monitoring and a plan for the diffusion tube monitoring locations.

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Appendix 1

| | | | | |
|---|---|---|---|---|
| **Justification for Diffusion Tube Monitoring** | Public Protection | Telford & Wrekin Council | | |

## Justification for Diffusion Tube Monitoring

Contents

## 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 $PM_{2.5}$.

## 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 regulates the larger infrastructure.

## 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 $PM_{2.5}$. It has been shown that current levels of $PM_{2.5}$ 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 abberations in mitotic spindles, increased presence of reactive oxygen species and DNA damage *in vitro* pre-mitosis ($G_2$) phase, and could likely account for some of the effects caused via $PM_{2.5}$ exposure. It has also been shown that exposure at 25 $\mu g/cm^2$ $PM_{2.5}$ 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 $PM_{2.5}$ 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 ($NO_2$) is also a major driver with regards to health issues from air pollution. For instance (Han, et al., 2013) show that exposure to NO2 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.

$NO_2$ 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, $PM_{2.5}$ 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 monoxide.

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 $PM_{2.5}$) 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 $PM_{2.5}$ by 1µg/m$^3$ 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)

## WHO

The World Health Organisation has produced Air Quality Guideline Values for Europe, based on the most up-to-date epidemiological science at the time of publication. The WHO themselves have a number of bodies who have produced authoritative reports relating to air quality.

## 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$^3$ 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

It has been noted for some time that some of the diffusion tube locations were potentially not appropriate monitoring locations. For instance, for a long time there was a diffusion tube located at the AURN station in Staffordshire. Whilst it was understandable why this was located there at the time, it is felt that, given DEFRAs guidance on diffusion tube bias that it is now unnecessary to locate a diffusion tube there to determine the accuracy of the diffusion tubes in comparison to the automatic monitoring station. It was also noted that there are a large number of co-located (double, or triple in some cases) diffusion tubes, which were also used to calculate bias. To get value for money, and referencing DEFRAs studies on biases within diffusion tube providers, and their different preparatory approaches and techniques, that a more rigorous approach to location, following guidance in DEFRA 2009, was to be utilised to gather a more representative picture of the air quality within the borough, taking account of location of receptors from sources and canyon effects, the latter of which appears to have largely been ignored within the previous distribution of diffusion tubes.

The relevant criteria were analysed on GIS, and the following locations were determined for the placement of any future diffusion tube placement. It should also be noted that the three diffusion tubes to be placed at Alscott are the result of the provision of Section 106 monies for the Council to determine the effects of the development on the air in this part of the borough.

Road traffic count data has been used to determine which are the busiest roads, and where the nearest relevant receptors are. The busiest roads (excluding the M54 and slip roads) are:

| Road | Nearest relevant receptor | Distance (metres) |
|---|---|---|
| A442 Queensway [1] | Lake End Drive | 77 |
| A442 Trench Lock | Heinz, Hortonwood 2 | 43 |
| A442 Queensway [2] | Boscobel Close | 74 |
| A5223 Whitchurch Drive – South | Manor Rise | 58 |
| Apley Avenue, Wellington | Lime Tree Way | 103 |
| A5223 Whitchurch Drive – Middle | Mercia Drive | 41 |
| B5072 Hall Park Way | Hotel | 51 |
| A464 Stafford Park | Factory | 33 |
| A5 Rampart Way | Offices | 77 |
| A4640 Redhill Way | Checkley Lane | 39 |

1 Cygnet Drive Monitoring position is some 200m to the south

2 Holmer Lake monitoring position is some 400m to the south

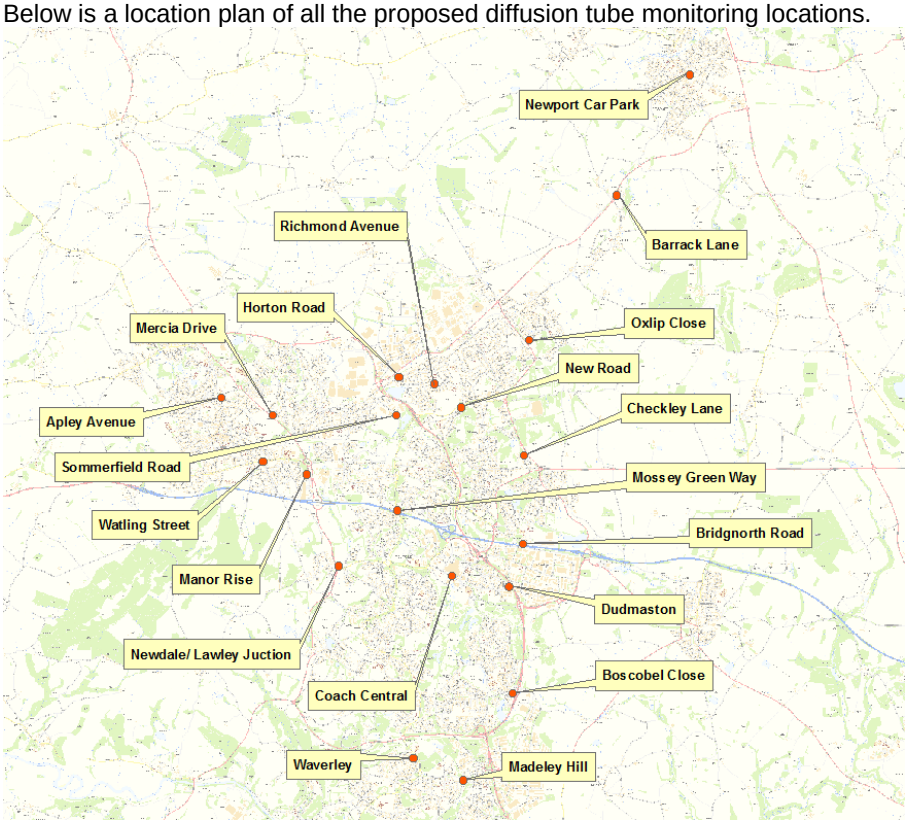
These are the locations of the busiest roads as monitored by Telford & Wrekin Council. There are only two monitoring locations relatively close to these in the previous monitoring regime. Three of the locations were sited to monitor the emissions from vehicles on the M54. There was one location on the ring road at Wellington. All other monitoring locations appeared to be to measure urban background concentrations.

None of the locations appear to take into account any canyon effects from the presence of buildings within the location, or appear to relate to the locations of any sensitive receptors.

As such, and working on the principal that the same number of tubes are utilised as previously (excluding the additional three at Alscott), the diffusion tubes should be placed in the following areas:

| Tube No. | Barcode Number | Lamppost Number | Location | Justification |
|---|---|---|---|---|
| 1 | 19 | | B4373 Mossey Green Way | M54, B4373 |
| 2 | 7 | | Manor Rise | A5223 |
| 3 | 14 | | New Road | Wrockwardine Wood Way |
| 4 | 18 | | Checkley Lane | A4640 |
| 5 | 10 | | Mercia Drive | A5523 |
| 6 | 9 | | Apley Avenue | Apley Avenue |
| 7 | 4 | | Dudmaston | M54 |
| 8 | 20 | | Shifnal Road | M54 |
| 9 | 3 | | Boscobel Close | A442 |
| 10 | 11 | | Sommerfield Road | A442 |
| 11 | 12 | | Horton Road | A518 |
| 12 | 2 | | Waverley | B4373 |
| 13 | 1 | | Madeley Hill | Roundabout at foot of steep climb on busy junction |
| 14 | 5 | | Coach Central | Southwater Development, canyon |
| 15 | 13 | | Richmond Avenue | Urban Background |
| 16 | 16 | | Barrack Lane | A518 |
| 17 | 17 | | Newport Car Park | Newport Centre |
| 18 | 6 | | Newdale Lawley Junction | Lawley Development |
| 19 | 15 | | Oxlip Close | A4640 |
| 20 | 8 | | Watling Street | B5061 Cross Roads |

Below is a location plan of all the proposed diffusion tube monitoring locations.



# Glossary

| | |
|---|---|
| Adsorption | A surface based process where a gas, a liquid, or a dissolved solid adheres to another surface |
| Aerosols | An aerosol is a colloid (where insoluble particles are disbursed through another substance) of fine solid particles, or liquid droplets, in a gas. Clouds are an example of an aerosol. |
| Air Quality Objectives | Targets of certain air pollutants harmful to human health set by the European Union and adopted into English law, that the Government must comply with by a certain date. |
| Air Quality Strategy for England, Wales, Scotland and Wales | A formal strategy published by the Government detailing how they intend to comply with the Air Quality Objectives. |
| Ammonia | A compound of nitrogen and hydrogen (NH3) with numerous industrial uses, that is also caustic and extremely hazardous to aquatic life. |
| Apoptosis | The programmed death of cells in multicellular life; insufficient apoptosis may cause some cancers. |
| AURN | DEFRAs automatic urban and rural air quality monitoring network; a network of over 100 automatic machines that continuously monitor the atmosphere at their location. |
| Bacterial endotoxins | Sugar compounds that form part of the cell wall of bacteria that produce strong a strong immune response in animals. |
| Bronchial epithelial cells | Cells that form the lining of the bronchus and bronchioles that secrete mucus and help remove particles from the lung. |
| Canyon effect | The effect of tall, high-sided buildings with a narrow gap between them, on the passage of air, and thus the clearance of pollution. |
| Carbon monoxide | A compound of carbon and oxygen (CO), toxic to animals in air, converted to ozone in the presence of sunlight |
| Carcinogen | A substance that, upon exposure, is metabolised to other compounds that are thought to cause some cancers. |
| Chimney height (D1) applications | Under Section 15 of the Clean Air Act 1993, someone with a chimney from a furnace is required to apply for an approval of the height of the chimney. |
| Chronic | Long-term exposure to something measured over years. |
| Coal | Lithified organic remains, formed under pressure and elevated temperatures in the earths crust. There are numerous different types of coal of varying quality and composition. When burned gives off numerous harmful compounds |
| DEFRA | Government department responsible for the Environment, Food and Rural Affairs. |
| Denitrification | A process where nitrate is reduced by microbes, ultimately producing molecular hydrogen. |
| Diabetes | A group of metabolic diseases whereby either the pancreas does not produce sufficient insulin, or cells within the body do not respond to insulin. |
| Diffusion tubes | Acrylic or polypropylene transparent tubes that are left exposed for a period of time (usually a month) and collect nitrogen oxides on a triethanolamine (TEA) soaked gauze. |
| DNA strand breakage | This where the sugars joining the two supporting strands of the double helix of DNA are seperated. They can lead to genome rearrangements. |
| DNA-Protein cross-links | This is where compounds interrupt the DNA linkage, and ths affects DNA replication leading to replication arrest and cell death. |
| Dose | The quantity of a substance that someone, or something, is exposed to. |
| Environment Agency | Government body that is responsible for protecting and enhancing |

| | |
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| | the environment. |
| Environmental Permitting | Legal process whereby certain polluting activities are required to possess a permit with the intention of limiting any polluting emissions. The Environment Agency are responsible for large scale A1 permits, local authorities are responsible for all others. |
| Epidemiology | A branch of science that studies the patterns, causes and effects of disease in populations. |
| European Union | A political and econominc union of 28 member states promoting a standardised system of law across it's members for trade purposes. |
| Greenhouse gases | Gases emmited to atmosphere that absorbes visible light, and emit infra-red light, thus warming the atmosphere. |
| ($G_2$) phase | A phase of cell division preceding mitosis. |
| Health Protection Agency | Government body that is responsible for protecting and enhacing public health. Subsequently became Public Health England. |
| Heart disease | AKA cardiovascular disease; any disease that affects the cardiovascular system, with numerous causes. |
| High fat diet | A diet high in fat. |
| Hydrochloric acid | A solution of water and hydrogen chloride (HCl) with numerous industrial uses and sources, that is highly corrosive. Also called acidum salts, muriatic acid and spirits of salt. |
| IARC | The International Agency for Research on Cancer, it is part of the World Health Organisation and conducts and coordinates research into cancer. |
| *In vitro* | Latin for "in glass", it refers to expermints on biological cells outside of their normal context. Studies on cells in animals are termed *In vivo* (Latin for "within the living"). |
| Insulin resistance | The condition where cells in the body fail to the normal action of insulin. |
| Lungs inflammatory response | A response by the lungs from exposure to harmful stimuli. |
| Mercury | A metal that is liquid at room temperature. Mercury has numerous industrial uses and is toxic. |
| Metabolism | Chemical transformations of substances that occur inside the body. |
| Metals | A metal is an element that is typically hard, opaque and shiny with good electrical and thermal properties. |
| Mitosis | The process in cell division where chromosomes in the cell are seperated into two identical sets of chromosomes within separate nuclei. |
| Mitotic spindles | The structure in cells that segregates chromsomes between daughter cells during cell division. |
| Mortality | Susceptability to death. |
| National Planning Policy Framework | Government policy on how the planning regime as laid down by the Town and Country Planning Act should work. |
| Nitric oxide | A compound of nitrogen and oxygen (NO), it is an important cellular signalling molecule that is formed in vehicle engines, amongst other sources. |
| Nitrogen Dioxide | A compound of nitrogen and oxygen ($NO_2$), it is widely used for industrial purposes, and is toxic via inhalation. |
| Nitrogen Oxides | Nitrogen Oxides ($NO_x$) are a family of substances caused by the burning of fuel in atmospheric oxygen and nitrogen. It can be converted to ozone and nitric acid in the environment. |
| Nanometre (nm) | An SI Unit of length, equivalent to one billionth of a metre. |
| Organic compounds | A class of compounds where the principal element is carbon. |
| Oxidation | A chemical reaction where an element loses an electron. |
| Ozone | A compound of Oxygen ($O_3$) and is used in industry as an oxidiser. |

| | |
|---|---|
| | Exposure to ozone is linked to premature death, asthma, bronchitis, heart attack and other cardiopulmonary problems. |
| Persistent organic pollutants | Organic compounds that are resitant to degradation and persist in the environment for decades to centuries. They are mostly pesticides but also include PCBs and dioxins. |
| $PM_{2.5}$ | Pieces of solid or liquid matter with a size less than 2.5 micrometres (a micrometre is one millionth of a metre). |
| Progress report | Legally required report that the Council has to submit to DEFRA updating them on the air quality of the Borough. |
| Radionuclides | An atom with an unstable nucleus that emits energy in the form of radiation. |
| Reactive nitrogen species | Nitric oxide and superoxide metabolised by bacteria to produce peroxynitrite. It reacts with haemoglobin and myoglobin changing their structure, and thus affecting their function. |
| Reactive oxygen species | ROS are formed from the metabolism of oxygen in cells, and produce oxygen ions and peroxides. They are implicated ina number of effects and diseases, including ageing and cancer. |
| Sea coal | A number of meanings; coal found on beaches, from the sea; coal that was brought across the sea from the continent, and a term used in the south of England to distinguish coal from charcoal. |
| Section 106 | An agreement between a Developer and a Local Planning Authority with regards to the Developer agreeing to fund certain projects, such as school places, parks, ecology or the environment. |
| Smog | A portmanteau of smoke and fog; consists of soot, other particulates, sulphur dioxide and other components. |
| Soot | Particles of carbon resulting from the incomplete combustion of hydrocarbons. |
| Sulphur dioxide | Sulphur dioxide is a compound of sulphur and oxygen ($SO_2$). Used in industry principally for the production of sulphuric acid, it has been linked with numerous ailments, including respiratory systems and disease, difficulty in breathing, as well as death. |
| Sulphuric acid | A solution of water and sulphur dioxide ($H_2SO_4$) with numerous industrial uses and sources, that is highly corrosive. Also called oil of vitriol. |
| Systemic genotoxin | A genotoxin is a substance that induces damage to the genetic material of cells. A systemic toxin is one whose effects are distant from the site of absorption; a substance that is ingested but affects the liver is systemic. |
| Updating and screening assessments | Legally required report that the Council has to submit to DEFRA updating them on the air quality of the Borough every three years. |
| World Health Organisation (WHO) | A specialized body of the United Nations specializing in public health. |

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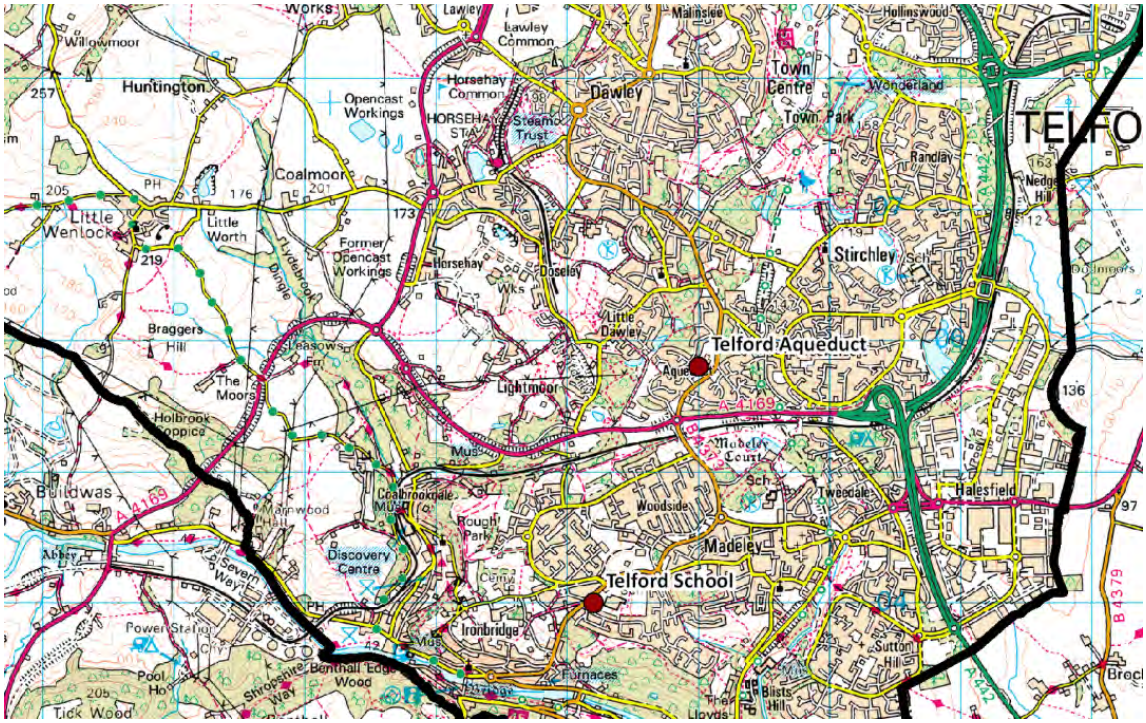
# Appendix D: Map(s) of Monitoring Locations



# Appendix E: Summary of Air Quality Objectives in England

### Table E.1 – Air Quality Objectives in England

| Pollutant | Air Quality Objective[4] | |
|---|---|---|
| | Concentration | Measured as |
| Nitrogen Dioxide ($NO_2$) | 200 µg/$m^3$ not to be exceeded more than 18 times a year | 1-hour mean |
| | 40 µg/$m^3$ | Annual mean |
| Particulate Matter ($PM_{10}$) | 50 µg/$m^3$, not to be exceeded more than 35 times a year | 24-hour mean |
| | 40 µg/$m^3$ | Annual mean |
| Sulphur Dioxide ($SO_2$) | 350 µg/$m^3$, not to be exceeded more than 24 times a year | 1-hour mean |
| | 125 µg/$m^3$, not to be exceeded more than 3 times a year | 24-hour mean |
| | 266 µg/$m^3$, not to be exceeded more than 35 times a year | 15-minute mean |

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

# Glossary of Terms

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

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