LOCAL AIR QUALITY MANAGEMENT

FURTHER ASSESSMENT

MANCHESTER ROAD, KNUTSFORD
<table>
<thead>
<tr>
<th>Local Authority Officer</th>
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</thead>
<tbody>
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<td>Westfields, Middlewich Road, Sandbach</td>
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<td>Report Reference number</td>
<td>Manchester Road, Knutsford, Further Assessment</td>
</tr>
<tr>
<td>Date</td>
<td>December 2011</td>
</tr>
</tbody>
</table>
Executive Summary

A Detailed Assessment of the air quality undertaken in 2009, resulted in Cheshire East Borough Council identifying a row of properties on the A50 Manchester Road in Knutsford where the annual mean National Air Quality Objective for nitrogen dioxide (NO₂) was being or likely to be breached. As a result of the report, an Air Quality Management Area (AQMA) was declared.

The authority is statutorily required under Part IV of the Environment Act 1995 to produce a Further Assessment following declaration of an AQMA. This report fulfils this requirement.

The outcome of this Further Assessment has highlighted that it is not necessary to adjust the boundary of the AQMA as the area of exceedance at relevant exposure is likely to be confined to the properties identified in the original assessment.

Based on monitored levels, in order to achieve the nitrogen dioxide annual mean air quality objective within the AQMA, a 5.4µg/m³ reduction in NO₂ is required.

Source apportionment has shown that local road traffic emissions are the main source contributing to the pollution within the AQMA.

Information contained within the report will be taken forward to the Action Plan in the form of a site specific action plan.
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1.0 Introduction

Part IV of the Environment Act 1995 requires Local Authorities to review and assess the air quality within their areas. This forms the basis of the Local Air Quality Management (LAQM) regime which is fundamental in achieving the Government’s National Air Quality Objectives, as set out in the Air Quality Strategy\(^1\).

In 2009, Cheshire East Council undertook a Detailed Assessment of the air quality along the main roads through Knutsford town centre. Monitoring data showed annual mean levels of nitrogen dioxide ($\text{NO}_2$) in excess of the national air quality objective and a dispersion modelling report was commissioned to determine the extent of the exceedance. The report determined that the area of exposure to excess levels was localised and was confined to 5 properties that are located approximately 3 metres from the kerbside of the A50 Manchester Road. Manchester Road runs north from a 5 arm roundabout in the centre of Knutsford. Queuing often occurs along this section of road. Background levels are affected by the M6 motorway approximately 1.7 km to the east of the town centre.

The boundary of the area was drawn up to include these properties only. As a result, on 1\(^{st}\) April 2010 Cheshire East Council declared an Air Quality Management Area (AQMA).

The area declared is shown in Figure 1.1.

Section 84 (1) of the Environment Act 1995 requires that Local Authorities submit a Further Assessment report within 12 months of declaring an AQMA. The purpose of a Further Assessment is outlined in Local Air Quality Management Technical Guidance LAQM.TG (09)\(^2\) reproduced in figure 1.2.

7.02 The Further Assessment is intended to allow authorities to:

- confirm their original assessment, and thus ensure they were correct to designate an AQMA in the first place;
- calculate more accurately what improvement in air quality, and corresponding reduction in emissions, would be required to attain the air quality objectives within the AQMA;
- refine their knowledge of sources of pollution, so that the air quality Action Plan may be appropriately targeted;
- take account of any new guidance issued by Defra and the Devolved Administrations, or any new policy developments that may have come to light since declaration of the AQMA;
- take account of any new local developments that were not fully considered within the earlier Review and Assessment work. This might, for example, include the implications of new transport schemes, commercial or major housing developments etc. that were not committed or known of at the time of preparing the Detailed Assessment;
- Carry out additional monitoring to support the conclusion to declare the AQMA; Corroborate the assumptions on which the AQMA has been based, and to check that the original designation is still valid, and does not need amending in any way; and
- Respond to any comments made by statutory consultees in respect of the Detailed Assessment.

Figure 1.2   Purpose of a Further Assessment- reproduced from LAQM.TG (09)
2.0 Diffusion Tube Quality Control

Diffusion tube monitoring is undertaken at 5 sites within and surrounding the AQMA. The diffusion tubes are located and exposed in accordance with guidance issued in 2006\(^3\).

Diffusion tubes are supplied and analysed by Gradko International Ltd. All procedures and activities within the laboratory are fully documented as part of the laboratory management system. Gradko have the relevant U.K.A.S accreditation for compliance with ISO-IEC 17025. The laboratory is also part of the Workplace Analysis Scheme for Proficiency (W.A.S.P) coordinated by the Health and Safety Executive.

All diffusion tubes are prepared using the 20% TEA in water method. The tubes are stored, handled and exposed in accordance with instructions and procedures laid down by the laboratory in particular unexposed tubes are stored in the freezer, and exposed tubes are returned to the laboratory within 24 hours of exposure, or if this is not possible, stored in the freezer.

3.0 Diffusion Tube Bias Adjustment

A study by DEFRA and the devolved administrations carried out in 2002\(^4\) highlighted differences in the performance of diffusion tubes based on preparation method, analytical laboratory and other variable factors. In order to address this, it is necessary to apply a correction factor to the diffusion tube results, known as a bias adjustment.

Diffusion tubes are exposed alongside chemiluminescent analysers in local co-location studies. The tube results and the automatic analyser results are compared to give a local adjustment factor. A number of authorities enter their local bias adjustment factors into a national database to produce a combined national adjustment factor\(^5\). A decision is required to determine whether the local or national bias adjustment factor is more appropriate.

Guidance on which factor to use is available from the DEFRA website. In respect of the nitrogen dioxide results reported in this Further Assessment, there is a local co-location study near to the AQMA. However a low proportion of valid data was collected from the real time analyser in 2010 and as such all diffusion tube data is adjusted by the national factor.

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\(^3\) AEA Technology (2006) NO2 Diffusion Tubes for LAQM, Guidance for Local Authorities, AEA


\(^5\) Bias adjustment methodology available from [http://www.defra.gov.uk](http://www.defra.gov.uk)
4.0 Air Quality Monitoring and Modelling for Further Assessment

The AQMA boundary was drawn using data from the modelling work which identified the predicted area likely to exceed the annual mean NO₂ objective of 40 µg/m³.

In order to confirm the original decision the results from monitoring have been examined. Details of monitoring results are shown in Table 4.1, which describes all the monitoring sites within and immediately surrounding the AQMA. Figure 4.1 shows the locations of the monitoring sites – the co-location site is referred to as CE42.

<table>
<thead>
<tr>
<th>Site Ref</th>
<th>Address</th>
<th>Site Type</th>
<th>Grid Ref</th>
<th>Pollutant Monitored</th>
<th>Distance to the kerb (m)</th>
<th>Distance from receptor (m)</th>
<th>AQMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
<td>Manchester Road, Knutsford</td>
<td>Real time analyser, roadside</td>
<td>X374978 Y378774</td>
<td>NOₓ, NO₂</td>
<td>3</td>
<td>&lt;1</td>
<td>N</td>
</tr>
<tr>
<td>CE42, 43,44</td>
<td>Road Sign, Manchester Road, Knutsford (co- located with RTA)</td>
<td>Co-located</td>
<td>X375457 Y378410</td>
<td>NO₂</td>
<td>1.1</td>
<td>7</td>
<td>N</td>
</tr>
<tr>
<td>CE47</td>
<td>17 Manchester Road, Knutsford</td>
<td>Roadside</td>
<td>X374978 Y378774</td>
<td>NO₂</td>
<td>1.1</td>
<td>0</td>
<td>Y</td>
</tr>
<tr>
<td>CE46</td>
<td>Canute Place, Knutsford</td>
<td>Roadside</td>
<td>X374982 Y378690</td>
<td>NO₂</td>
<td>0.5</td>
<td>16.5</td>
<td>N</td>
</tr>
<tr>
<td>CE45</td>
<td>Gaskell Avenue, Knutsford</td>
<td>Roadside</td>
<td>X375018 Y378725</td>
<td>NO₂</td>
<td>1.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>CE40</td>
<td>Knutsford Day Nursery, Adams Hill</td>
<td>Roadside</td>
<td>X374940 Y378825</td>
<td>NO₂</td>
<td>2.5</td>
<td>0</td>
<td>N</td>
</tr>
</tbody>
</table>

Table 4.1 Monitoring Site Details
Figure 4.1 Monitoring Sites around the Area of the AQMA

New data available since the initial declaration can be used to confirm, or otherwise the decision to declare the AQMA, or to inform any decision to amend the extent of the AQMA.

All of the monitoring sites with the exception of CE47 are located outside the boundary of the AQMA. CE40, CE45, CE42 and CE47 are located in positions representing relevant exposure. Site CE46 is located near the roadside and not close to properties that are considered as representing relevant exposure. CE42 is located in triplicate and co-located with an automatic NO$_x$ analyser. All data obtained from diffusion tubes are bias corrected in accordance with the methodology available from the internet$^6$. As there was only 82.5% data capture for 2010 from the real time analyser, the national bias adjustment factor has been used. The bias adjustment results from local monitoring are presented in Table 4.2 with levels above the objective shown in bold.

$^6$ Bias adjustment methodology available from [www.defra.gov.uk](http://www.defra.gov.uk)
<table>
<thead>
<tr>
<th>Site Ref</th>
<th>Address</th>
<th>2010 Data Capture (months / %)</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
<td>Road Sign, Manchester Road</td>
<td>82.8%</td>
<td>N/A</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Bias Adjustment Factor for relevant year</td>
<td>0.91</td>
<td>0.90</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>CE42,43,44</td>
<td>Road Sign, Manchester Road (co-located with RTA)</td>
<td>12</td>
<td>37.7</td>
<td>38.9</td>
<td></td>
</tr>
<tr>
<td>CE47</td>
<td>17 Manchester Road,</td>
<td>11</td>
<td>42.4</td>
<td>39.1</td>
<td>45.4</td>
</tr>
<tr>
<td>CE46</td>
<td>Canute Place</td>
<td>12</td>
<td>43.8</td>
<td>41.4</td>
<td>44.1</td>
</tr>
<tr>
<td>CE45</td>
<td>Gaskell Avenue</td>
<td>11</td>
<td>30.0</td>
<td>29.6</td>
<td>34.5</td>
</tr>
<tr>
<td>CE40</td>
<td>Knutsford Day Nursery, Adams Hill</td>
<td>12</td>
<td>33.6</td>
<td>32.0</td>
<td>34.0</td>
</tr>
</tbody>
</table>

**Table 4.2 Knutsford Bias Adjusted Annual Mean NO₂ Levels (μg/m³)**

The data capture at the RTA monitoring site was below the level where the results can be considered as valid and therefore this assessment can only consider the diffusion tube data. Table 4.2 shows that nitrogen dioxide concentrations in 2010 exceeded the annual mean nitrogen dioxide objective at site CE47 in the AQMA and at site CE46 at Canute Place. Monitoring undertaken at other locations in Knutsford shows concentrations are below the objective.

Site CE46 is located near the roundabout approximately 100 metres to the south of the AQMA and 16.5 metres from the nearest sensitive receptor. It is accepted that concentrations of NO₂ diminish rapidly with increasing distance from the source, and as such it is necessary to correct the monitoring data for site CE46 to reflect this. A spreadsheet is available⁷ to perform this calculation. Distance corrected, the NO₂ annual mean is 31.3 µg/m³, well below the annual objective. The modelling exercise as part of the 2009 Detailed Assessment also confirmed that any relevant receptors on Canute Place are not exposed to concentrations above the national objective and that this monitoring location is not representative of relevant exposure. Subsequent monitoring has indicated that

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⁷ NO₂ distance corrected spreadsheet available from [www.defra.gov.uk](http://www.defra.gov.uk)
concentrations near this location have not altered sufficiently so as to make these conclusions obsolete.

Site CE47 is representative of the 5 residential properties within the AQMA that are nearest to the roadside. Monitoring has shown that concentrations since the Detailed Assessment have not decreased and that there remains an exposure to levels above the national objective at these properties. Air quality modelling in the Detailed Assessment also demonstrated that levels elsewhere were well below the objective.

Given the above observations, it is considered that the extent of the AQMA is unlikely to have changed in the time since the previous assessment in 2009. It is therefore considered unnecessary to carry out a further modelling exercise to assess the extent of the exceedances. There is however a requirement to carry out a source apportionment study as part of a Further Assessment and a dispersion modelling exercise has been completed to support this. A full report detailing the modelling and source apportionment can be seen in Appendix 1.

4.1 Results of Further Assessment: Recommendations for Action

That the boundary remain unchanged to reflect the results of the ongoing monitoring and that the Air Quality Management Area include only those properties where the nitrogen dioxide standard is/or likely to be breached. This is confined to the existing five residential properties. The required Action Plan will therefore focus on this area.
5.0 Required Reduction in Pollutant Emissions

It is a requirement of a Further Assessment to determine the reduction in emissions of the relevant pollutant which will be required to achieve the air quality objective. This is important as it allows the local authority to judge the scale of effort which will be required within the Action Plan.

The reduction required is calculated using the methodology in LAQM.TG (09). The methodology (Box 7.2) suggests using the highest annual mean from either verified models or monitoring for the calculation.

Receptor CE47 was used as it is the only monitoring location within the AQMA and where an annual mean concentration of 45.4µg/m³ was recorded in 2010.

The reduction in NO₂ required to meet the objective is therefore:

\[
\text{Measured Value (2010) – Air Quality Objective} = 45.4\mu g/m^3 - 40\mu g/m^3 = 5.4\mu g/m^3
\]
It is necessary to express the corresponding required reduction in local emissions as NO\textsubscript{x} due to local road traffic, rather than NO\textsubscript{2}. This is because the primary emission from vehicles is NO\textsubscript{x} and the relationship between NO\textsubscript{x} and NO\textsubscript{2} is not linear.

The methodology described in Box 7.2 in the guidance was used to calculate the NO\textsubscript{x} reduction required to comply with the objective, at monitoring sites where an exceedence had been measured; the results are presented in Table 5.1:

<table>
<thead>
<tr>
<th>Site</th>
<th>Monitored NO\textsubscript{2} (2010 bias adjusted)</th>
<th>Equivalent Road NO\textsubscript{x}</th>
<th>NO\textsubscript{2} National Standard</th>
<th>Equivalent Road NO\textsubscript{x}</th>
<th>Required NO\textsubscript{x} Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE47</td>
<td>45.4 (\mu\text{g/m}^3)</td>
<td>89.4 (\mu\text{g/m}^3)</td>
<td>40 (\mu\text{g/m}^3)</td>
<td>67.8 (\mu\text{g/m}^3)</td>
<td>24.2%</td>
</tr>
</tbody>
</table>

Table 5.1 Required reduction in road NO\textsubscript{x}

6.0 Date by which the objective will be met

It is necessary to project current concentrations to future years to determine whether the objective will be achieved by the relevant year using the projection calculations shown in revised Box 2.1 from Technical Guidance LAQM TG (09). Table 6.1 provides an indication of the potential timescales involved should reductions continue at a rate originally thought. Figures in italics are predicted values only.

<table>
<thead>
<tr>
<th>CE47</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45.4</td>
<td>43.7</td>
<td>41.9</td>
<td>40.2</td>
<td>38.5</td>
</tr>
</tbody>
</table>

Table 6.1 Date by which the Objective will be met

7.0 Source Apportionment

It is a requirement of the Further Assessment to refine the knowledge of the sources of pollution to ensure the Action Plan can be targeted effectively. This has been undertaken using receptor CE47. Monitoring has indicated that the annual mean standard is exceeded
at this location although it is not at a property facade. The sources have been broken down into rural background, M6 motorway background, other background and local roads split by vehicle type.

The resulting percentage (rounded to a whole number) for each pollutant source is shown in Table 7.1 (extracted from the modelling report).

<table>
<thead>
<tr>
<th>Background</th>
<th>Local Major Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34%</td>
</tr>
<tr>
<td>Rural</td>
<td>M6 Motorway</td>
</tr>
<tr>
<td></td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Cars</td>
</tr>
<tr>
<td></td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>LGVs</td>
</tr>
<tr>
<td></td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Mcycles</td>
</tr>
</tbody>
</table>

Table 7.1  Knutsford NO₂ Source Apportionment

This distinction between vehicle types will help the Borough Council identify the potential focus of Action Planning work for transportation based initiatives.
8.0 Conclusions

The results of the Further Assessment, supported by monitoring data, indicate that the boundary of the Air Quality Management Area will not need to be reviewed and that the area of exceedance of the NO$_2$ objective is confined to the 5 residential properties currently within the AQMA.

Source apportionment has identified that road traffic is the most predominant source of nitrogen dioxide; this is also consistent with local knowledge and experience. Local road traffic emissions contribute 66% of NO$_2$ concentrations. Of the various road vehicles, cars and HGV’s combined contribute to 53% of total ambient nitrogen dioxide levels at the receptor within the AQMA. This information will be taken forward to the Action Plan development, which is currently ongoing.

Nitrogen dioxide improvements are required within the Air Quality Management Area. It was calculated that a 24.2% reduction in local road sourced NOx concentrations is required to achieve the NO$_2$ objective.
Appendix 1- Dispersion Modelling Report

Knutsford Air Quality Model 2011

Report prepared in house October 2011
Introduction

This report outlines the air quality modelling exercise carried out in the Knutsford area to fulfil the requirements of a Further Assessment produced as part of the Local Air Quality Management process. The area which has been modelled focuses upon the existing Air Quality Management Area (AQMA) and is shown on the map below.

Map 1: Existing Knutsford Air Quality Management Area

The AQMA in Knutsford is localised and consists of 5 properties that are located just 3 metres from the kerbside of the A50 Manchester Road. Manchester Road runs north from a 5 arm roundabout in the centre of Knutsford. Queuing often occurs along this section of road. Background levels are affected by the M6 motorway approximately 1 mile to the east of the AQMA.

The purpose of this modelling exercise is not to re-assess the extent of the AQMA’s area but to carry out a source apportionment study. The objective is to estimate the proportion that various sources contribute to total nitrogen dioxide levels in the AQMA.

In addition, this report estimates the required reduction in local road sourced NOx concentrations to achieve the national annual NO\textsubscript{2} objective. It is intended that the results of this study will inform the air quality action plans.
Methodology

This section looks at the methodology used in collating the emission data and interpreting the model results. Technical guidance TG09 (DEFRA⁸) was used unless stated. 2010 was used for the study year as it was the most recent year.

Cheshire East Council holds an emissions inventory for the Borough on the SMHI Airviro system.

The primary objective of this study was to assess the contribution of various road vehicle types on NO₂ concentrations in the AQMA and therefore only emissions from local major roads were modelled in this exercise. These roads are listed in Appendix 2 and are the major roads within the modelling area defined on Map 2 below. However, other sources of NOx were accounted for in the background levels available online and include the NOx contribution of the M6 motorway.

![Model Area](image.png)

Figure 2.1 Map showing extent of modelling area

2010 traffic data was taken from the Department for Transport website⁹ which gave annual average daily traffic (AADT) flows for all the major roads in Knutsford (Appendix 2).

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The available traffic data also gave vehicle type compositions for 2010 and these were matched with the most representative standard ‘roadtype’ as defined in the emissions database. A bottom-up method has been used for defining these standard vehicle compositions. The five vehicle types used were:

- Cars
- Light goods vehicles
- Heavy goods vehicles
- Buses
- Motorcycles

Collating all traffic data available across the Borough, a total of 35 standard vehicle composition types were entered into the emissions database. Cars and light goods vehicles were divided into petrol and diesel portions based on national traffic statistics from the Department for Transport.

A similar method was used to define standard traffic flow profiles for each day of the week. These were defined for heavy goods vehicles (HGVs) and all other vehicles. Individual road profiles were grouped according to their correlation with each other. The mean flow profile was then calculated from each group. The flow profiles were combined with the vehicle compositions to give a series of road types that could be entered into the Airviro database. This represents a more detailed approach than that used in the original assessment.

The database then combines this road traffic data with speed related emission factors derived from the UK Emission Factors Database to calculate an emission along each road source. The emission factors used are those published in 2010.

Speed data was estimated for the road links used in the model and were based on consultations with Cheshire East Council Highways and local knowledge. Road links near to the roundabout experience queuing for much of the day and a conservative estimate of 20km/hr was used for these. Appendix 2 lists the AADT and the assumed average vehicle speed for all roads included in the models.

Guassian models were run at a resolution of 25 metres for the 5 vehicles types listed above in order to assess their relative contributions.

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Background values for NO\textsubscript{x} and NO\textsubscript{2} were derived from the national background level maps available online. Emission estimates from all major roads were subtracted from the total background levels to avoid double counting.

The receptor used for the source apportionment was the monitor CE47 which is the only site to be located in the AQMA and is near to the façade of 17 Manchester Road (see Map 3 below). The NO\textsubscript{2} annual mean recorded in 2010 was 45.4µg/m\textsuperscript{3}. Background NO\textsubscript{2} levels were taken from the data online and adjusted for the omission of local major road sources (not including motorways). This was subtracted from the monitored levels to calculate the contribution of local major roads. The relative contribution of each of the model results at this receptor was used to give a percentage contribution of each vehicle type on local roads to overall NO\textsubscript{2} concentrations.

Map 3: Manchester Road AQMA NO\textsubscript{2} receptor location

The motorway and rural background have been taken from the national NO\textsubscript{x} background maps and converted to NO\textsubscript{2} using the online tool.

In addition, a Further Assessment is required to calculate the equivalent reduction in road sourced NO\textsubscript{x} concentrations to comply with the annual mean NO\textsubscript{2} standard of 40µg/m\textsuperscript{3}. Again receptor and monitor CE47 was used to represent concentrations in the AQMA. The
online NO₂ to NOₓ tool has been used to calculate the required local road NOₓ level reduction to meet the NOₓ concentration that corresponds to an ambient NO₂ level of 40µg/m³.

**Verification**

As previously stated the purpose of the modelling in this report is not to assess the extent of the existing AQMA but to estimate the relative contributions from various sources in this area. There are no background monitoring locations nearby to verify background levels and therefore it has been assumed that these levels are correct. Therefore it is also assumed the remaining concentrations are sourced from the local major roads modelled and these have not been included in the background levels.
Results

The pollutant sources have been broken down into rural background, M6 background, other background and local roads split by vehicle type. The resulting percentage (rounded to a whole number) for each pollution source is shown in Table 2 below.

<table>
<thead>
<tr>
<th>Background</th>
<th>Local Major Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td>66%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rural</th>
<th>M6 Motorway</th>
<th>Other Background</th>
<th>Cars</th>
<th>HGVs</th>
<th>LGVs</th>
<th>Buses</th>
<th>Mcycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>11%</td>
<td>20%</td>
<td>4%</td>
<td>25%</td>
<td>28%</td>
<td>7%</td>
<td>6%</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Knutsford AQMA NO₂ source apportionment

The table below shows the required reduction in local road sourced NOₓ levels in the AQMA to achieve the national NO₂ standard.

<table>
<thead>
<tr>
<th>Site</th>
<th>Monitored NO₂</th>
<th>Equivalent Road NOₓ</th>
<th>NO₂ National Standard</th>
<th>Equivalent Road NOₓ</th>
<th>Required NOₓ Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE47</td>
<td>45.4 μg/m³</td>
<td>89.4 μg/m³</td>
<td>40 μg/m³</td>
<td>67.8 μg/m³</td>
<td>24.2%</td>
</tr>
</tbody>
</table>

Table 3: Required reduction in road NOₓ
**Discussion**

**Model Validation**

Airviro is a widely used modelling tool developed by the Swedish Meteorological and Hydrological Institute (SMHI). Information on this system and examples of its use is available online\(^\text{10}\).

The Gaussian model is designed to model pollution concentrations over urban areas. It was considered as a suitable tool for this study.

**Emission Data**

All the traffic volume and vehicle type proportions were taken from the DfT - ref website and are for 2010. The quality of this data gives a high level of confidence in the data used to model source apportionment. Importantly, for a source apportionment exercise, the data includes a breakdown of vehicle types.

Speed data was estimated for the road links modelled in this exercise. Whilst this introduces an element of uncertainty, the estimates tended to be cautious based on our experience and tended to be on the low side. Road data used is listed in Appendix 2.

Non traffic related sources were included in the background level used and there was no double counting of these sources although uncertainties will exist in the use of the estimates from which the background levels are derived.

**Meteorological Data**

Woodford meteorological data can be considered as a fair representation of the conditions in Knutsford. It is located approximately 9 miles to the north east of the town centre. The 2010 data set is 98.5% complete. In addition, the topography in Knutsford is flat and therefore similar to that at the meteorological station in Woodford.

**Monitoring Data**

The monitor used for source apportionment is located in the AQMA near the façade of residential receptors. Therefore, it gives an accurate and relevant concentration to use for

source apportionment and to estimate the required NO\textsubscript{x} emissions reduction to achieve the national objective.

A real time analyser is located on Manchester Road but data collection was low in 2010 and therefore these results could not be considered as valid.

The diffusion tube results have been bias corrected using national factors. For the same reasons as above, a local factor derived from the real time analyser was not used to correct the results.

The height of the diffusion tube is 2 metres, they were therefore considered as a valid comparison to the modelled concentrations which were also calculated at this height.

**Discussion of Results**

TG(09) advises that errors in model results at roadside properties are more likely to be due to errors in local road sourced NO\textsubscript{x} than other pollutant sources. As we are only considering the relative contributions of various road vehicles on concentrations in a small area it is not considered necessary to validate the model by adjusting local road sourced NO\textsubscript{x} contribution. Any adjustment would apply uniformly to all modelled road vehicle sources and not affect the proportions.

It was not possible to verify the background levels provided online but local major roads were omitted to avoid double counting. These levels have been assumed to be correct and therefore there is an amount of uncertainty in the assumed proportion between background and local road sourced NO\textsubscript{2} concentrations.

At site CE47, the source apportionment results predict that local major road traffic emissions contribute 66% of NO\textsubscript{2} concentrations. Of the various road vehicles, cars contribute 25% and HGVs 33% to ambient levels with LGVs and Buses accounting for 7% and 6% respectively. Actions targeting car and HGV emission reductions would clearly have the greatest impact on concentrations in this area. The proportion of HGVs on the roads in this area is relatively low (under 4%) although there may be some scope in pursuing actions that targeted emissions from these vehicles in the vicinity.

The study also shows that a reduction of 24.2% in local road sourced NO\textsubscript{x} levels is required to achieve the national annual mean standard at properties in the AQMA.
Conclusions

Data for the model was as detailed and locally specific as possible. The receptor used for the exercise is located in the AQMA.

The source apportionment NO\textsubscript{x} emissions from HGVs and cars combined contribute 53% of total ambient nitrogen dioxide levels at the monitoring site in the AQMA (CE47). A significant proportion of background NO\textsubscript{2} levels are sourced from the M6 motorway.

A reduction of 24.2% in local major road derived NO\textsubscript{x} concentrations is required at this location to achieve the national annual mean NO\textsubscript{2} standard.
Appendix 2

Modelled road links: AADTs and speeds

<table>
<thead>
<tr>
<th>NAME</th>
<th>VEHICLES</th>
<th>Average Speed (kph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5033 : A556-B5083(NORTHWICH RD)</td>
<td>13553</td>
<td>50</td>
</tr>
<tr>
<td>A50 : A5033-A5034N(MANCHESTER RD)</td>
<td>13106</td>
<td>50</td>
</tr>
<tr>
<td>A50 : A5033-B5083(MANCHESTER RD)</td>
<td>13106</td>
<td>40</td>
</tr>
<tr>
<td>A5033 : B5083-A50(NORTHWICH RD)</td>
<td>15041</td>
<td>20</td>
</tr>
<tr>
<td>A50 : B5083-A5033(MANCHESTER RD)</td>
<td>14548</td>
<td>20</td>
</tr>
<tr>
<td>A50 : KNUTSFORD ROUNDABOUT</td>
<td>13500</td>
<td>10</td>
</tr>
<tr>
<td>A50 : B5083-A50(KING EDWARD RD)</td>
<td>26344</td>
<td>20</td>
</tr>
<tr>
<td>A537 : B5083-A50(ADAMS HILL)</td>
<td>21991</td>
<td>20</td>
</tr>
<tr>
<td>A50 : B5081-KNUTSFORD (TOFT RD)</td>
<td>9894</td>
<td>40</td>
</tr>
<tr>
<td>A537 : B5083-B5085(ADAMS HILL)</td>
<td>21991</td>
<td>30</td>
</tr>
<tr>
<td>A537 : KNUTSFORD-OLLERTON(CHELFORD RD)</td>
<td>10097</td>
<td>50</td>
</tr>
</tbody>
</table>