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*the heart of Leicestershire*

Results of **Stage 4**  
Review and Assessment of:

# Air Quality In Blaby District

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# Executive Summary

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality, which culminated in the Environment Act, 1995. The Air Quality Strategy provides a framework for air quality control through air quality management and air quality standards. These and other air quality standards<sup>1</sup> and their objectives<sup>2</sup> have been enacted through the Air Quality Regulations in 1997 and 2000. The Environment Act 1995 requires Local Authorities to undertake an air quality review. In areas where the air quality objective is not anticipated to be met, Local Authorities are required to establish Air Quality Management Areas to improve air quality.

The first step in this process is to undertake a review of current and potential future air quality. A minimum of two air quality reviews are recommended in order to assess compliance with air quality objectives; one to assess air quality at the outset of the Air Quality Strategy and a second to be carried out towards the end of the policy timescale (2005). The number of reviews necessary depends on the likelihood of achieving the objectives. Each of these two reviews is split into components. For the first round of air quality review and assessment, there were four components. The components are: Stages 1 to 3; Stage 4 and Action Plans. Stage 4 and Action Plans are normally completed in parallel. Not all local authorities have to complete all the components.

This report is equivalent to a Stage 4 Air Quality Review and Assessment for Blaby District Council, as outlined in the Government's published guidance.

Blaby District Council has completed a Stage 3 Air Quality Review and Assessment. The results of this indicated that there are areas almost certain to exceed the annual mean objective for nitrogen dioxide (NO<sub>2</sub>). As a result of this air quality review and assessment, Blaby District Council has declared 3 Air Quality Management Areas. Work considering PM<sub>10</sub> is still ongoing. The Air Quality Management Areas (AQMA) for NO<sub>2</sub> within the county are:

- ❑ A5460 Narborough Road South (AQMA 1)
- ❑ M1 Corridor, Enderby (AQMA 2)
- ❑ M1 Corridor Thorpe Astley/Kirby Muxloe (AQMA 3)

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<sup>1</sup> Refers to standards recommended by the Expert Panel on Air Quality Standards. Recommended standards are set purely with regard to scientific and medical evidence on the effects of the particular pollutants on health, at levels at which risks to public health, including vulnerable groups, are very small or regarded as negligible.

<sup>2</sup> Refers to objectives in the Strategy for each of the eight pollutants. The objectives provide policy targets by outlining what should be achieved in the light of the air quality standards and other relevant factors and are expressed as a given ambient concentration to be achieved within a given timescale.

The general approach taken to this Stage 4 assessment was to:

- Identify the improvement needed in concentrations of nitrogen dioxide at selected receptors within the Air Quality Management Areas, including the receptors where the greatest improvements were needed\*;
- Collect and interpret additional data to support the Stage 4 assessment, including detailed traffic flow data around locations where exceedences of the NO<sub>2</sub> objective were predicted\*;
- Consider recent continuous monitoring and diffusion tube measurements;
- Identify the contributions of the relevant sources to the exceedences (local traffic, background sources, and other relevant sources)\*;
- Use monitoring data from the NO<sub>2</sub> continuous monitors located at within neighbouring Leicester City Council to assess the ambient concentrations produced by the road traffic and to calibrate the output of the co ordinated NO<sub>2</sub> modelling studies\*;
- Model the concentrations of NO<sub>2</sub> around the selected AQMAs, concentrating on the locations (receptors) where people might be exposed over the relevant averaging times of the air quality objectives\*;
- Present the concentrations as contour plots and assess the uncertainty in the predicted concentrations\*;
- Consider any changes that are needed to the existing Air Quality Management Areas;

\* This part of the assessment has been undertaken by Leicester City Council and collated in this report by netcen.

The monitoring and modelling carried out for this assessment show that nitrogen dioxide concentrations are expected to exceed the annual average objective at certain locations in the declared AQMAs.

Relatively high NO<sub>2</sub> diffusion tube measurements have been recorded at a number of sites throughout Blaby. However, all exceeding diffusion tubes are located within the AQMA suggesting appropriate designation of the AQMA boundary.

The Stage 4 modelling however shows that the area of potential exceedence of the annual average objective for 2005 extends further along the road links than the areas covered by the existing Air Quality Management Areas, particularly in AQMA 3. The decision to revoke, extend or reduce the area of the AQMAs should consider the uncertainty inherent in the modelling approach used. Given the uncertainty in the modelling, and that a detailed assessment, in round 2, is already underway, it is recommended that this is given further consideration in that further round of assessment, with respect to extension of the Air Quality Management Areas.

The reduction needed in annual mean NO<sub>2</sub> concentrations to ensure that concentrations at all relevant receptors in the AQMAs did not exceed 40 µg m<sup>-3</sup> was: 10 µg m<sup>-3</sup> for AQMA 1, 10 µg m<sup>-3</sup> for AQMA 2, and 12 µg m<sup>-3</sup> for AQMA 3.

The source apportionment work (Blaby Air Quality Action Plan: Consultation Draft Jan 2004) identified emissions of oxides of nitrogen (NO<sub>x</sub>) from traffic on roads close to the AQMAs as the important source from which emissions might be reduced. The general background of NO<sub>x</sub> cannot be easily reduced except by national or regional measures. Emissions of NO<sub>x</sub> from local traffic accounted for approximately 71% at the M1 and 52% at Narborough Road South of the total modelled oxides of nitrogen concentration.

## Acronyms and definitions

AADTF	Annual Average Daily Traffic Flow
ADMS	an atmospheric dispersion model
AQDD	an EU directive (part of EU law) - Common Position on Air Quality Daughter Directives, commonly referred to as the Air Quality Daughter Directive
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AP	Action Plan
AURN	Automatic Urban and Rural Network (nationally funded network)
base case	In the context of this report, the emissions or concentrations predicted at the date of the relevant air quality objective (2005 for nitrogen dioxide)
CO	Carbon monoxide
d.f.	degrees of freedom (in statistical analysis of data)
DETR	Department of the Environment Transport and the Regions (now defra and the devolved administrations)
defra	Department for the Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EPA	Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards (UK panel)
EU	European Union
GIS	Geographical Information System
HA	Highways Agency
kerbside	0 to 1 m from the kerb
LADS	Urban background model specifically developed for Stage 3 Review and Assessment work by netcen. This model allowed contributions of the urban background and road traffic emissions to be calculated
Limit Value	An EU definition for an air quality standard of a pollutant listed in the air quality directives
n	number of pairs of data
NAEI	National Atmospheric Emission Inventory
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Oxides of nitrogen
NRTF	National Road Traffic Forecast
ppb	parts per billion
r	the correlation coefficient (between two variables)
receptor	In the context of this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SD	standard deviation (of a range of data)
SO <sub>2</sub>	Sulphur dioxide
TEMPRO	A piece of software produced for the Highways Agency used to forecast traffic flow increases
UWE AQMRC	University of the West of England Air Quality Management Resource Centre

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**Appendix 1** Stage 4 monitoring



# 1 Introduction to this Stage 4 air quality assessment

This section outlines the reason that the Stage 4 air quality review and assessment was commissioned, and briefly explains what a Stage 4 air quality review and assessment is.

## 1.1 PURPOSE OF THE STUDY

Blaby District Council have completed a Stage 3 Air Quality Review and Assessment. The results of this indicated that exceedences of objectives for nitrogen dioxide (NO<sub>2</sub>) are likely along the M1 and at the A5460/A563 junction in the local authority. Three discrete areas along these roads have been declared as an AQMA.

Blaby District Council now requires further review and assessment of its air quality – a Stage 4 review and assessment – as specified under Section 84 of the Environment Act (1995).

## 1.2 BRIEF EXPLANATION OF A STAGE 4 AIR QUALITY REVIEW AND ASSESSMENT

The 1995 Environment Act places duties on local authorities with regard to local air quality review and, where potential problems are identified, the management of local air quality. The air quality review is designed as a multi-stage process, with progressively more complex assessments at each stage.

If a local authority declares an air quality management area, Section 84(1) of the Environment Act 1995 requires the local authority to carry out a further assessment of existing and likely future air quality in the AQMA. This further assessment is called a Stage 4 air quality review and assessment, and is intended to supplement information the authority already has.

For each pollutant where there is an expected exceedence of the air quality objective, the Stage 4 should calculate:

- how great an improvement is needed; and
- the extent to which different sources contribute to the problem (source apportionment).

### **1.3 OVERVIEW OF APPROACH TAKEN**

The general approach taken to this Stage 4 assessment was to:

- Identify the improvement needed in concentrations of nitrogen dioxide at selected receptors within the Air Quality Management Areas, including the receptors where the greatest improvements were needed\*;
- Collect and interpret additional data to support the Stage 4 assessment, including detailed traffic flow data around locations where exceedences of the NO<sub>2</sub> objective were predicted\*;
- Consider recent continuous monitoring and diffusion tube measurements;
- Identify the contributions of the relevant sources to the exceedences (local traffic, background sources, and other relevant sources)\*;
- Use monitoring data from the NO<sub>2</sub> continuous monitors located at within neighbouring Leicester City Council to assess the ambient concentrations produced by the road traffic and to calibrate the output of the co coordinated NO<sub>2</sub> modelling studies\*;
- Model the concentrations of NO<sub>2</sub> around the selected AQMAs, concentrating on the locations (receptors) where people might be exposed over the relevant averaging times of the air quality objectives\*;
- Consider three scenarios to improve air quality and identify the improvements in air quality that might be possible for nitrogen dioxide;
- Present the concentrations as contour plots and assess the uncertainty in the predicted concentrations\*;
- Consider any changes that are needed to the existing Air Quality Management Areas;
- Consider the feasibilities of implementing the options in a simple way

\* study carried out by Leicester City Council

### **1.4 RELEVANT GUIDANCE DOCUMENTATION USED**

This report has used the guidance in LAQM.TG (03) published in January 2003. Reference has also been made to previous guidance LAQM.TG4 (00), published in May 2000.

### **1.5 NUMBERING OF TABLES AND FIGURES**

The numbering scheme is not sequential, and the figures and tables are numbered according to the chapter or section that they relate to.

### **1.6 POLLUTANTS CONSIDERED IN THIS REPORT**

Blaby has only declared AQMAs for nitrogen dioxide and so this is the only pollutant considered in this report.

### **1.7 UNITS OF CONCENTRATION USED AND CONVERSIONS TO OTHER UNITS**

This report presents concentrations of nitrogen dioxide in units of  $\mu\text{g m}^{-3}$ , which is consistent with units used in the current UK Air Quality Strategy.

To convert concentrations of nitrogen dioxide between  $\mu\text{g m}^{-3}$  and ppb (parts per billion), use the following relationships:

$$\mu\text{g m}^{-3} / 1.91 = \text{ppb}$$

$$1.91 \times \text{ppb} = \mu\text{g m}^{-3}$$

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## 2 The UK Air Quality Strategy

The Government published its proposals for review of the National Air Quality Strategy in early 1999 (DETR, 1999). These proposals included revised objectives for many of the regulated pollutants. A key factor in the proposals to revise the objectives was the agreement in June 1998 at the European Union Environment Council of a Common Position on Air Quality Daughter Directives (AQDD).

Following consultation on the Review of the National Air Quality Strategy, the Government prepared the Air Quality Strategy for England, Scotland, Wales and Northern Ireland for consultation in August 1999. It was published in January 2000 (DETR, 2000).

### 2.1 UPDATED AIR QUALITY STANDARDS AND OBJECTIVES

**Table 2.1** Major elements of the Environment Act 1995

Part IV Quality	Air	Commentary
Section 80		Obliges the Secretary of State (SoS) to publish a National Air Quality Strategy as soon as possible.
Section 81		Obliges the Environment Agency to take account of the strategy.
<b>Section 82</b>		Requires local authorities, any unitary or district, to review air quality and to assess whether the air quality standards and objectives are being achieved. Areas where standards fall short must be identified.
<b>Section 83</b>		Requires a local authority, for any area where air quality standards are not being met, to issue an order designating it an air quality management area (AQMA).
<b>Section 84</b>		Imposes duties on a local authority with respect to AQMAs. <b>The local authority must carry out further assessments</b> and draw up an action plan specifying the measures to be carried out and the timescale to bring air quality in the area back within limits.
Section 85		Gives reserve powers to cause assessments to be made in any area and to give instructions to a local authority to take specified actions. Authorities have a duty to comply with these instructions.
Section 86		Provides for the role of County Councils to make recommendations to a district on the carrying out of an air quality assessment and the preparation of an action plan.
Section 87		Provides the SoS with wide ranging powers to make regulations concerning air quality. These include standards and objectives, the conferring of powers and duties, the prohibition and restriction of certain activities or vehicles, the obtaining of information, the levying of fines and penalties, the hearing of appeals and other criteria. The regulations must be approved by affirmative resolution of both Houses of Parliament.
Section 88		Provides powers to make guidance which local authorities must have regard to.

This study essentially forms part of the requirements of Section 84 of the Part IV Air Quality of the Environment Act 1995.

## 2.2 OVERVIEW OF THE PRINCIPLES AND MAIN ELEMENTS OF THE AIR QUALITY STRATEGY

The main elements of the AQS can be summarised as follows:

- The use of a health effects based approach using national air quality standards and objectives.
- The use of policies by which the objectives can be achieved and which include the input of important actors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with target dates of 2003, 2004 and 2005 for the achievement of objectives and a commitment to review the Strategy every three years.

It is intended that the NAQS will provide a framework for the improvement of air quality that is both clear and workable. In order to achieve this, the Strategy is based on several principles that include:

- the provision of a statement of the Government's general aims regarding air quality;
- clear and measurable targets;
- a balance between local and national action and
- a transparent and flexible framework.

Co-operation and participation by different economic and governmental sectors is also encouraged within the context of existing and potential future international policy commitments.

### 2.2.1 National Air Quality Standards

At the centre of the AQS is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. Most of the proposed standards have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). These standards and associated specific objectives to be achieved between 2003 and 2008 are shown in Table 2.2. The table shows the standards in ppb and  $\mu\text{g m}^{-3}$  with the number of exceedences that are permitted (where applicable) and the equivalent percentile.

### 2.2.2 The difference between 'standards' and 'objectives' in the UK AQS

Air quality *standards* (in the UK AQS) are the concentrations of pollutants in the atmosphere that can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups. The standards have been set at levels to avoid significant risks to health.

The *objectives* of the UK air quality policy are framed on the basis of the recommended standards. The objectives are based on the standards, but take into account feasibility, practicality, and the costs and benefits of fully complying with the standards.

Specific objectives relate either to achieving the full standard or, where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as November 5th. For example, if an objective is to be complied with at the 99.9th percentile, then 99.9% of measurements at each location must be at or below the level specified.

**Table 2.2** Air Quality Objectives in the Air Quality Regulations (2000) for the purpose of Local Air Quality Management

Pollutant	Concentration limits		Averaging period	Objective	
	( $\mu\text{g m}^{-3}$ )	(ppb)		( $\mu\text{g m}^{-3}$ )	[number of permitted exceedences a year and equivalent percentile] date for objective
<b>Benzene</b>	16.25	5	<b>running annual</b> mean	<b>16.25</b>	by 31.12.2003
<b>1,3-butadiene</b>	2.25	1	<b>running annual</b> mean	<b>2.25</b>	by 31.12.2003
<b>CO</b>	11,600	10,000	<b>running 8-hour</b> mean	<b>11,600</b>	by 31.12.2003
<b>Pb</b>	0.5	-	<b>annual</b> mean	<b>0.5</b>	by 31.12. <b>2004</b>
	0.25	-	<b>annual</b> mean	<b>0.25</b>	by 31.12. <b>2008</b>
<b>NO<sub>2</sub></b> (see note)	200	105	<b>1 hour</b> mean	<b>200</b>	by 31.12.2005 [maximum of 18 exceedences a year or equivalent to the 99.8 <sup>th</sup> percentile]
	40	21	<b>annual</b> mean	<b>40</b>	by 31.12.2005
<b>PM<sub>10</sub></b> (gravimetric) (see note)	50	-	<b>24-hour</b> mean	<b>50</b>	by 31.12.2004 [maximum of 35 exceedences a year or ~ equivalent to the 90 <sup>th</sup> percentile]
	40	-	<b>annual</b> mean	<b>40</b>	by 31.12.2004
<b>SO<sub>2</sub></b>	266	100	<b>15 minute</b> mean	<b>266</b>	by 31.12.2005 [maximum of 35 exceedences a year or equivalent to the 99.9 <sup>th</sup> percentile]
	350	132	<b>1 hour</b> mean	<b>350</b>	by 31.12.2004 [maximum of 24 exceedences a year or equivalent to the 99.7 <sup>th</sup> percentile]
	125	47	<b>24 hour</b> mean	<b>125</b>	by 31.12.2004 [maximum of 3 exceedences a year or equivalent to the 99 <sup>th</sup> percentile]

**Notes**

1. Conversions of ppb (and ppm to  $\mu\text{g m}^{-3}$ ) correct at 20°C and 1013 mb.
2. The objectives for nitrogen dioxide are provisional.
3. PM<sub>10</sub> measured using the European gravimetric transfer standard or equivalent. The Government and the devolved administrations see this new 24-hour mean objective for particles as a staging post rather than a final outcome. Work has been set in hand to assess the prospects of strengthening the new objective.

### 2.2.3 Relationship between the UK National Air Quality Standards and EU air quality Limit Values

As a member state of the EU, the UK must comply with European Union Directives.

There are three EU ambient air quality directives that the UK has transposed in to UK law. These are:

- **96/62/EC** Council Directive of 27 September 1996 on ambient air quality assessment and management. (the Ambient Air Framework Directive)
- **1999/30/EC** Council Directive of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead in ambient air. (the First Daughter Directive)
- **2000/69/EC** Directive of the European Parliament and the Council of 16 Nov 2000 relating to limit values for benzene and carbon monoxide in ambient air. (the Second Daughter Directive)

The first and second daughter directives contain air quality Limit Values for the pollutants that are listed in the framework directive. The United Kingdom (i.e. Great Britain and Northern Ireland) must comply with these Limit Values. The UK air quality strategy should allow the UK to comply with the EU Air Quality Daughter Directives, but the UK air quality strategy also includes some stricter national objectives for some pollutants, for example, sulphur dioxide.

The Government is ultimately responsible for achieving the EU limit values. However, it is important that Local Air Quality Management is used as a tool to ensure that the necessary action is taken at local level to work towards achieving the EU limit values by the dates specified in those EU Directives.

### 2.2.4 Recent changes to the UK National Air Quality Standards

Defra and the devolved administrations issued a consultation document in 2001 with proposed changes to the UK AQS for benzene, carbon monoxide and particulate matter (defra, 2001). The proposed changes were:

#### For **benzene**

- An objective derived from the long-term policy aim of **3.25  $\mu\text{g m}^{-3}$  as a running annual mean** recommended by UK EPAQS (Expert Panel on Air Quality Standards). The objective for benzene included in the 2000 Strategy is  $16 \mu\text{g m}^{-3}$  as a running annual mean to be achieved by 2003. This is derived from the EPAQS recommended standard. The UK adopted the second EU Air Quality Daughter Directive (which sets limit values for benzene and carbon monoxide) in 2000. This Daughter Directive sets a limit value for benzene of  $5 \mu\text{g m}^{-3}$  as an annual mean to be achieved by 2010.

#### For **carbon monoxide**

- Replacing the existing objective derived from the recently agreed EU limit value. The objective for carbon monoxide included in the 2000 Strategy is  $11.6 \text{ mg m}^{-3}$  as a running 8-hour mean to be achieved by 2003. This is derived from the UK EPAQS recommended standard. The second EU Air Quality Daughter Directive sets a limit value for carbon monoxide of  $10 \text{ mg m}^{-3}$  as a maximum daily 8-hour mean to be achieved by 2005. Defra propose to set a new objective of achieving the EU limit value by the end of 2003, which is **10  $\text{mg m}^{-3}$  as a maximum daily 8-hour mean** to be achieved by 2005.

For **particulates** new provisional objectives of

- for **all parts of the UK**, except London and Scotland, a **24-hour mean of 50  $\mu\text{g m}^{-3}$  not to be exceeded more than 7 times per year** and an **annual mean of 20  $\mu\text{g m}^{-3}$** , both to be achieved by the end of 2010;
- for London, a 24-hour mean of 50  $\mu\text{g m}^{-3}$  not to be exceeded more than 10-14 times per year and an annual mean of 23-25  $\mu\text{g m}^{-3}$ , both to be achieved by the end of 2010;
- for Scotland, a 24-hour mean of 50  $\mu\text{g m}^{-3}$  not to be exceeded more than 7 times per year and an annual mean of 18  $\mu\text{g m}^{-3}$ , both to be achieved by the end of 2010.

New objectives came into force towards the end of 2002 following the adoption of the Air Quality (Wales) Amendment Regulations, 2002. Local Authorities are not required to assess their air quality against these new objectives as part of the Stage 4 Review and Assessment.

### **2.2.5 Policies in place to allow the objectives for the pollutants in AQS to be achieved**

The policy framework to allow these objectives to be achieved is one that takes a local air quality management approach. This is superimposed upon existing national and international regulations in order to effectively tackle local air quality issues as well as issues relating to wider spatial scales. National and EC policies that already exist provide a good basis for progress towards the air quality objectives set for 2003 to 2008. For example, the Environmental Protection Act 1990 allows for the monitoring and control of emissions from industrial processes and various EC Directives have ensured that road transport emission and fuel standards are in place. These policies are being developed to include more stringent controls. Recent developments in the UK include the announcement by the Environment Agency in January 2000 on controls on emissions of  $\text{SO}_2$  from coal and oil fired power stations. This system of controls means that by the end of 2005 coal and oil fired power stations will meet the air quality standards set out in the AQS.

Local air quality management provides a strategic role for local authorities in response to particular air quality problems experienced at a local level. This builds upon current air quality control responsibilities and places an emphasis on bringing together issues relating to transport, waste, energy and planning in an integrated way. This integrated approach involves a number of different aspects. It includes the development of an appropriate local framework that allows air quality issues to be considered alongside other issues relating to polluting activity. It should also enable co-operation with and participation by the general public in addition to other transport, industrial and governmental authorities.

An important part of the Strategy is the requirement for local authorities to carry out air quality reviews and assessments of their area against which current and future compliance with air quality standards can be measured. Over the longer term, these will also enable the effects of policies to be studied and therefore help in the development of future policy. The Government has prepared guidance to help local authorities to use the most appropriate tools and methods for conducting a review and assessment of air quality in their District. This is part of a package of guidance being prepared to assist with the practicalities of implementing the AQS. Other guidance covers air quality and land use planning, air quality and traffic management and the development of local air quality action plans and strategies.

### **2.2.6 Timescales to achieve the objectives for the pollutants in AQS**

In most local authorities in the UK, objectives will be met for most of the pollutants within the timescale of the objectives shown in Table 2.2. It is important to note that the objectives for  $\text{NO}_2$  remain provisional. The Government has recognised the problems associated with achieving the standard for ozone and this will not therefore be a statutory requirement. Ozone is a secondary pollutant and transboundary in nature and it is recognised that local authorities themselves can exert little influence on concentrations when they are the result of regional primary emission patterns.

## **2.3 AIR QUALITY REVIEWS – THE APPROACHES AND EXPECTED OUTCOMES**

A range of Technical Guidance has been issued to enable air quality to be monitored, modelled, reviewed and assessed in an appropriate and consistent fashion. This includes LAQM.TG(03) 'Review and Assessment: Technical Guidance' and earlier guidance LAQM.TG4(00) May 2000, on 'Review and Assessment: Pollutant Specific Guidance'. This review and assessment has considered the procedures set out in this technical guidance.

The primary objective of undertaking a review of air quality is to identify any areas that are unlikely to meet national air quality objectives and ensure that air quality is considered in local authority decision making processes. The complexity and detail required in a review depends on the risk of failing to achieve air quality objectives and it has been proposed therefore that reviews should be carried out in stages. All the stages of review and assessment may be necessary and every authority was expected to undertake at least a first stage review and assessment of air quality in their authority area. The Stages are briefly described in the following table, Table 2.3.

Table 2.3 describes the stages of the first round of Review and Assessment. Local Authorities are currently undertaking a second round of Review and Assessment to be completed in 2003/4. Further rounds will take place in 2006/7 and 2009/10.

**Table 2.3** Brief details of Stages in the Air Quality Review and Assessment process

Stage	Objective	Approach	Outcome
<b>First Stage Review and Assessment</b>	<ul style="list-style-type: none"> <li>Identify all significant pollutant sources within or outside of the authority's area.</li> </ul>	<ul style="list-style-type: none"> <li>Compile and collate a list of potentially significant pollution sources using the assessment criteria described in the Pollutant Specific Guidance</li> </ul>	
	<ul style="list-style-type: none"> <li>Identify those pollutants where there is a <b>risk</b> of exceeding the air quality objectives, and for which further investigation is needed.</li> </ul>	<ul style="list-style-type: none"> <li>Identify sources requiring further investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Decision about whether a Stage 2 Review and Assessment is needed for one or more pollutants. If not, no further review and assessment is necessary.</li> </ul>
<b>Second Stage Review and Assessment</b>	<ul style="list-style-type: none"> <li>Further screening of significant sources to determine whether there is a significant risk of the air quality objectives being exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>Use of screening models or monitoring methods to assess whether there is a risk of exceeding the air quality objectives.</li> </ul>	
	<ul style="list-style-type: none"> <li>Identify those pollutants where there is a <b>risk</b> of exceeding the objectives, and for which further investigation is needed.</li> </ul>	<ul style="list-style-type: none"> <li>The assessment need only consider those locations where the highest likely concentrations are expected, and where public exposure is relevant.</li> </ul>	<ul style="list-style-type: none"> <li>Decision about whether a Stage 3 Review and Assessment is needed for one or more pollutants. If, as a result of estimations of ground level concentrations at suitable receptors, a local authority judges that there is no significant risk of not achieving an air quality objective, it can be confident that an Air Quality Management Area (AQMA) will not be required.</li> <li>However, if there is doubt that an air quality objective will be achieved a third stage review should be conducted.</li> </ul>

**Table 2.3 (contd.)** Brief details of Stages in the Review and Assessment process

Stage	Objective	Approach	Outcome
<b>Third Stage Review and Assessment</b>	<ul style="list-style-type: none"> <li>Accurate and detailed assessment of both current and future air quality. Assess the <b>likelihood</b> of the air quality objectives being exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>Use of validated modelling and quality-assured monitoring methods to determine current and future pollutant concentrations.</li> </ul>	
	<ul style="list-style-type: none"> <li>Identify the geographical boundary of any exceedences, and description of those areas, if any, proposed to be designated as an AQMA.</li> </ul>	<ul style="list-style-type: none"> <li>The assessment will need to consider all locations where public exposure is relevant. For each pollutant of concern, it may be necessary to construct a detailed emissions inventory and model the extent, location and frequency of potential air quality exceedences.</li> </ul>	<ul style="list-style-type: none"> <li>Determine the location of any necessary Air Quality Management Areas (AQMA). Once an AQMA has been identified, there are further sets of requirements to be considered.</li> <li>A further assessment of air quality in the AQMA is required within 12 months, which will enable the degree to which air quality objectives will not be met, and the sources of pollution that contribute to this to be determined. A local authority must also prepare a written action plan for achievement of the air quality objective. Both air quality reviews and action plans are to be made publicly available.</li> </ul>

**Table 2.3 (contd.)** Brief details of Stages in the Review and Assessment process

Stage	Objective	Approach	Outcome
<b>Fourth Stage Review and Assessment</b>  <b>(to support the Action Plan)</b>	<ul style="list-style-type: none"> <li>Further accurate and detailed assessment of both current and future air quality. Should concentrate on areas where the Stage 3 assessment indicated exceedences of the objectives are likely.</li> </ul>	<ul style="list-style-type: none"> <li>Use of validated modelling and quality-assured monitoring methods to determine current and future pollutant concentrations.</li> </ul>	<ul style="list-style-type: none"> <li>Confirm outcome of original AQMA designation and alter if necessary (for example, as a result of changes in the emission factors used in the modelling)</li> </ul>
	<ul style="list-style-type: none"> <li>Source apportionment in regions where there are exceedences. Understand contributions from traffic, industrial, domestic and background sources.</li> </ul>	<ul style="list-style-type: none"> <li>Analyse modelling results.</li> </ul>	<ul style="list-style-type: none"> <li>Understand the contributions from the various sources, and therefore select the source where action can be taken to reduce emissions</li> </ul>
	<ul style="list-style-type: none"> <li>Assess a range of scenarios to improve air quality and reduce or eliminate the risk of air quality objectives being exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>Liase with stakeholders such as the Highways Agency, the Environment Agency and the local industry to help define scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Identify the most likely scenarios to improve air quality and use these in the modelling. Incorporate scenarios into any Action Plan produced.</li> </ul>
	<ul style="list-style-type: none"> <li>Identify the geographical boundaries of any exceedences in the scenarios.</li> </ul>	<ul style="list-style-type: none"> <li>Analyse modelling results.</li> </ul>	<ul style="list-style-type: none"> <li>Incorporate modelling results of the scenarios into any Action Plan produced. Consider how to implement any Action Plan to improve air quality.</li> </ul>

Local authorities are expected to have completed the first round of review and assessment of air quality by December 2000. A further second round review should have been completed for the purposes of the Act before the target date of 2003. The first and second stages are combined as the Upgrading and Screening Assessment (USA) in the second round, the third stage is now termed the Detailed Assessment (DA).

## 2.4 LOCATIONS THAT THE REVIEW AND ASSESSMENT MUST CONCENTRATE ON

For the purpose of review and assessment, the authority should focus their work on locations where members of the public are likely to be exposed over the averaging period of the objective. Table 2.4 summarises the locations where the objectives should and should not apply.

**Table 2.4** Typical locations where the objectives should and should not apply

<b>Averaging Period</b>	<b>Pollutants</b>	<b>Objectives <i>should</i> apply at ...</b>	<b>Objectives <i>should not</i> generally apply at ...</b>
<b>Annual mean</b>	<ul style="list-style-type: none"> <li>• 1,3 Butadiene</li> <li>• Benzene</li> <li>• Lead</li> <li>• Nitrogen dioxide</li> <li>• Particulate Matter (PM<sub>10</sub>)</li> </ul>	<ul style="list-style-type: none"> <li>• All background locations where members of the public might be regularly exposed.</li> </ul>	<ul style="list-style-type: none"> <li>• Building facades of offices or other places of work where members of the public do not have regular access.</li> </ul>
		<ul style="list-style-type: none"> <li>• Building facades of residential properties, schools, hospitals, libraries etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Gardens of residential properties.</li> </ul>
			<ul style="list-style-type: none"> <li>• Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term</li> </ul>
<b>24 hour mean and 8-hour mean</b>	<ul style="list-style-type: none"> <li>• Carbon monoxide</li> <li>• Particulate Matter (PM<sub>10</sub>)</li> <li>• Sulphur dioxide</li> </ul>	<ul style="list-style-type: none"> <li>• All locations where the annual mean objective would apply.</li> </ul>	<ul style="list-style-type: none"> <li>• Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.</li> </ul>
		<ul style="list-style-type: none"> <li>• Gardens of residential properties.</li> </ul>	

**Table 2.4 (contd.)** Typical locations where the objectives should and should not apply

<b>Averaging Period</b>	<b>Pollutants</b>	<b>Objectives apply at ...</b>	<b>Objectives should generally not apply at ...</b>
<b>1 hour mean</b>	<ul style="list-style-type: none"> <li>• Nitrogen dioxide</li> <li>• Sulphur dioxide</li> </ul>	<ul style="list-style-type: none"> <li>• All locations where the annual mean and 24 and 8-hour mean objectives apply.</li> </ul>	<ul style="list-style-type: none"> <li>• Kerbside sites where the public would not be expected to have regular access.</li> </ul>
		<ul style="list-style-type: none"> <li>• Kerbside sites (e.g. pavements of busy shopping streets).</li> </ul>	
		<ul style="list-style-type: none"> <li>• Those parts of car parks and railway stations etc. that are not fully enclosed.</li> </ul>	
		<ul style="list-style-type: none"> <li>• Any outdoor locations to which the public might reasonably be expected to have access.</li> </ul>	
<b>15 minute mean</b>	<ul style="list-style-type: none"> <li>• Sulphur dioxide</li> </ul>	<ul style="list-style-type: none"> <li>• All locations where members of the public might reasonably be expected for a period of 15 minutes or longer.</li> </ul>	

It is unnecessary to consider exceedences of the objectives at any location where public exposure over the relevant averaging period would be unrealistic, and the locations should represent non-occupational exposure.

### **3 Stage 4 Air Quality Review and Assessment and Action Planning**

This section contains information about Stage 4 Air Quality Review and Assessments and Action Plans. It explains the relationships between the Stage 4 and Action Plans, what each document should contain, and the timescales for producing the documents.

#### **3.1 THE RELATIONSHIPS BETWEEN A STAGE 4 AIR QUALITY REVIEW AND ASSESSMENT AND AN ACTION PLAN**

If a local authority declares an Air Quality Management Area, Section 84(1) of the Environment Act 1995 requires that local authority to carry out a further assessment of existing and likely future air quality in the AQMA. This further assessment is called a Stage 4 Air Quality Review and Assessment, and is intended to supplement information the authority already has. It is a duty of the LA to complete this Stage 4 Air Quality Review and Assessment.

For each pollutant where there is an exceedence of the air quality, the Stage 4 should calculate:

- how great an improvement is needed; and
- the extent to which different sources contribute to the problem (source apportionment of traffic, industrial, domestic and background – if appropriate).

This should give a clear picture of the sources that authorities can control or influence. It should ensure that Action Plans strike a balance between the contribution from local authorities and the contribution that must come from other sectors. It should allow them to target their responses more effectively and ensure that the relative contributions of industry, transport and other sectors are cost effective and proportionate. It should include, in particular, an estimate of the costs and feasibility of different abatement options to allow for the development of proportionate and effective Action Plans (although this information could be included within the Action Plan, rather than the Stage 4). Further liaison with other agencies (including, in particular, the Environment Agency and the Highways Agency) is likely to be essential.

Essentially, the production of the Stage 4 air quality review and assessment and the Action Plan are activities that the LA can complete in parallel, rather than sequentially.

#### **3.2 RECENT GUIDANCE ON STAGE 4 AIR QUALITY REVIEW AND ASSESSMENT**

Defra and the devolved administrations have issued guidance on what they expect in a Stage 4. This expands on the information that is available in LAQM.G1(00) - Framework for review and assessment of air quality. It has been incorporated into new policy guidance LAQM.PG(03).

Essentially, the Stage 4 provides the technical justification for the measures an authority includes in its Action Plan. Defra expect that the Stage 4 will allow Local Authorities:

- To calculate more accurately how much of an improvement in air quality is needed to deliver the air quality objectives within the AQMA
- To refine their knowledge of the sources of pollution so that air quality Action Plans can be properly targeted
- To take account of national policy developments that may come to light after the AQMA declaration (the revision of the vehicle emission factors is an example of this kind of policy development)
- To take account of local policy developments, for example, new transport schemes in the vicinity of the AQMA or of any new major housing or commercial developments
- To carry out more intensive monitoring in the problem areas to confirm earlier findings
- To corroborate other assumptions on which the designation of the AQMA was based and to check that the original designation is still valid, and does not need amending
- To respond to comments made by statutory consultees (if there were any relevant comments made)

### **3.3 ACTION PLANS**

Local Authorities are required to prepare a written Action Plan for each AQMA setting out the actions they intend to take in pursuit of achieving the air quality objectives. This has to include a timetable for implementing the plan.

The Action Plan should contain the scenarios that have been modelled in the Stage 4 review and assessment. It should contain a summary of the air quality improvements that might be possible for each of the scenarios identified. The Stage 4 provides the technical justification for the measures an authority includes in its Action Plan.

The Action Plan should also contain simple estimates of the costs and feasibilities of implementing those scenarios. The Action Plan may also consider the non-health benefits of implementing scenarios in the Action Plan, for example, reductions in road traffic accident deaths as a result of road improvements that also reduce vehicle emissions.

The LA can then identify which scenario(s) offer the most cost-effective or cost-beneficial way of improving air quality.

## 4 Information used to support this assessment

This section lists the key information used in this review and assessment.

### 4.1 MAPS AND DISTANCES OF RECEPTORS FROM ROADS

Blaby District Council provided detailed OS landline data for the parts of the district covered by the AQMAs. Individual buildings or groups of buildings (receptors) were identified from the electronic OS Landline maps of the areas and the distances of these receptors from the road determined from the maps.

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### 4.2 ROAD TRAFFIC DATA

Leicester City Council provided modelled (TRIPS) traffic data on behalf of the Council. The data included:

- Annual average daily traffic flow and average vehicle speeds;

The traffic data was for the years 2001 or 2005. This data was used in the modelling was carried out by Leicester City Council.

The traffic data used are from the County database and includes traffic flows (AADT) and speed. It includes all major roads in the central area of the County including the roads that influence the Blaby AQMAs.

### 4.3 EMISSION FACTORS USED IN THIS REVIEW AND ASSESSMENT

The vehicle emission factors used for national mapping have recently been revised by Defra and the devolved administrations<sup>3</sup>. The most recent emission factors have been used in this Stage 4.

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<sup>3</sup> The new set of emission factors on the NAEI website ([www.naei.org.uk/emissions/index.php](http://www.naei.org.uk/emissions/index.php)) approved by DEFRA and DTLR for use in emissions and air quality modelling, following consultation of the TRL Report "Exhaust Emission Factors 2001: Database and Emission Factors" by TJ Barlow, AJ Hickman and P Boulter, TRL, September 2001

## 5 Stage 4 Review and Assessment for Nitrogen Dioxide

This section summarises

- the work that was done at Stage 3 and the areas of exceedence of the air quality objectives for nitrogen dioxide
- monitoring that was completed for the Stage 3 Air Quality Review and Assessment or to more generally assess concentrations around Blaby

### 5.1 LATEST STANDARDS AND OBJECTIVES FOR NITROGEN DIOXIDE

In June 1998, the Common Position on Air Quality Daughter Directives (AQDD) agreed at Environment Council included the following objectives to be achieved by 31 December 2005 for nitrogen dioxide:

- An annual average concentration of  $40 \mu\text{g m}^{-3}$  (21 ppb);
- $200 \mu\text{g m}^{-3}$  (100 ppb) as an hourly average with a maximum of 18 exceedences in a year.

The National Air Quality Strategy was reviewed in 1999 (DETR, 1999). The Government proposed that the annual objective of  $40 \mu\text{g m}^{-3}$  be retained as a provisional objective and that the original hourly average be replaced with the AQDD objective. The revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR, 2000) and the Air Quality Regulations (2000) include the proposed changes.

The new hourly objective is slightly more stringent than the original hourly objective. Modelling studies suggest that in general achieving the annual mean of  $40 \mu\text{g m}^{-3}$  is more demanding than achieving either the former or current hourly objective. If the annual mean is achieved, the modelling suggests the hourly objectives will also be achieved.

### 5.2 KEY FINDINGS OF THE STAGE 3 REVIEW AND ASSESSMENT

Blaby District Council carried out a Stage 3 assessment. The Stage 3 Review and Assessment included continuous monitoring data and detailed dispersion modelling of the major roads in order to predict areas of exceedence of the nitrogen dioxide objectives.

The Stage 3 report concluded for  $\text{NO}_2$  that an exceedence of the air quality objective is predicted and that an AQMA be declared to incorporate the 3 areas predicted to exceed.

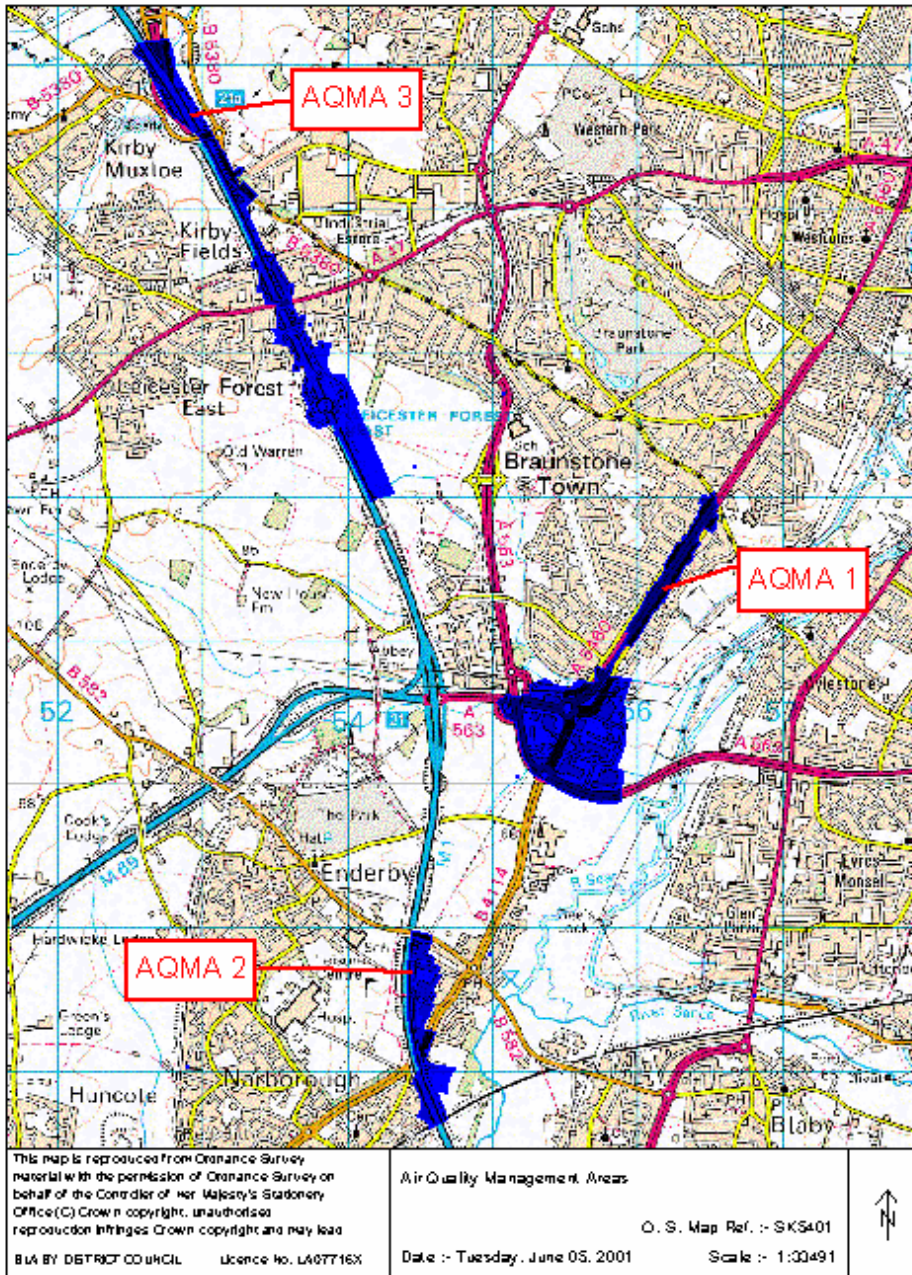
### 5.3 AIR QUALITY MANAGEMENT AREAS DECLARED BY BLABY DISTRICT COUNCIL

Three areas were declared as AQMAs for predicted exceedences of the annual objective:

- ❑ A5460 Narborough Road South (AQMA 1)\*
- ❑ M1 Corridor, Enderby (AQMA 2)
- ❑ M1 Corridor Thorpe Astley/Kirby Muxloe (AQMA 3)

\*also predicted possible exceedance of hourly objective

**Figure 5.1a Blaby District Council Air Quality Management Areas**



## 5.4 AMBIENT MONITORING

### 5.4.1 QA/QC of continuous monitoring data

We understand that the monitoring data at Croft (grid ref 451768 295837) was operated by Blaby District Council and data were scaled on the basis of routine calibrations.

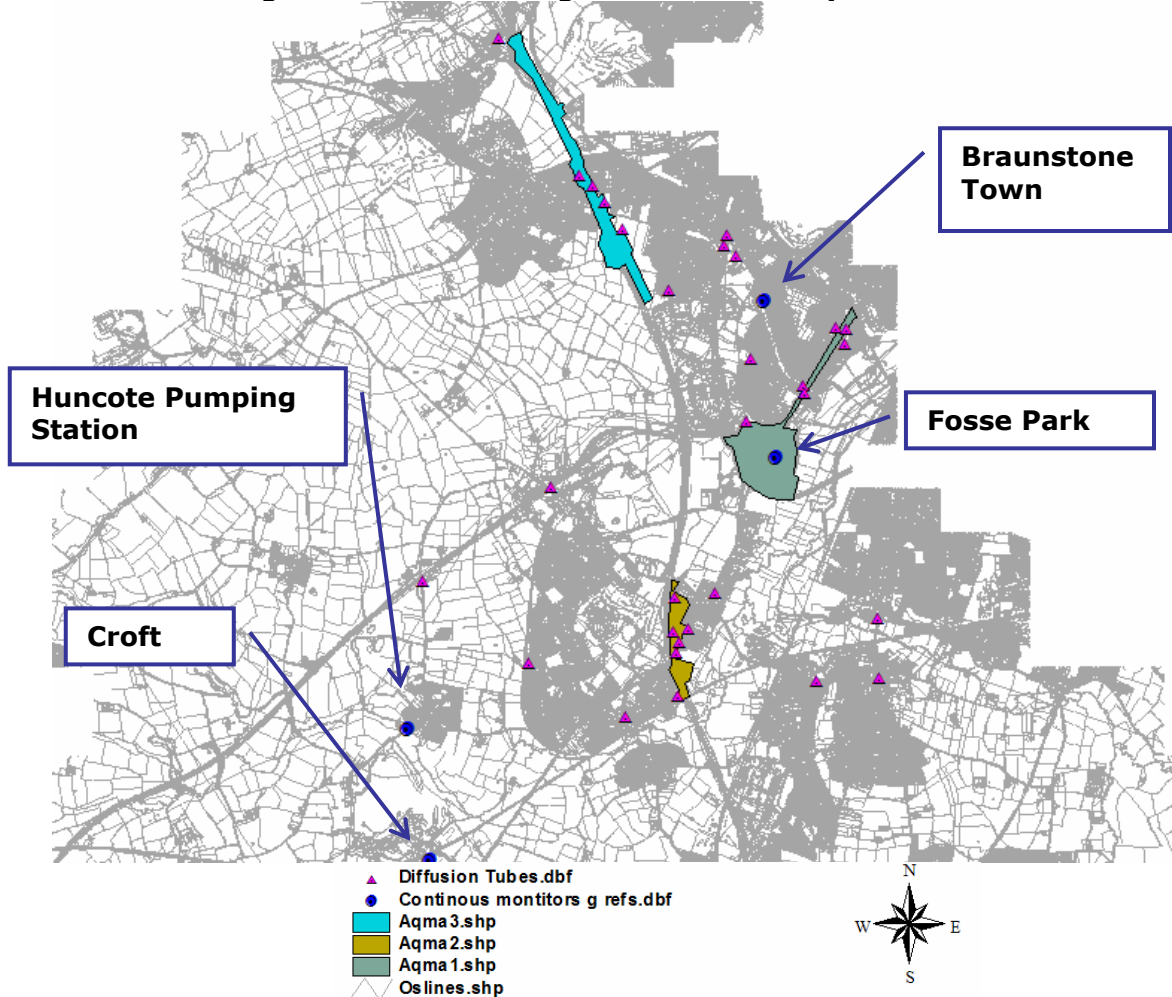
However, it is important to note that model verification was undertaken using continuous monitoring data from Leicester as the modelling for Leicester City Council and Blaby District Council has been undertaken by Leicester City Council undertaking the same modelling methodology and modelling concurrently (see chpt 5.5).

### 5.4.2 Summary of continuous monitoring data

Table 5.1 summarises the measurements of nitrogen dioxide concentrations at the continuous monitoring stations for relevant periods. Automatic monitoring has been carried out in Blaby using a mobile facility since 2000; the monitoring periods and locations are summarised below;

Croft	Jan 2002	-	Dec 2003	12 months
Huncote Pumping Station	Jun 2001	-	Jan 2002	6 months
Fosse Park	Jan 2001	-	Jun 2001	6 months
Braunstone Town	Jan 2000	-	Nov 2000	11 months

**Figure 5.1b Monitoring Location in Blaby District Council**



Note: AQMA on this diagram are approximate, See Figure 5.1a for AQMA definition

Further details of the monitoring and are given in Appendix 1

Table 5.1: Summary of continuous monitoring data

Site	Period	Data capture, %	NO <sub>2</sub> Concentration, µg m <sup>-3</sup>	
			Period average	Number of exceedences of hourly objective
Croft	2002	90	20	0
Croft	2003	92	21	0
Huncote	Jun 2001 – Jan 2002	95	24	0
Fosse Park	Jan 2001 – Jun 2001	99	36	0
Braunstone Town	Jan 2000 – Nov 2000	95	32	0

#### 5.4.3 Comparison of measured concentrations with air quality objectives

The measured nitrogen dioxide concentrations from continuous monitoring sites within Blaby District council are below the objective level for 2005. However, the monitoring equipment is currently located in a background site outside of the AQMA areas.

#### 5.4.4 Diffusion tube data

Nitrogen dioxide diffusion tube measurements have been made in the district council area since 1993. Results are summarised here corrected for laboratory bias.

Bias adjustment factors have been taken from the collocation studies spreadsheet summary given on the FAQs questions site of the defra review and assessment website (<http://www.uwe.ac.uk/aqm/review/answers.html#RND9>). No bias adjustment factor is yet available for 2003 and so data for that year has not been considered here.

**Table 5.2 Bias Adjusted Diffusion Tube Data**

<i>Year and Bias adjustment factor applied (f)</i>	<i>2000 f= 0.85</i>	<i>2001 f= 0.87</i>	<i>2002 f= 0.9</i>	<i>Prediction from 2001 to 2005</i>	<i>Prediction from 2002 to 2005</i>
Alexander St		34		30*	
Alyssum Way	27	25		22	
Branting Hill		37		33	
Cleveleys Ave	34	35		31	
County Arms	36	43	41	38	38
Cumberwell Dr		45		40*	
Cyril Street	34	34	27	30	25
Forest Road/M69 bridge	30	39	34	35	31
Glenfield	29	38		34*	
Grange Farm	39	39		35*	
Hinckley Road/M1 bridge	51	49	48	44*	44*
Jordans	41	46	35	41*	32
K Edward	43	54	44	48*	41*
Kingsway North	41	39		34*	
Kingsway School		38		34*	
Kirby Muxloe		33		29	
Leicester Road	46	51	44	46*	40*
Mill Hill/M69 Bridge		54		48*	
Millfield School	37	41		37	
Nox Box		33	22	29	20
Nox Box		31	21	28	19
Nox Box		34	20	30	18
Queens D	43	43		39*	
St Johns	33	38		34*	
The Osiers		39	37	34	34
Thorpe A	37	40	37	35	34
Weavers	32				
Westover Road	28	33		29	

\*Sites within AQMA

All the Diffusion Tubes sites that are predicting an exceedance are contained within the already designated AQMAs.

#### 5.4.5 Comparison of measured concentrations with air quality objectives

Relatively high concentrations of nitrogen dioxide have been measured at some locations within Blaby District council using diffusion tubes. Some Diffusion tube locations are predicted to exceed the 2005 objective. However those locations are all contained within the designated AQMAs. There are no tubes outside the AQMAs predicted to exceed the objectives in 2005.

## 5.5 OVERVIEW OF THE AIR QUALITY MODELLING FOR THIS STAGE 4 ASSESSMENT

### 5.5.1 Summary of the modelling approach used in this Stage 4 assessment

The air quality impact from roads has been assessed by Leicester City Council using AIR VIRO, version 2.4 a Gaussian dispersion calculation method. Emission factors used within the model are taken from AEA/Stanger/Casella. The model predicted forward from 2002 to 2005 the year of the objective.

The meteorological data used was for 2001, taken from the Leicester Meteorological mast, approximately 4 miles NW of the City centre.

A background value of 25  $\mu\text{g}/\text{m}^3$  NO<sub>x</sub> was added to modelled concentration before converting the total concentration to NO<sub>2</sub>. The source of the background data was the Harwell AURN monitoring station, selected as most appropriate after discussion with the monitoring helpline. Modelled NO<sub>x</sub> was converted to NO<sub>2</sub> using the Derwent Middleton equation.

### 5.5.2 Validation, verification and bias adjustment of the model

In simple terms, model validation is where the model is tested at a range of locations and is judged suitable to use for a given application. It is understood that the AIR VIRO model is considered a validated model.

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations. The validation methodology was from "Air Quality Management Areas: Turning Reviews Into Action" NSCA 2000.

Bias adjustment is the process where the concentrations of the model are adjusted to agree with local air quality monitoring data. A correction factor of 1.6 was calculated by comparing the modelled and monitored results at 6 roadside locations in Leicester for the meteorological year (2001) used for the dispersion calculations (model runs). Following the approach outlined in NSCA guidance document, the monitored and modelled annual mean values were compared at each of the roadside monitoring stations. A factor was derived at each of the stations, which represented the systematic error in the model prediction. An average correction factor of 1.6 was calculated and this was used to correct the raw model output, to bring it in line with the measured values. By plotting measured and the corrected-modelled values, a best fit line was then produced. The equation of this line was then used to give a final correction to the modelled data, and give a better fit between modelled and measured data.

The recommended uncertainty is +/- 2 standard deviations. For these results this is an uncertainty of +/- 2  $\mu\text{g}/\text{m}^3$ . Thus using this methodology, modelled values of less than 38  $\mu\text{g}/\text{m}^3$  is very unlikely to exceed the 40  $\mu\text{g}/\text{m}^3$  objective, values between 38 and 42  $\mu\text{g}/\text{m}^3$  may exceed the objective, and values greater than 42  $\mu\text{g}/\text{m}^3$  are very likely to exceed the objective. The NSCA methodology recommends that AQMAs include the uncertainty region, i.e. predicted values above 38  $\mu\text{g}/\text{m}^3$  should be considered as a predicted exceedence.

The Annual Average NO<sub>2</sub> has been modelled by Leicester Council for the 3 areas declared as AQMAs.

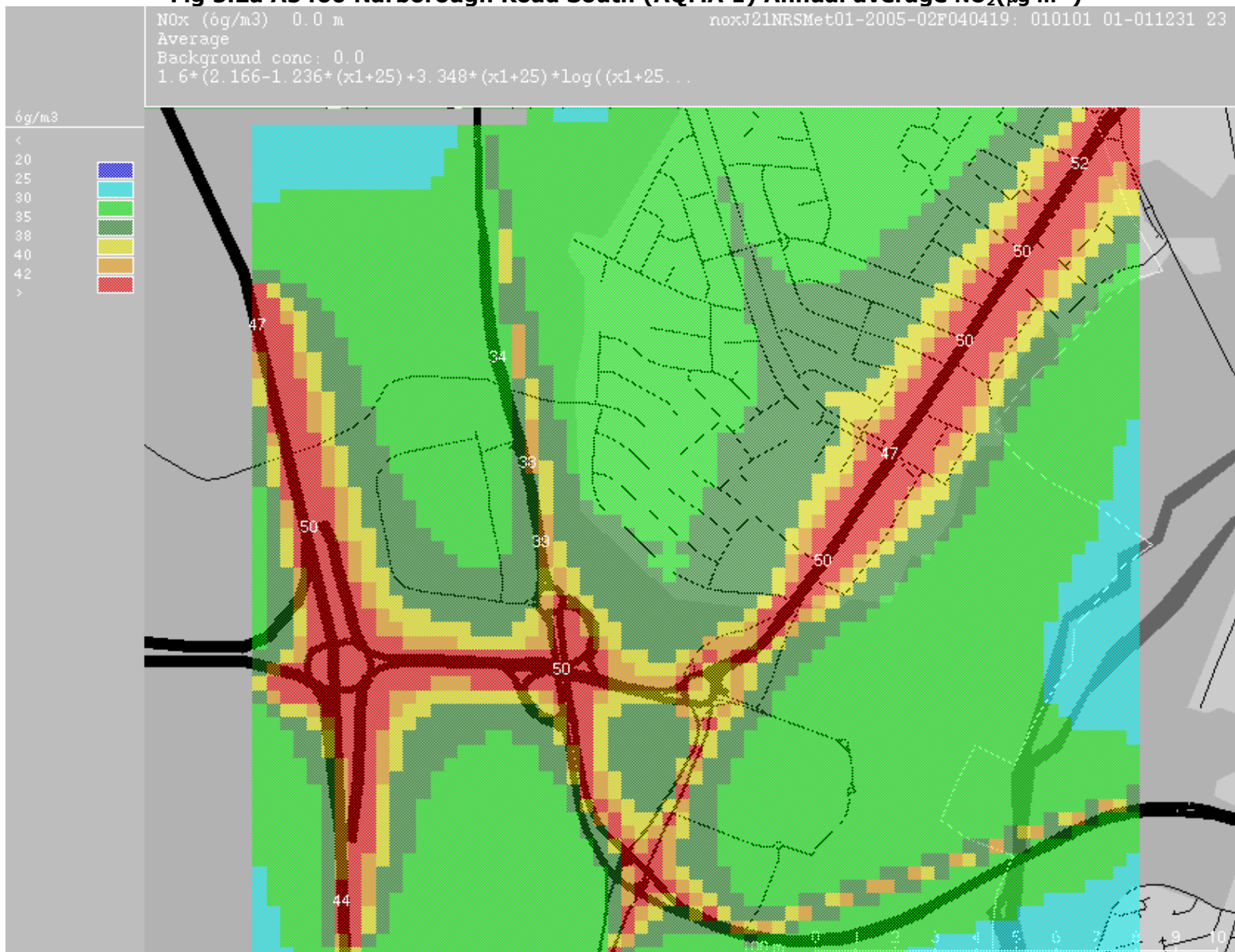
- A5460 Narborough Road South (AQMA 1)
- M1 Corridor, Enderby (AQMA 2)
- M1 Corridor Thorpe Astley/Kirby Muxloe (AQMA 3)

The modelling output in the form of contour maps is given in Figures 5.2 to 5.4. The concentrations are predicted for 2005 using meteorological data from 2001. The

modelling includes background NO<sub>x</sub> (converted to NO<sub>2</sub>) of 25 µg/m<sup>3</sup>. This background is obtained from the Harwell rural site. A correction factor of 1.6 has been applied. This is considered to have an uncertainty: +/- 2 µg/m<sup>3</sup>, (2 standard deviations). The values only apply to areas within 10m of kerbside.

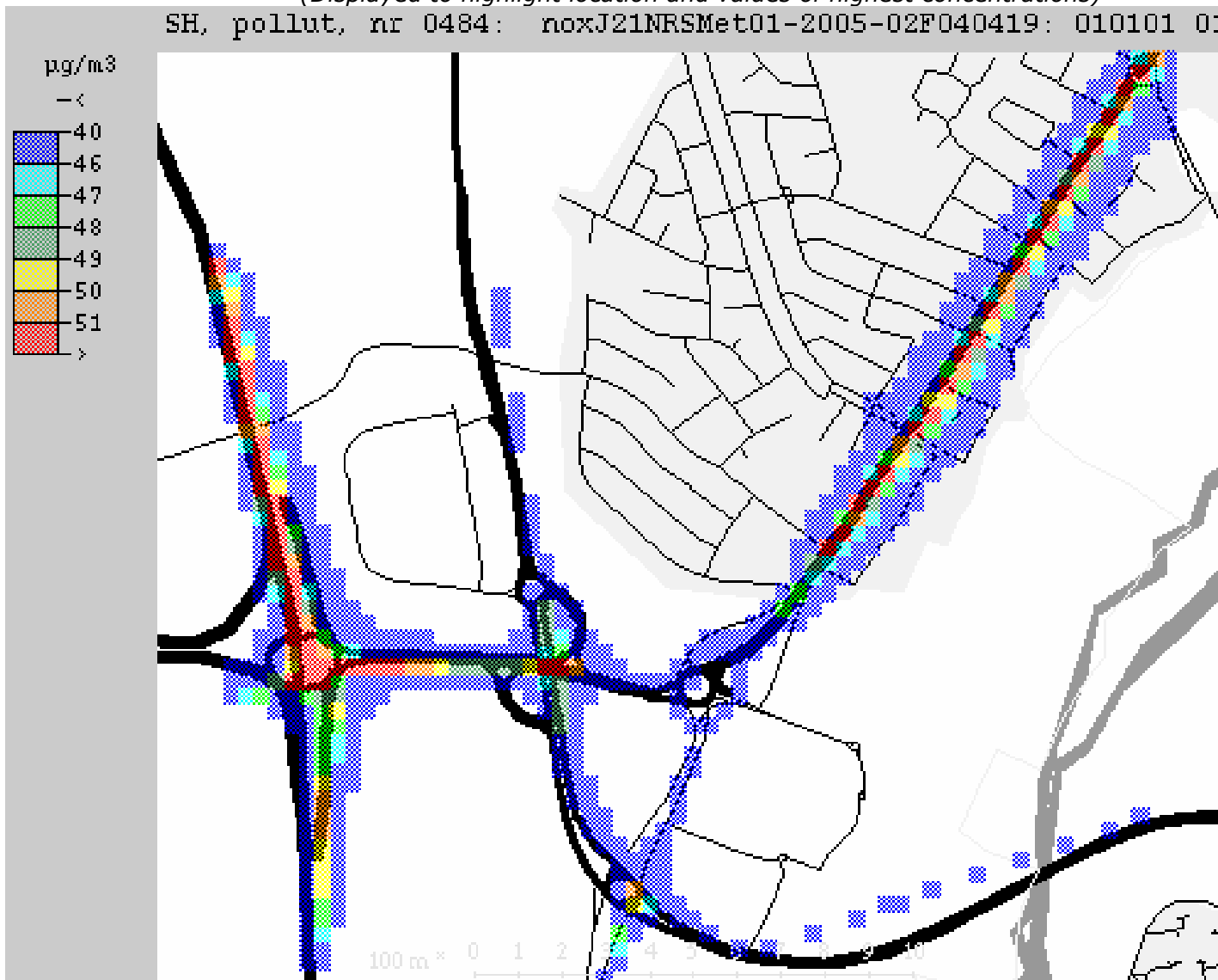
The hourly objective has not be modelled. Where the annual objective is met it is anticipated the hourly will also be met. However if there is an exceedance of the annual, an exceedance of the hourly is also possible.

**Fig 5.2a A5460 Narborough Road South (AQMA 1) Annual average NO<sub>2</sub>(μg m<sup>-3</sup>)**



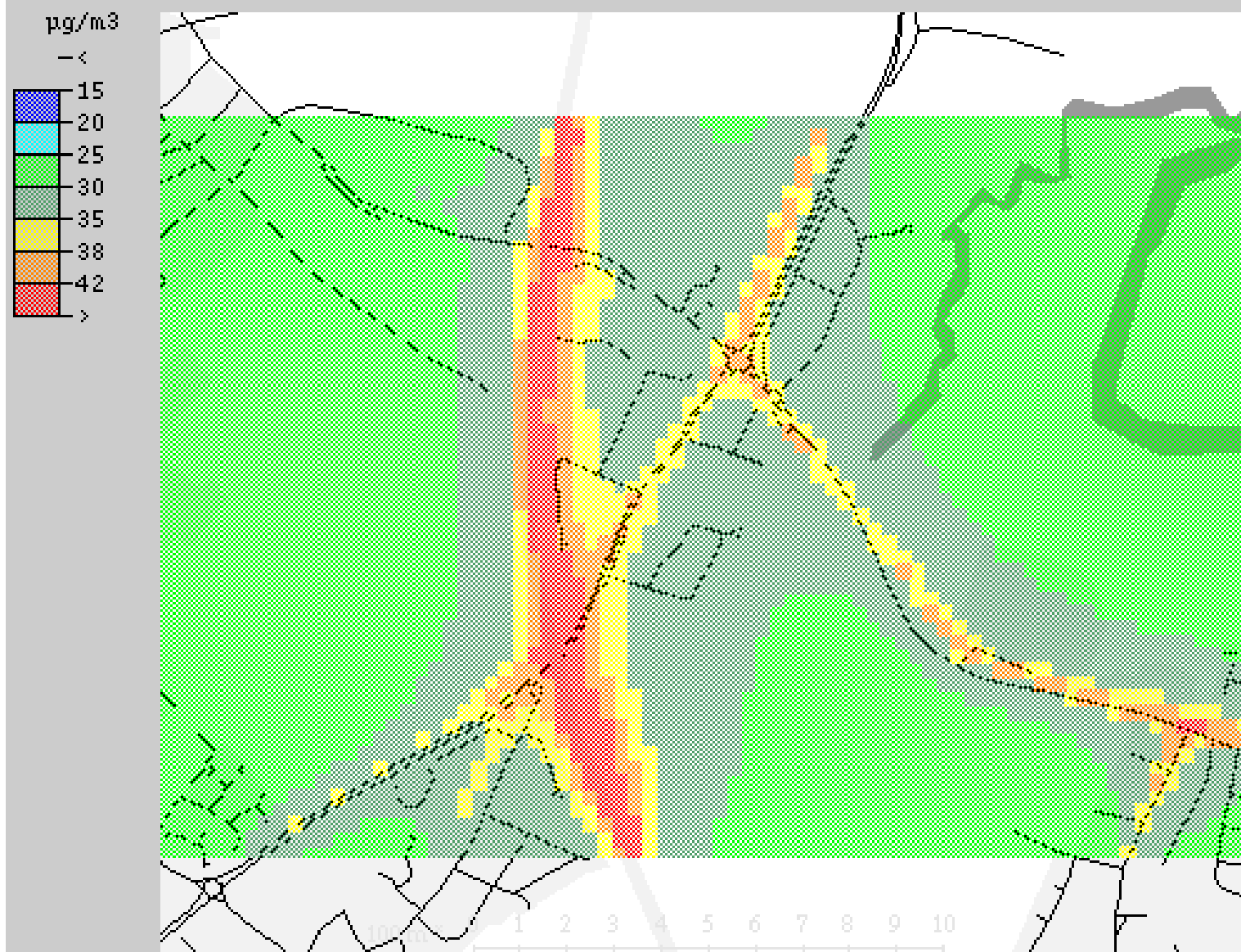
**Fig 5.2b A5460 Narborough Road South (AQMA 1) Annual average NO<sub>2</sub>(µg m<sup>-3</sup>)**  
(Displayed to highlight location and values of highest concentrations)

SH, pollut, nr 0484: noxJ21NRSMet01-2005-02F040419: 010101 01



**Fig 5.3a M1 Corridor, Enderby (AQMA 2) Annual average NO<sub>2</sub> (µg m<sup>-3</sup>)**

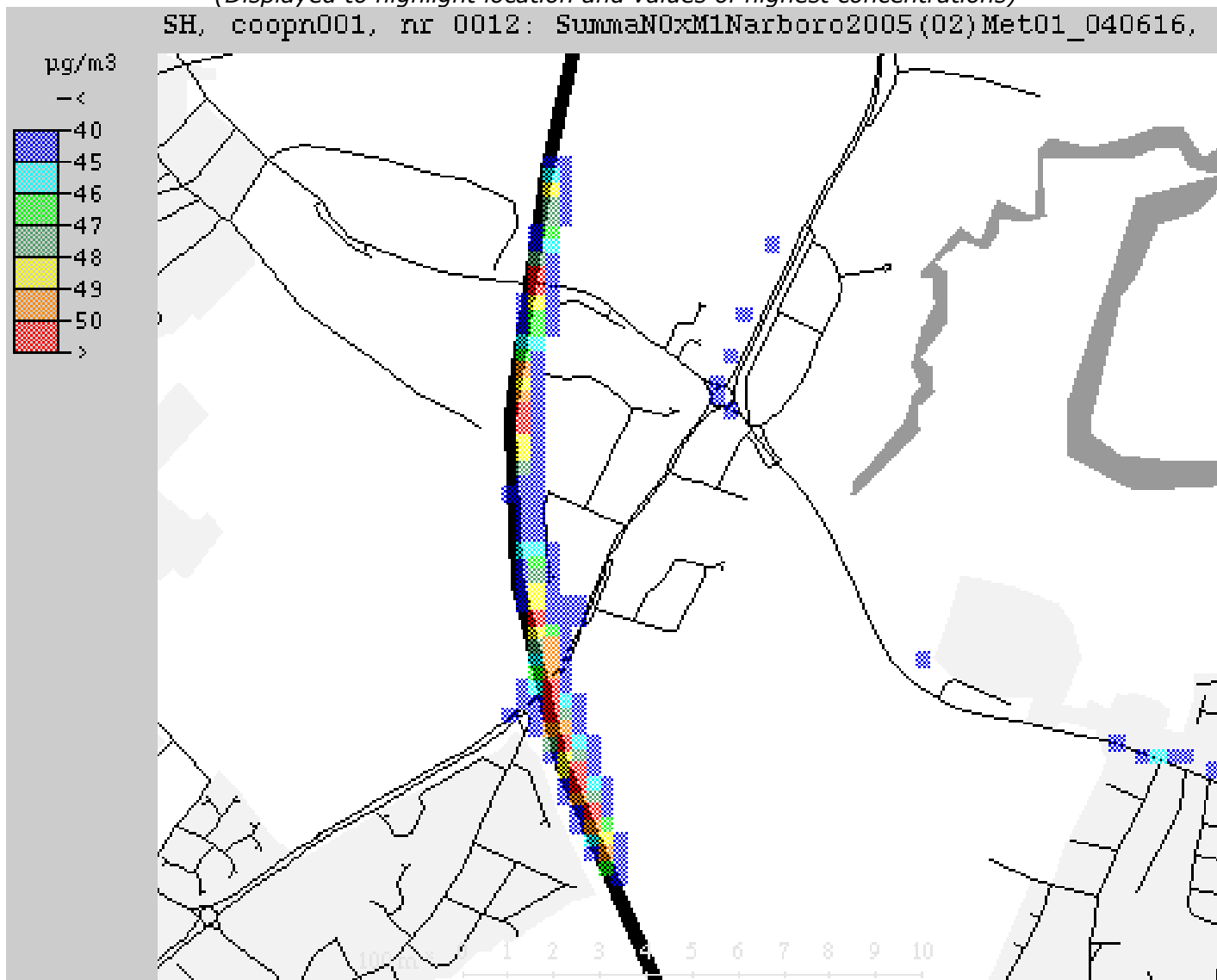
SH, coopn001, nr 0012: SummaNOxM1Narboro2005(02)Met01\_040616, j



**Fig 5.3b M1 Corridor, Enderby (AQMA 2) Annual average NO<sub>2</sub>( $\mu\text{g m}^{-3}$ )**

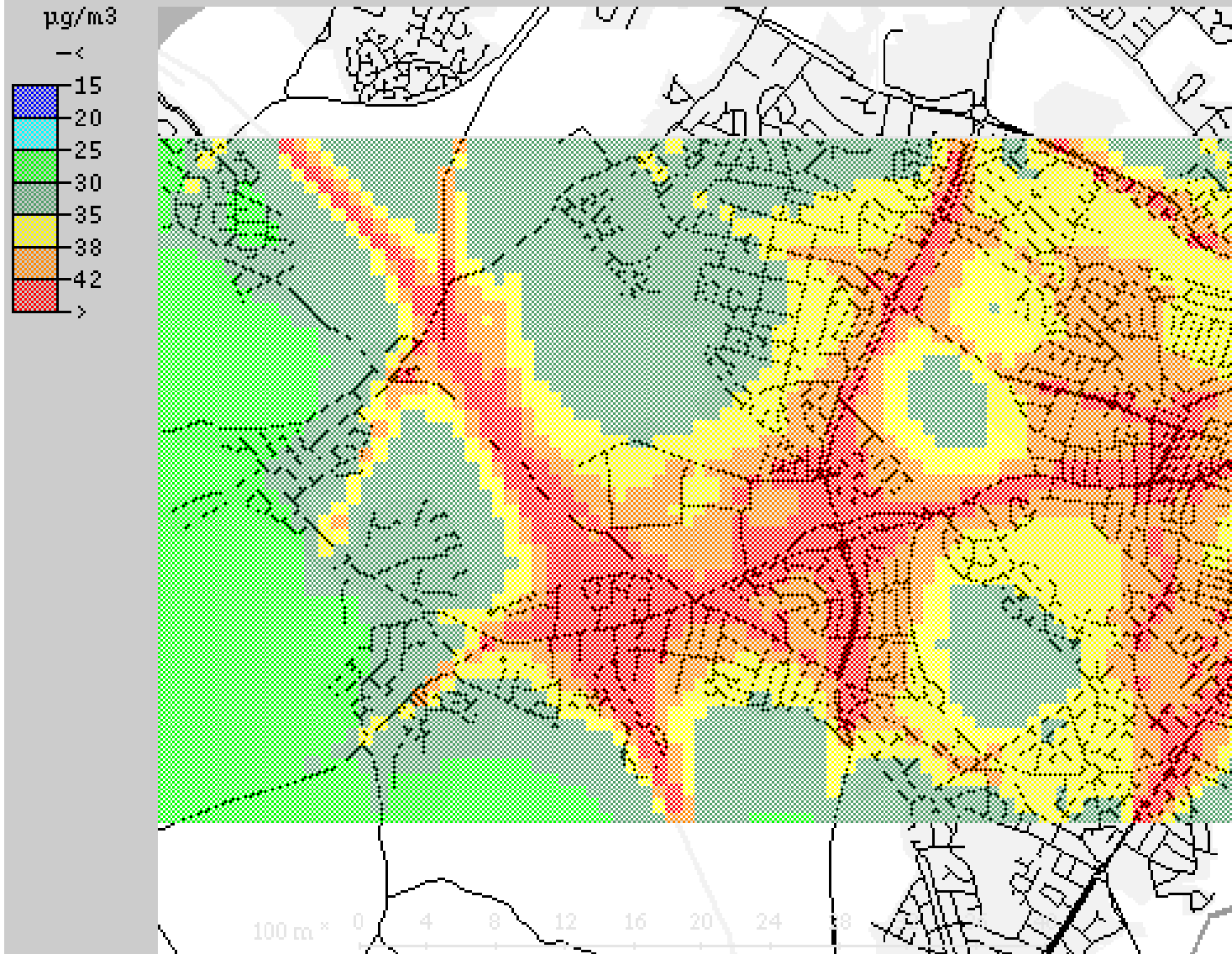
*(Displayed to highlight location and values of highest concentrations)*

SH, coopn001, nr 0012: SummaNOxM1Narboro2005(02)Met01\_040616, j

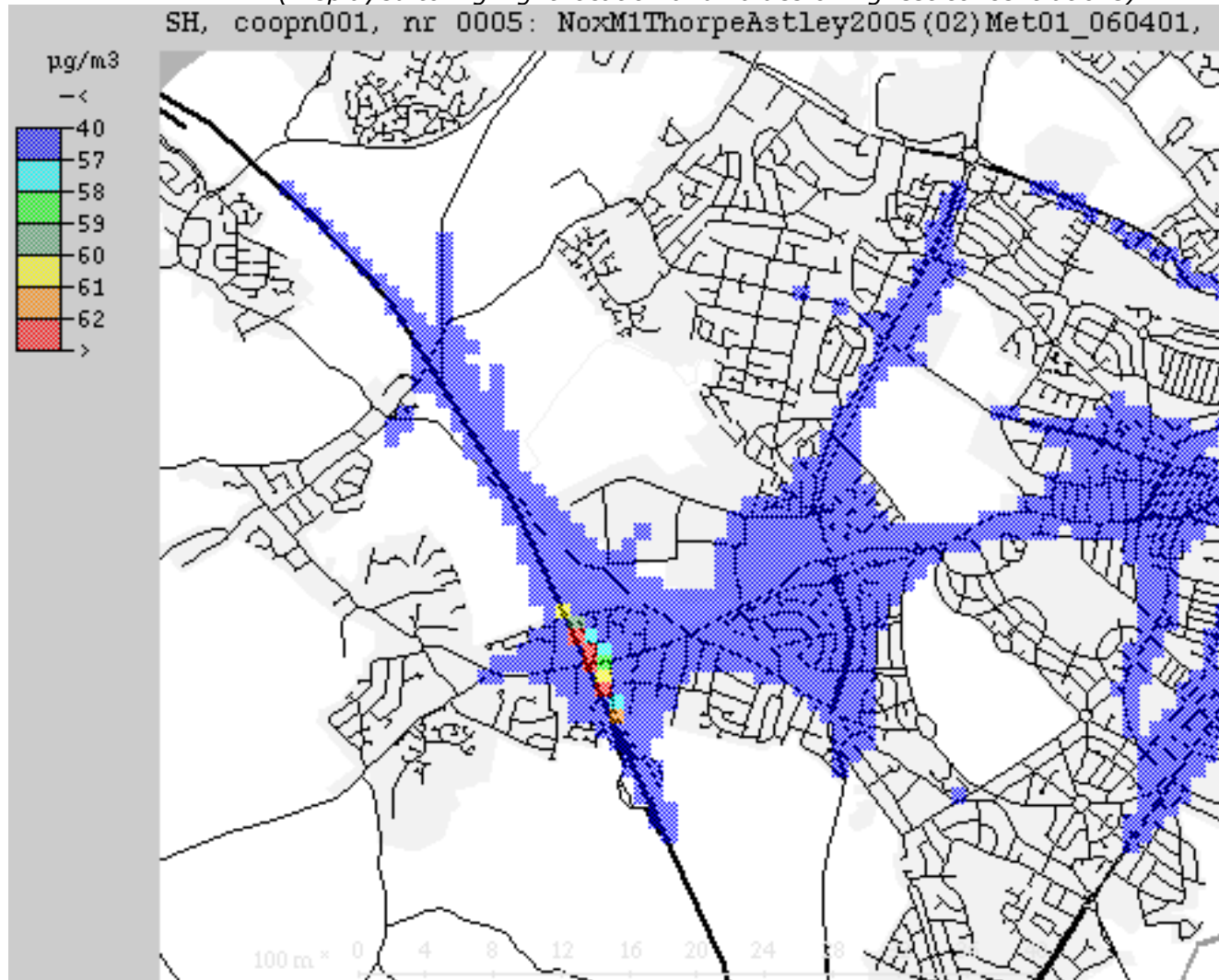


**Fig 5.4a M1 Corridor Thorpe Astley/Kirby Muxloe (AQMA 3), Annual average NO<sub>2</sub>(µg m<sup>-3</sup>)**

SH, coopn001, nr 0005: NoxM1ThorpeAstley2005(02)Met01\_060401,



**Fig 5.4b M1 Corridor Thorpe Astley/Kirby Muxloe (AQMA 3), Annual average NO<sub>2</sub>(µg m<sup>-3</sup>)**  
(Displayed to highlight location and values of highest concentrations)



## 5.6 IMPROVEMENTS NEEDED IN AIR QUALITY

### 5.6.1 The improvement that is needed – general points

A key step in the Stage 4 Review and Assessment process is to identify the improvements needed in air quality, when there are exceedences of the UK air quality objectives.

An important point to note is that the Local Authority does not need to attempt to improve air quality beyond the air quality objective that is being exceeded. This applies even if that authority has taken a precautionary approach and deliberately set the boundary of their AQMA at, for example, the 36  $\mu\text{g}/\text{m}^3$  contour rather than the 40  $\mu\text{g}/\text{m}^3$  contour, in the case of the annual mean  $\text{NO}_2$  objective.

For example, an AQMA may have been declared for  $\text{NO}_2$ , and for administrative reasons, the boundary of the AQMA may include houses where the concentrations of  $\text{NO}_2$  are not predicted to exceed the annual mean objective of 40  $\mu\text{g}/\text{m}^3$ . Let us say the maximum exceedence of the annual mean  $\text{NO}_2$  objective at a relevant receptor in the AQMA was 43  $\mu\text{g}/\text{m}^3$ . The maximum improvement that would be needed in this example AQMA will therefore be 3  $\mu\text{g}/\text{m}^3$ . In this example, this will mean that some houses in the AQMA will experience concentrations of  $\text{NO}_2$  possibly much lower than the annual mean objective.

### 5.6.2 Areas of predicted exceedence of the air quality objectives considered in this Stage 4 assessment

Blaby District Council identified three AQMAs on the basis of the Stage 3 Review and Assessment where it was considered likely that the annual mean objective for nitrogen dioxide would not be achieved.

Blaby District Council also identified that for AMQA 1 it was considered possible that the hourly mean objective for nitrogen dioxide may not be achieved.

Figures 5.2 – 5.4 show the areas where the modelling has predicted exceedences of the annual mean  $\text{NO}_2$  objective (in 2005). The hourly objective has not been modelled.

### 5.6.3 A5460 Narborough Road South Air Quality Management Area 1

Fig. 5.2 shows the modelled concentrations throughout the Narborough Road South AQMA area. Predicted concentrations for 2005 are generally above the objective in locations within 10m of the road. There are residential properties in the predicted area of exceedence of the objective. Properties closest to and either side of the motorway are likely to be exposed to annual average nitrogen dioxide concentrations in excess of 40  $\mu\text{g m}^{-3}$ . The highest predicted concentration at a building facade is 50  $\mu\text{g m}^{-3}$ . An improvement of 10  $\mu\text{g m}^{-3}$  is required to achieve the objective at all building facades in the area. Blaby District Council needs to ensure there is relevant personal exposure at these building facades. Blaby District Council had concluded in the Stage 3 report that an exceedence of the hourly objective was possible within this AQMA. Leicester Council has not modelled for this objective, but as an exceedence of the annual objective is predicted an exceedence of the hourly is possible.

### 5.6.4 M1 Corridor, Enderby Air Quality Management Area 2

Fig.5.3 shows the modelled concentrations throughout the Enderby AQMA area. Predicted concentrations for 2005 are above the objective in locations within 10m of the road. There are residential properties in the predicted area of exceedence of the objective. Properties closest to and either side of the motorway are likely to be exposed to annual average nitrogen dioxide concentrations in excess of 40  $\mu\text{g m}^{-3}$ . The highest predicted concentration at a building facade is 50  $\mu\text{g m}^{-3}$ . An improvement of 10  $\mu\text{g m}^{-3}$  is required to

achieve the objective at all building facades in the area. Blaby District Council needs to ensure there is relevant personal exposure at these building facades.

### **5.6.5 M1 Corridor Thorpe Astley/Kirby Muxloe Air Quality Management Area 3**

Fig.5.4 shows the modelled concentrations throughout the M1 Corridor Thorpe Astley/Kirby Muxloe AQMA area. Predicted concentrations for 2005 are above the objective in locations within 10m of the road. There are residential properties in the predicted area of exceedence of the objective. Properties closest to and either side of the motorway are likely to be exposed to annual average nitrogen dioxide concentrations in excess of  $40 \mu\text{g m}^{-3}$ . The highest predicted concentration at a building facade is  $62 \mu\text{g m}^{-3}$ . An improvement of  $22 \mu\text{g m}^{-3}$  is required to achieve the objective at all building facades in the area. Blaby District Council needs to ensure there is relevant personal exposure at these building facades.

## **5.7 SOURCE APPORTIONMENT**

Source apportionment is the process whereby the contributions from the sources of a pollutant are determined. In local air quality, the relevant sources could include: traffic; local background; industrial and domestic. Contributions from the different types of vehicles (for example, cars, lorries and buses) can also be considered to highlight which class of vehicle is contributing most to the emissions from traffic. Source apportionment allows the most important source or sources to be identified and options to reduce ambient concentrations of pollutants can then be considered and assessed.

The source apportionment should:

- Confirm that exceedences of  $\text{NO}_2$  are due to road traffic (for Blaby)
- Determine the extent to which different vehicle types are responsible for the emission contributions to  $\text{NO}_2$  within Blaby's AQMAs: this will allow traffic management scenarios to be modelled/tested to reduce the exceedences
- Quantify what proportion of the exceedences of  $\text{NO}_2$  is due to background emissions, or local emissions from busy roads in the local area. This will help determine whether local traffic management measures could have a significant impact on reducing emissions in the area of exceedence, or, whether national measures would be a suitable approach to achieving the air quality objectives

An assessment of the source apportionment has been made (Table 5.3). The site selected for the M1 is in AQMA2, at the nearest house to the point where the M1 crosses the B4114, King Edward Avenue. In all cases traffic is the dominant local source of  $\text{NO}_x$  emission. For Narborough Road South light duty vehicles (LDVs) contribute more than heavy duty vehicles (HDVs), whilst this situation is reversed on the motorway. In all cases there is a reduction in emissions in the period 1996 to 2005 as a result of national and European legislation on fuel and vehicle quality.

**Table 5.7: Preliminary assessment of the contribution of different sources to NOx concentrations in the AQMAs (Blaby Air Quality Action Plan: Consultation Draft Jan 2004)**

<b>M1</b>			
<b>1996</b>	ppb	ug/m-3	%
<b>Background</b>	21.0	39.9	28%
<b>B4114 – LDVs</b>	6.7	12.7	9%
<b>B4114 – HDVs</b>	8.3	15.8	11%
<b>M1 – LDVs</b>	12.0	22.9	16%
<b>M1 – HDVs</b>	26.0	49.3	35%
<b>Totals</b>	74.0	140.6	100%
<b>2005</b>	ppb	ug/m-3	%
<b>Background</b>	15.4	29.3	29%
<b>B4114 – LDVs</b>	2.8	5.4	5%
<b>B4114 – HDVs</b>	7.2	13.6	13%
<b>M1 – LDVs</b>	5.4	10.3	10%
<b>M1 – HDVs</b>	22.6	42.9	42%
<b>Totals</b>	53.4	101.46	100%
<b>Narborough Road South</b>			
<b>1996</b>	ppb	ug/m-3	%
<b>Background</b>	21	39.9	29%
<b>LDVs</b>	45.0	85.6	63%
<b>HDVs</b>	6.0	11.3	8%
<b>Totals</b>	72.0	136.8	100%
<b>2005</b>	ppb	ug/m-3	%
<b>Background</b>	15.4	29.26	48%
<b>LDVs</b>	13.2	25.1	41%
<b>HDVs</b>	3.5	6.7	11%
<b>Totals</b>	32.2	61.1	100%

## **6 Implications of this Stage 4 air quality review and assessment for Blaby**

This section highlights the implications of this Stage 4 assessment for Blaby District Council.

The section explains any changes that may be needed to the current extent of the current Air Quality Management Areas.

### **6.1 CHANGES TO THE AIR QUALITY MANAGEMENT AREA AS A RESULT OF THIS STAGE 4 MODELLING**

Defra and the devolved administrations have specified that the Stage 4 assessment must comment on any changes that might be necessary to the extent of the AQMA as a result of the Stage 4 modelling.

The Diffusion tube monitoring does not predict any exceedence at locations not already contained within AQMAs already designated.

The Stage 4 modelling however shows that the area of potential exceedence of the annual average objective for 2005 extends further along the road links than the areas covered by the existing Air Quality Management Areas, particularly in AQMA 3. The decision to revoke, extend or reduce the area of the AQMAs should consider the uncertainty inherent in the modelling approach used. Given the uncertainty in the modelling, and that a detailed assessment, in round 2, is already underway, it is recommended that this is given further consideration in that further round of assessment, with respect to extension of the Air Quality Management Areas. Consideration should also be given to making an assessment against the hourly objectives.

It is recommended that the diffusion tube surveys continue, with triplicate collocation of diffusion tubes at a continuous monitor. Further detailed assessment of the vicinity of the diffusion tubes will then be possible, taking account of specific local circumstances (bus stops, pedestrian crossings, minor road junctions, traffic queues, domestic heating boilers etc.). It is also recommended that Blaby District Council consider relocating their automatic monitor into one of the AQMA areas close to residential exposure. This would enable measurement to gauge the success of the action plan proposals.

## 7 References

APEG (1997) Source apportionment of airborne particulate matter in the United Kingdom. Report of the Airborne Particles Expert Group.

Broughton, G.F.J., Willis, P.G., Clark, H. and Lampert, J. (2000) Air pollution in the UK: 1997. (Report presents results and information from the UK national automatic Urban Rural and Hydrocarbon monitoring networks. Report by the National Environmental Technology Centre (NETCEN) for the Department of the Environment, Transport and the Regions (DETR). NETCEN report number AEAT-5303. NETCEN, Culham Science Centre, Abingdon, Oxon., OX14 3ED.

Defra (2001) The air quality strategy for England, Scotland, Wales and Northern Ireland. A consultation document on proposals for air quality objectives for air quality objectives for particles, benzene, carbon monoxide and polycyclic hydrocarbons. Published by defra in partnership with the Scottish Executive, The National Assembly for Wales and the Department of the Environment for Northern Ireland.

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DETR (1999b) Road Traffic Statistics: 1999. Table 3.3: Traffic distribution by time of day.

DETR (2000) Concentrations of a range of air pollutants in the UK. See <http://www.aeat.co.uk/netcen/airqual/index.html>

DETR (2000) Review and Assessment: Pollutant Specific Guidance. Part IV of the Environment Act 1995. Local Air Quality Management. LAQM.TG(00) May 2000.

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EA (1998b) Guidance for estimating the air quality impact of stationary sources. Guidance Note 24.

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# Appendix 1

Stage 4 monitoring

## CONTENTS

**BLABY CROFT**

**01 January 2002 to 31 December 2003**

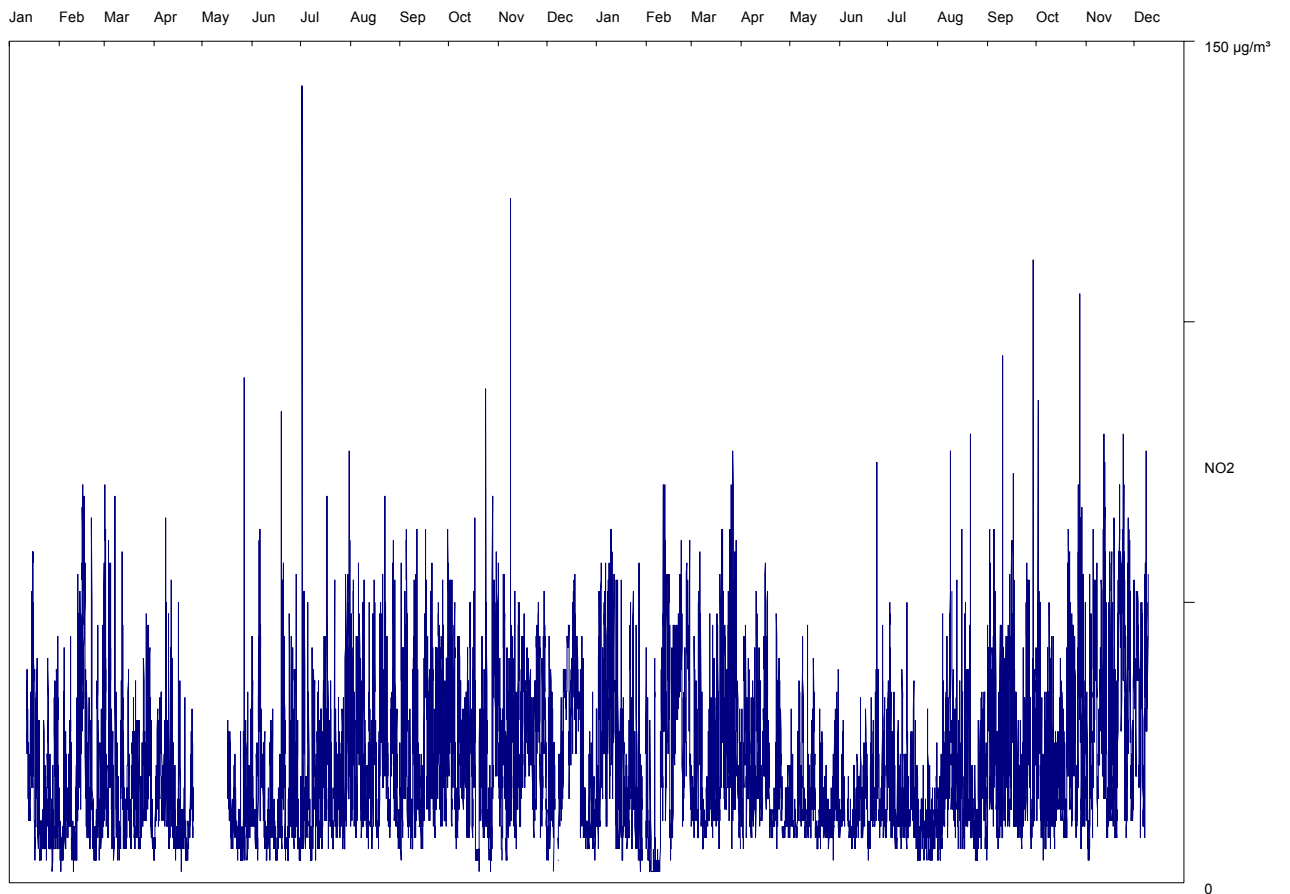
**These data are provisional and may be subject to further quality control**

POLLUTANT	NO <sub>2</sub>
Number Very High	0
Number High	0
Number Moderate	0
Number Low	15993
Maximum hourly mean	142 µg m <sup>-3</sup>
Maximum running 8-hour mean	64 µg m <sup>-3</sup>
Maximum running 24-hour mean	56 µg m <sup>-3</sup>
Maximum daily mean	53 µg m <sup>-3</sup>
Average	20 µg m <sup>-3</sup>
Data capture	91.3 %

All mass units are at 20'C and 1013mb

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

**Blaby Croft Air Monitoring  
Hourly Mean Data for 01 January 2002 to 31 December 2003**



### BLABY HUNCOTE

01 June 2001 to 31 January 2002

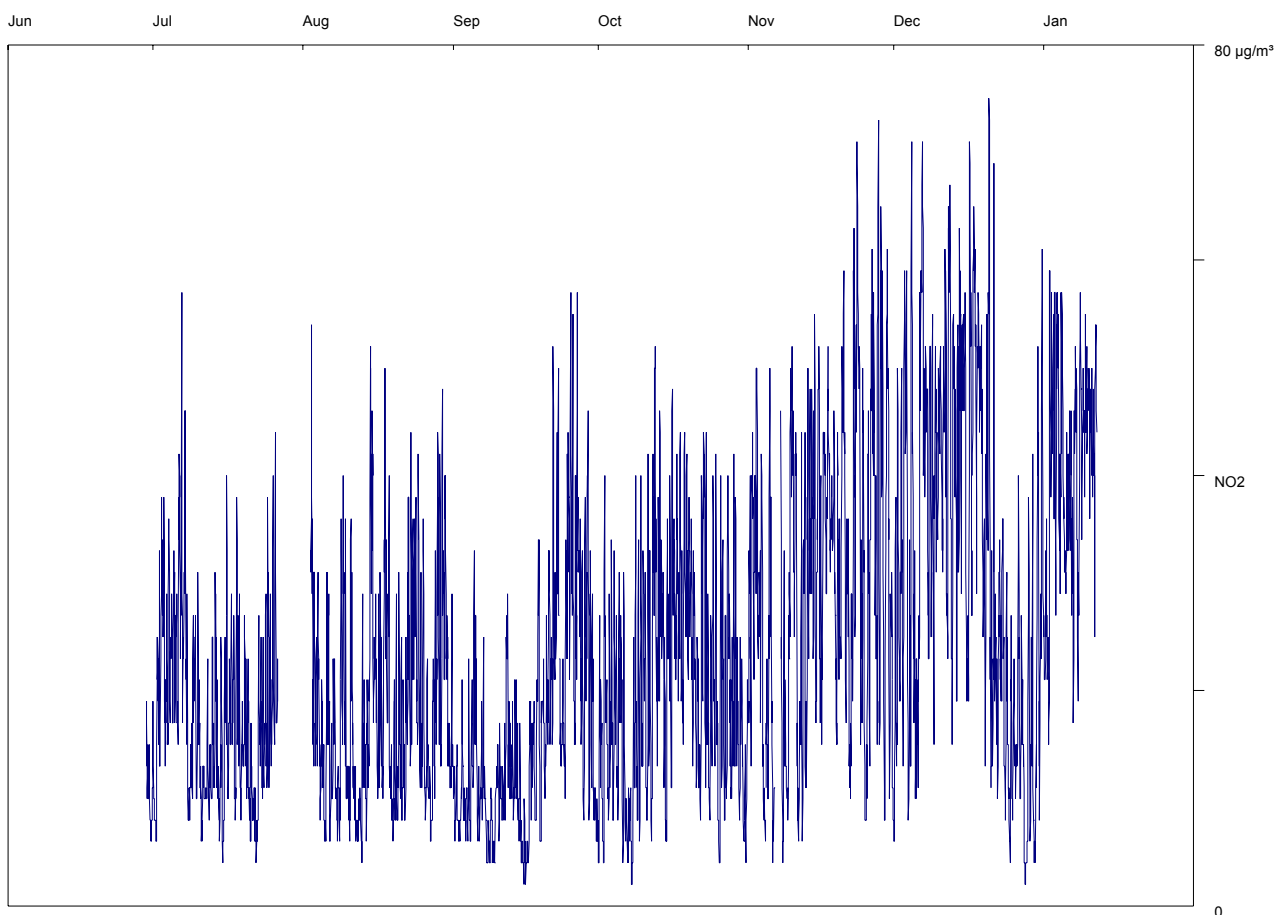
These data are provisional and may be subject to further quality control

POLLUTANT	NO <sub>2</sub>
Number Very High	0
Number High	0
Number Moderate	0
Number Low	4516
Maximum hourly mean	75 µg m <sup>-3</sup>
Maximum running 8-hour mean	66 µg m <sup>-3</sup>
Maximum running 24-hour mean	56 µg m <sup>-3</sup>
Maximum daily mean	51 µg m <sup>-3</sup>
Average	24 µg m <sup>-3</sup>
Data capture	76.8 %

All mass units are at 20°C and 1013mb

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	-	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

#### Blaby Huncote Air Monitoring Hourly Mean Data for 01 June 2001 to 31 January 2002



**BLABY FOSSE PARK  
01 January to 30 June 2001**

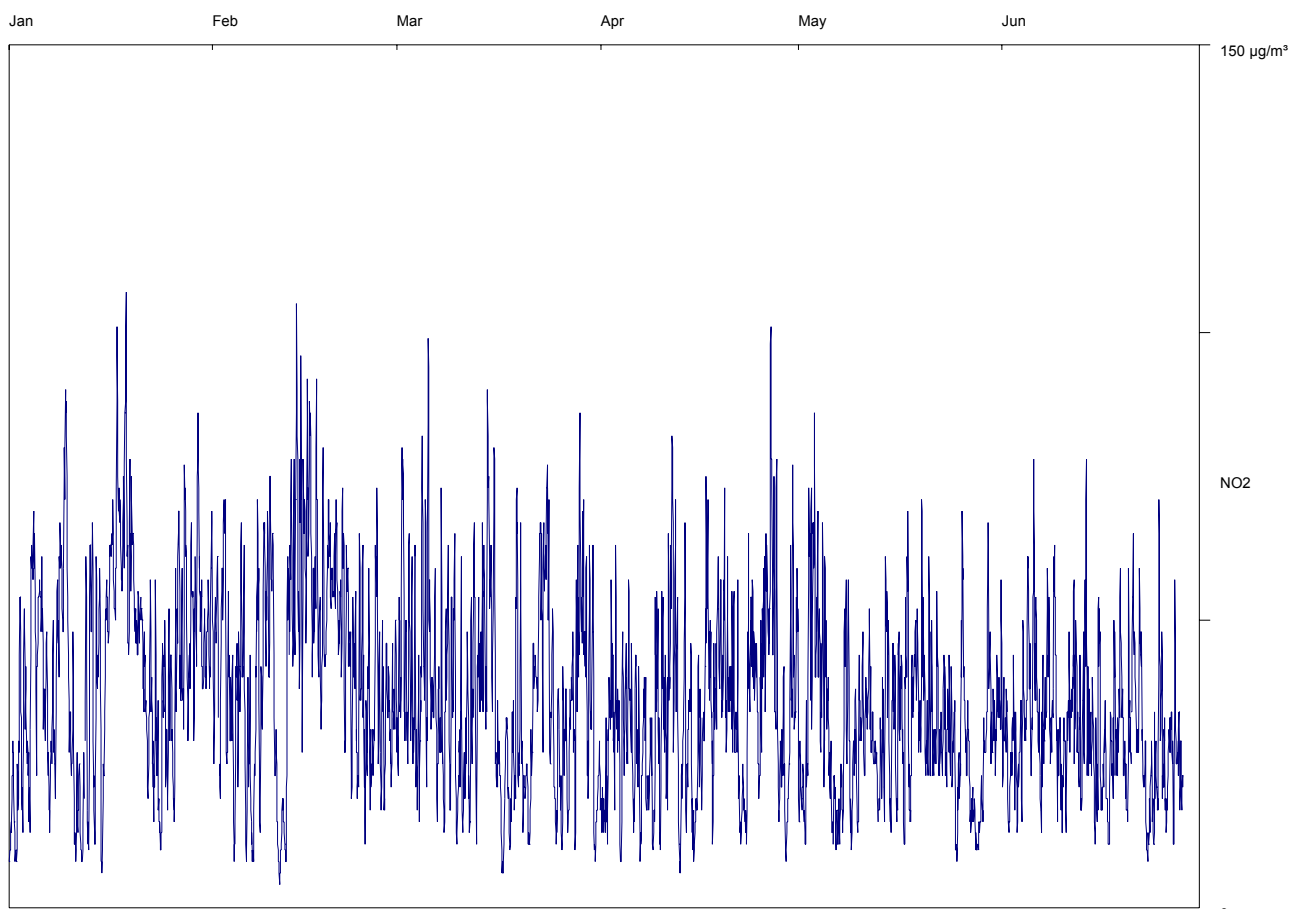
**These data are provisional and may be subject to further quality control**

POLLUTANT	NO <sub>2</sub>
Number Very High	0
Number High	0
Number Moderate	0
Number Low	4281
Maximum hourly mean	107 µg m <sup>-3</sup>
Maximum running 8-hour mean	89 µg m <sup>-3</sup>
Maximum running 24-hour mean	72 µg m <sup>-3</sup>
Maximum daily mean	72 µg m <sup>-3</sup>
Average	37 µg m <sup>-3</sup>
Data capture	98.5 %

All mass units are at 20'C and 1013mb

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	-	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

**Blaby Fosse Park Air Monitoring  
Hourly Mean Data for 01 January to 30 June 2001**



**BLABY BRAUNSTONE TOWN**  
**01 January to 30 November 2000**

These data are provisional and may be subject to further quality control

POLLUTANT	NO <sub>2</sub>
Number Very High	0
Number High	0
Number Moderate	0
Number Low	1390
Maximum hourly mean	86 µg m <sup>-3</sup>
Maximum running 8-hour mean	75 µg m <sup>-3</sup>
Maximum running 24-hour mean	53 µg m <sup>-3</sup>
Maximum daily mean	53 µg m <sup>-3</sup>
Average	32 µg m <sup>-3</sup>
Data capture	17.3 %

All mass units are at 20°C and 1013mb

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

**Blaby Braunstone Town Air Monitoring**  
**Hourly Mean Data for 01 January to 30 November 2000**

