HARBOROUGH DISTRICT COUNCIL

DISTRICT OF HARBOROUGH
RURAL SOUTH LEICESTERSHIRE

AIR QUALITY REVIEW AND ASSESSMENT

Stage 4 Review and Assessment

JUNE 2004

Environmental Services Section
June 2004

CONTENTS

SUMMARY

The Environment Act 1995 introduced a new concept in assessing local air quality. The Government published a National Air Quality Strategy in March 1997, with a revised edition published in January 2000. The national strategy sets out air quality standards and objectives for eight key air pollutants to be achieved between 2003 and 2008. For seven of these pollutants the local authorities were charged with working towards the objectives in a cost effective way. The seven pollutants which fall within the remit of the local authority are Benzene, 1,3-Butadine, Carbon Monoxide, Sulphur Dioxide, Lead, Particulates and Nitrogen Dioxide.

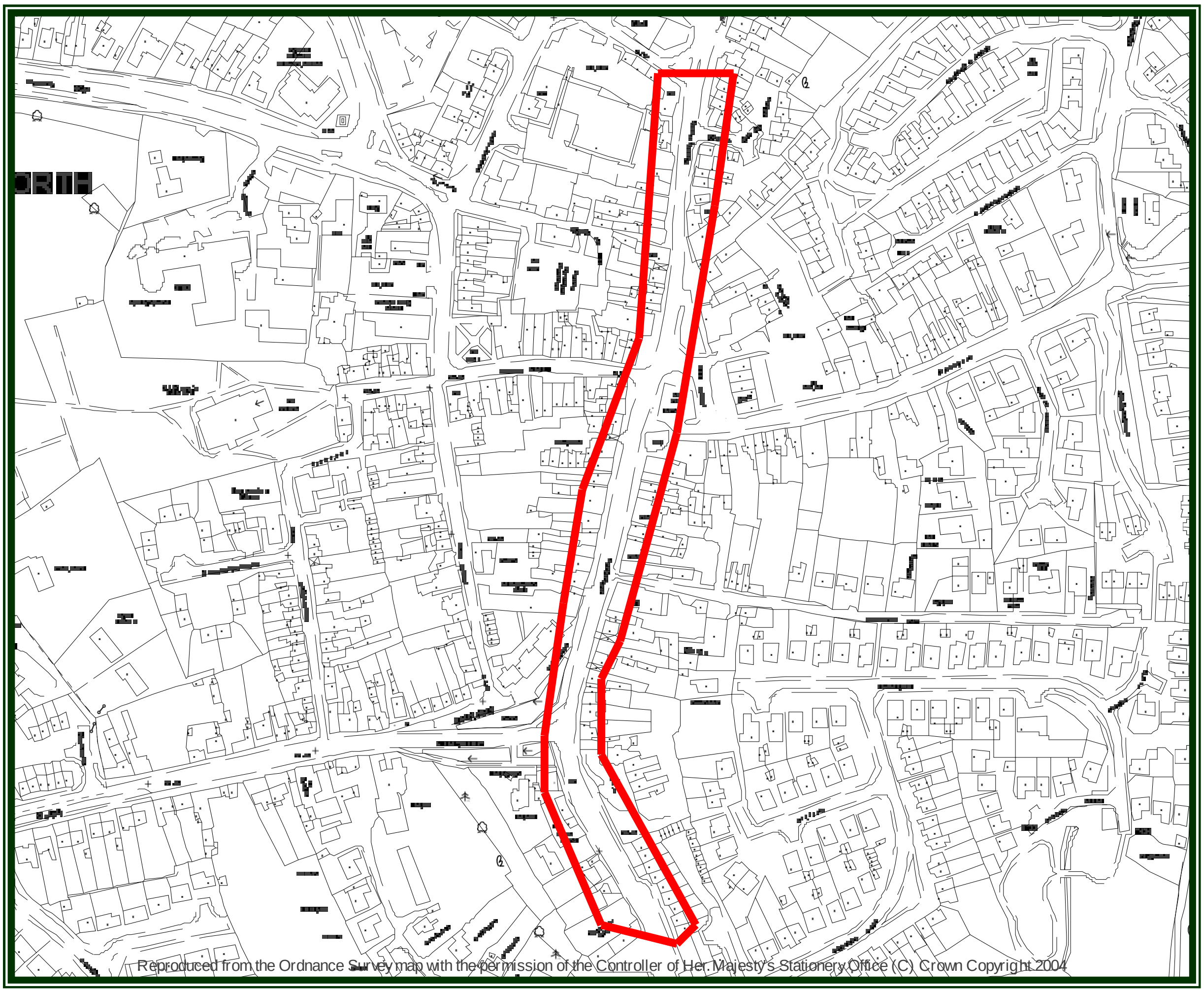
The Review and Assessment of the local air quality takes place over a number of stages. The First Stage Review and Assessment carried out in Harborough district concluded that further investigation would be required for Carbon Monoxide, Lead, Particulates and Nitrogen Dioxide. The Second and Third Stage review concluded that with the exception of Nitrogen Dioxide all of the National Air Quality Objectives would be met within the appropriate time frame. As it was anticipated that the nation objective for Nitrogen Dioxide was unlikely to be met in Lutterworth Town Centre, an Air Quality Management Area was declared in July 2001.

Where an Air Quality Management Area has been declared, a Stage 4 assessment is required to give local authorities the opportunity to supplement any information they have already gathered in their earlier review and assessment work.

The findings of the Stage 4 review confirm that the annual average National Air Quality Objective for Nitrogen Dioxide is unlikely to be achieved. In addition the original Air Quality Management Area was an under estimate of the extent of the area in which the national objectives will not be met. In view of this it is recommended that the existing Air Quality Management Area be extended and varied for Lutterworth town centre.

The proposed revised area is shown on the map in Figure 1

Figure 1 The Proposed Variation to the National Air Quality Management Area for Lutterworth Town Centre.



1. Introduction

1.1 Background

This report has been prepared in accordance with the Environment Act 1995 following the declaration of an Air Quality Management Area (AQMA) in Lutterworth Town Centre in July 2001. It examines in detail the various air pollution sources both within the District and external sources likely to have effect within the AQMA

The aims of the report are:

- To identify improvements needed in concentration of nitrogen dioxide within the Air Quality Management Area.
- To collect and interpret additional data to support the Stage 4 assessment, including traffic flow data
- To consider any recent monitoring undertaken in and around the AQMA.
- To model the concentrations of Nitrogen Dioxide in and around the AQMA
- To carry out a source apportionment exercise to determine the contribution of the various sources of Nitrogen Dioxide to the overall levels.
- To determine the relevance of the extent of the existing AQMA and to consider whether it is necessary to amend or revoke the AQMA in light of the findings of the Stage 4 report.

1.2 The Local Area

Harborough District Council is a diverse, largely rural authority covering approximately 230 square miles of Southern Leicestershire, as shown in figure two. Geographically it is the largest of the Leicestershire districts. Approximately 77,000 people live within the District.

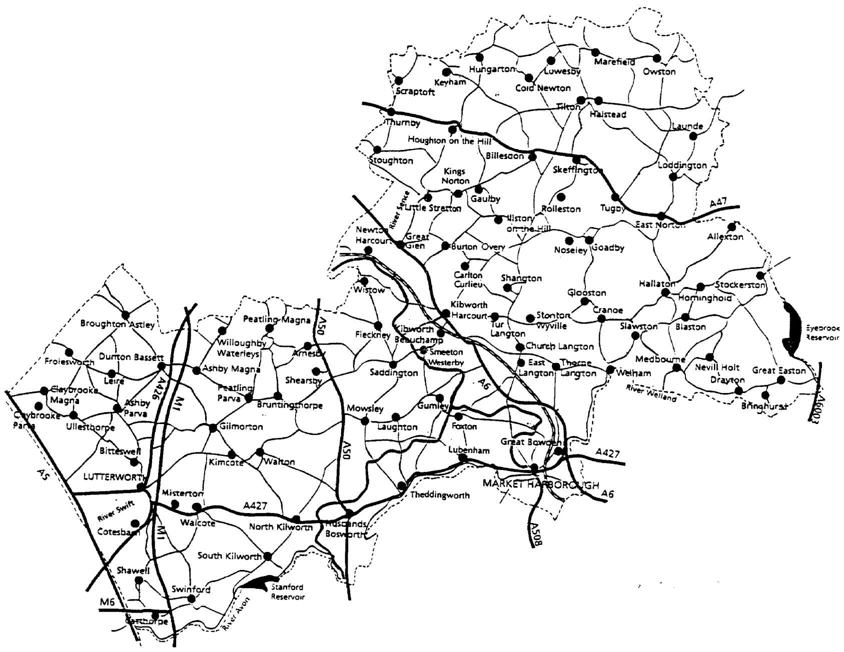
The two major population centres are the market towns of Market Harborough and Lutterworth, providing the main shopping and business services. These two towns, together with the villages of Thurnby, Bushby and Scraptoft adjoining Leicester City, and the villages of Broughton Astley, Great Glen, Kibworth and Fleckney accommodate 67% of the district population. The remaining residents live in villages varying from populations of several hundreds to hamlets comprising of a handful of dwellings.

The District borders on to the suburbs of Leicester to the north, Rutland to the east, Warwickshire to the west and Northamptonshire to the south. The District is dissected by a number of major roads; these include the M1, and a small section of the M6 and the A426 in the west, and the A6, A47 and A50 in the eastern side. These roads are a major part of the East Midlands road network and consequently are heavily used.

The good communication links have encouraged a number of industrial estates to develop; containing medium sized businesses carrying out a range of activities including coating and spraying, moulding, and timber processes. In the south west of the District there is a cluster of mineral activities including sand and gravel extraction, cement batching plants and other associated products

Figure 2

Map of the District



Although agriculture still plays an important role in the local economy, manufacturing and distribution are of ever increasing importance. At the extreme western side of the District is Magna Park, which is a major warehousing and distribution site, covering approximately 400 acres. A number of the major manufacturers within the UK are located on this site and the 24-hour operation results in a great deal of traffic as most of the products are transported by road. Magna Park is located between the M1 and the A5, therefore a majority of the traffic is directed onto these major roads, however the nearby town of Lutterworth is affected by the increase in road traffic.

1.3 The UK National Air Quality Strategy

The Government first published it's National Air Quality Strategy in 1997 with it's primary objective of ensuring that all citizens have access to public spaces without a risk to their health and quality of life, taking into consideration economical and technical practicalities.

Since it's first publication, the National Air Quality Strategy has been reviewed having regard to the findings of the European Union Environment Council of a Common Position on Air Quality Daughter Directive. The proposals for the revised air quality objectives where incorporated into a consultation document "Review of the National Air Quality Strategy" in 1999 and the new national strategy was published in January 2000.

The objectives of the strategy where based on the recommendations made by the Expert Panel on the Air Quality Standards. It should be recognised that the standards only refer to outdoor air quality and do not consider the health effects of indoor pollutants.

The National Air Quality Strategy has set standards and objectives for eight pollutants. The Environment Act 1995 places a requirement on local authorities to periodically review and assess the air quality in their district. The Air Quality Regulations 2000 and (Amendment) Regulations 2002 set out the legal objectives and the timescales by which they should be met. The eighth pollutant, ozone, is transboundary by nature and therefore has not been included in the regulations, however it remains an objective of the National Air Quality Strategy.

Table 1 shows the air quality objectives for the seven pollutants to be considered by the Local Authority as part of the Local Air Quality Management process.

Table 1

Pollutant	**Air Quality Objective Levels**	**Averaging Period**	**Air Quality Objective Dates**
Benzene	16.25 µg/m^3 5µg/m^3	running annual mean Annual mean	31st December 2003 31st December 2010
1,3-Butadiene	2.25 µg/m^3	running annual mean	31st December 2003
Carbon Monoxide CO	11.6 µg/m^3	Maximum daily running 8 hour mean	31st December 2003
Lead Pb	0.5 µg/m^3 0.25 µg/m^3	annual mean annual mean	31st December 2004 31st December 2008
Nitrogen Dioxide NO_2	200 µg/m^3 40 µg/m^3	1hourly mean not to be exceeded 18 times a year annual mean	31st December 2005
PM_{10} (Particulates)	50 µg/m^3 40 µg/m^3	24 hour mean not to be exceeded 35 times a year annual mean	31st December 2004
Sulphur Dioxide SO_2	125 µg/m^3 350 µg/m^3 266 µg/m^3	24 hour mean not to be exceeded 3 times a year 1 hourly mean not to be exceeded 24 times a year 15 minute mean not to be exceeded 35 times a year	31st December 2004 31st December 2004 31st December 2005

1.4 Explanation of the Air Quality Objectives Terminology

A) Averaging Periods

The time taken for exposure to cause adverse health effects varies from pollutant to pollutant.

Some pollutants such as sulphur dioxide can have an effect after as little as 15 minutes or less. Others such as lead have a longer-term cumulative effect. The times over which concentrations should be averaged vary to reflect this.

Evidence suggests that some pollutants, for example nitrogen dioxide have effects after short-term exposure, but that longer-term exposure may also result in an adverse impact on health. In these cases there are two objectives averaged over different time periods to reflect the different effects.

B) Percentage Compliance

For some pollutants, the air quality objectives have been set with relatively short averaging periods. The National Air Quality Strategy recognises that there is always the possibility of occasions when it would not be appropriate to try and achieve 100% compliance with the objective standards.

There will always be short periods of exceedance due to weather conditions or due to events such as Bonfire Night when the levels of Particulates will high.

To overcome these problems the percentile approach has been adopted for certain pollutants.

For example, for Particulates the 90^{th} percentile objective has been adopted. In real terms this means that the standard can be exceeded for approximately 10% of the days in a year. This allows for the daily maxima to exceed the limit value on 35 days in each year before the objective is breached.

C) Running Mean

Pollution levels vary over time and can fluctuate rapidly over short periods. These short-term variations are “smoothed” out by expressing the objective as a running mean over an appropriate time period.

For example, exposure for benzene should be kept as low as practical and the problems occur with exposure over long-term, therefore the Objective for benzene has been set as a running annual mean based on hourly values.

D) Exposure

The purpose of the National Air Quality Strategy was to develop Objectives that would protect human health. Consequently any exceedance of the Objective would only warrant further investigation and action where they occur at outdoor locations where members of the public might be regularly present for periods equal to the averaging time for the particular pollutant in question.

If the Objective for the relevant pollutant has a short averaging time, such as one of the Objectives for Nitrogen Dioxide, the air quality assessment would focus on any near-ground, outdoor location. This is the location where members of the public may be exposed to pollution levels that might exceed the Objective level.

Where the Objective level for a pollutant is based on a longer averaging time, the assessment will only look at locations such as housing, schools, hospitals or residential care establishments. This is because it would be expected that members of the public have the potential to be spent periods equivalent to the averaging time

1.5 The Phased Approach to Air Quality.

There is a requirement for all Local Authorities to assess the existing local air quality and to predict future conditions against the National Air Quality Objective.

The Review and Assessment takes place over several phases. The First Stage is a desktop analysis of each of the pollutants. Where this assessment indicated that the air quality objectives would not be met by national policy alone, the Local Authority is required to undertake a more detailed Stage 2 or Stage 3 assessment for the pollutants where the objective is not likely to be met. If the more detailed assessment confirms the findings of the earlier reviews then an Air Quality Management Area (AQMA) may be declared.

Following the declaration of the AQMA the Local Authority is required to carry out a further Stage 4 review to supplement the information previously collated from the earlier reviews and confirm the validity of the AQMA.

This information collected for the Stage 4 should give the Local Authority a clearer picture of the sources of the pollutants and should highlight the areas where the Local Authority could have influence and control. This allows the Local Authority to draw up an Action Plan that would provide an effective balance between the work of the Local Authority and other sectors. It would allow for a targeted approach to provide a cost effective and proportionate improvement in the local air quality. The Action Plan will include estimates of the costs and feasibility of different options available.

Chapter 2 The Stage 4 Review and Assessment

2.1 Introduction

Where an Air Quality Management Area has been declared the Environment Act 1995 requires local authorities to undertake a further Stage 4 assessment.

The Stage 4 assessment is an opportunity for the Local Authority to supplement the information they already have on the local air pollution climate and to re-evaluate and check the existing AQMA.

A Stage 4 review should consider the following areas –

- **Provide a summary of the Stage 3 assessment.**
- **Consider any further monitoring carried out since the declaration of the original AQMA**
- **Confirm the extent of the original Air Quality Management Area**
- **Carry out further modelling work, incorporating any changes to the emission factors, to predict the air quality for the objective year.**
- **Assess the improvements needed to deliver the National Air Quality Objectives within the management area.**
- **Consider any changes that are required to the existing AQMA.**

The Stage 4 report will only consider Nitrogen Dioxide, as this was the only pollutant where it was felt that the National Air Quality Objective would not be met.

2.2 Summary of the Stage 3 Review and Assessment

Following the First Stage review and assessment it was concluded that a Stage 2 and Stage 3 review would be required for carbon monoxide, lead, particulates and nitrogen dioxide.

A more detailed review was carried out on these pollutants and it was confirmed that with the exception of Nitrogen Dioxide all of the pollutants would meet the National Air Quality Objective.

However it was anticipated that the objective for Nitrogen Dioxide would not be met in the Market Street area of Lutterworth Town Centre. Consequently in July 2001 an AQMA was declared for this area. The extent of the AQMA can be found in appendix 1.

2.3 Further Monitoring Carried out Since the Stage 3 Assessment.

Following the Stage 3 review and assessment, a further diffusion tube was located outside of the AQMA in an attempt to assess whether the boundary of the AQMA was correct. In addition the continuous real time monitor remained within the AQMA and a diffusion tube was co-located with the monitor to give an indication of the level of agreement between the two methods. The location of the monitoring equipment location within and around the AQMA can be found in Appendix 2.

2.4 QA/QC of Monitoring Data

2.4(i) The Continuous Monitor

There is a service agreement in place with Casella ETI Data Services for the real time monitor. Where it appears that the analyser is not working correctly, an engineer visits the monitor at the earliest opportunity to minimise data loss. In addition an engineer from Casella services the system every six months and a full calibration of the system is undertaken along with preventative maintenance checks.

Data from the analyser is stored on the logger as “raw” or “uncorrected” data, therefore data needs to be corrected or “validated”. To validate the data, the analyser needs to be checked against a reference standard of “zero” air and “span” gas. The analyser performs an automatic calibration process to check the instrument performance by introducing a high concentration of NO gas. The daily calibration check, produces an actual zero response and a span response value, which is stored in a calibration, file on the logger. The site is visited on a regular basis and a manual calibration is undertaken and the filters are changed in accordance with the manufacturer’s specification.

2.4(ii) Diffusion Tubes

These are a simple and cost effective method of screening air quality in an area and they give a good general indication of average pollution concentrations. Their major use is to compare levels against the annual mean objective level.

The diffusion tubes are sent to Casella CRE Air. This laboratory has a defined quality system, which forms part of the UKAS accreditation system. The tubes are prepared by spiking with 10% TEA in water.

The laboratory takes part in the NO_2 network field inter-comparison run by the Health and Safety Laboratory (HSL). Full documentation on the quality control and calibration system can be found in Appendix 3

There are two diffusion tubes in Lutterworth, one falls within the AQMA and is collocated with the automatic analyser. The second tube falls outside the AQMA and was installed to give an indication as to whether the extent of the

AQMA was sufficient. The raw data for all of the diffusion tubes in the area can be found in Appendix 4

It is recognised that there are a number of ways that the bias in diffusion tubes can be corrected. The bias is the amount that the diffusion tube either over or under reads the levels of the pollutant it is measuring. Part IV of the Environment Act 1995 – Local Air Quality Management, Technical Guidance LAQM.TG (O3) makes provision for the calculation of a bias correction factor for diffusion tube results, from co-location studies where diffusion tubes are collated with an automatic chemiluminescence analyser. The Laboratory used for the preparation of the diffusion tubes has a bias adjustment figure of 0.94

The bias adjustment factor "A" is the ratio of the automatic analyser result to the collocated diffusion tube result is calculated by:

Bias adjustment A = <u>Mean annual chemiluminescence concentration</u>
Mean annual diffusion tube concentration

The diffusion tube within the AQMA in Lutterworth town centre is located along side the real time analyser. LAQM.TG(03) advises that the bias adjustment factor must be based on a minimum of 9 months collocation study. The collocated diffusion tube has been sited alongside the analyser for several years. However the data from the real time monitor has only been validated since July 2002. Therefore the collocation study was based on information collected during the period January 2003 to December 2003.

The results of the real time monitor can be found in Appendix 5 and Appendix 6

The collocated diffusion tube was Tube 2 and the average result from this tube was 45µg/m².

The bias adjustment for Nitrogen Dioxide based on results of the collocation study –

Bias Adjustment A = <u>Mean annual chemiluminescence concentration</u>
Mean annual diffusion tube concentration

Bias adjustment A = $\frac{53.4}{45}$

A = 1.187

From the collocation study it has been calculated that the annual mean diffusion tube results have to be multiplied by 1.187 to allow for the under reading of the tubes. The adjusted results can be found in Table 2

The Technical Guidance LAQM.TG(03) describes how measured data can be adjusted for the relevant year. Correction factors have been derived from the estimated reduction in road traffic emissions in future years.

Correction Factor = Measured Data X (Predicted Year correction/ Measures Year correction)

Correction Factor = Measured Data X (0.892/0.941)

Correction Factor = Measured Data X 0.839***

The adjusted measured concentrations of Nitrogen Dioxide have been projected forward to 2005 using the correction factor determined above. The results can be found in Table 2

Table 2

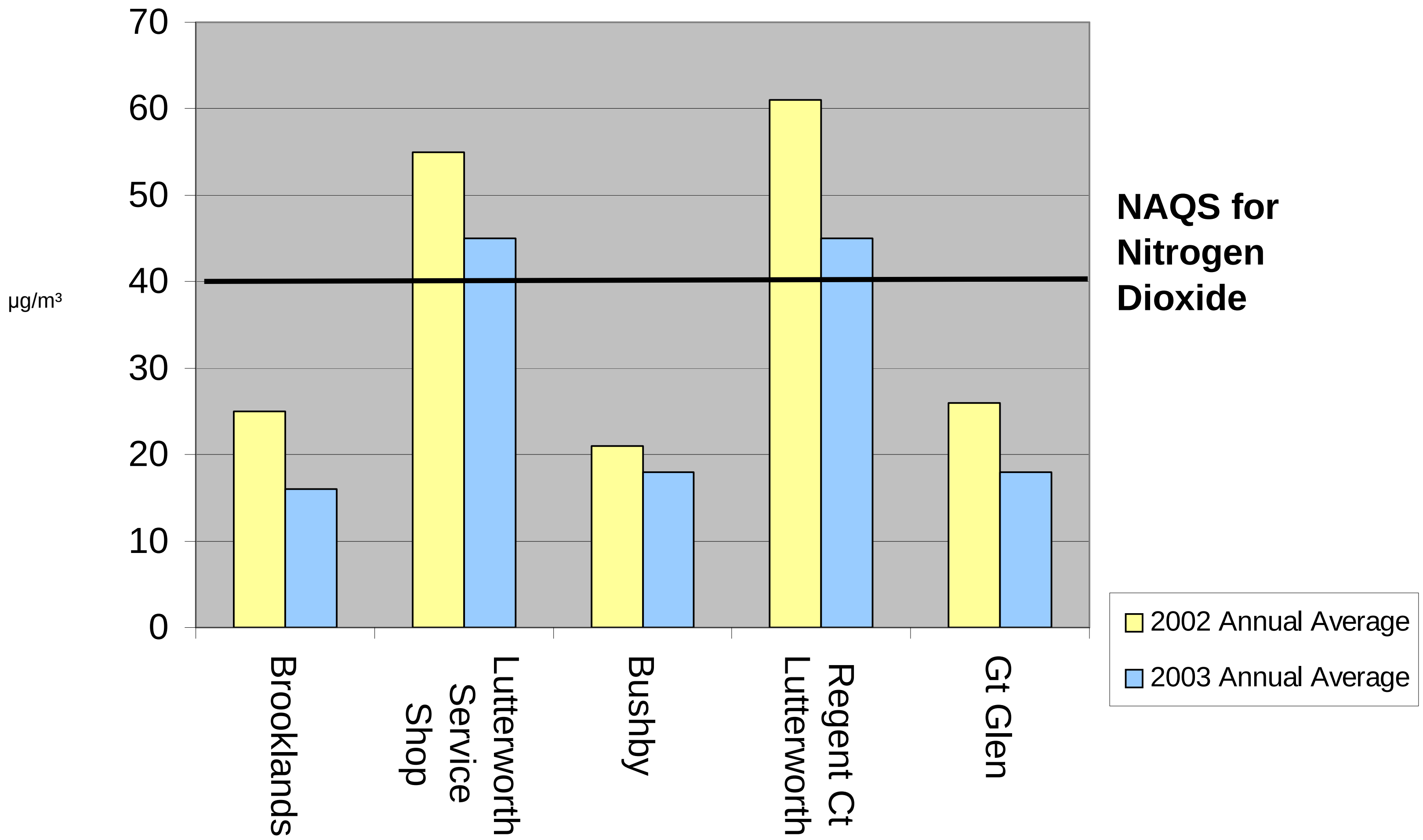
The Bias adjusted annual averages for Nitrogen Dioxide for 2003 and predicted levels for 2005

Tube Number	**Location**	**Bias adjusted results for 2003 µg/m³**	**Predicted levels for 2005 µg/m³**
1	Brooklands	18.99	15.93
2	Lutterworth Service Shop	53.41	44.81
3	Bushby	21.36	17.93
4	Regent Ct Lutterworth	60.53	50.79
5	Great Glen	22.55	18.92

Based on the predictions from the monitoring data the annual average Nitrogen Dioxide level in 2005 is likely to be exceeded at two locations. The monitoring location at the Lutterworth Service Shop falls within the existing AQMA whilst the location at Regent's Court is not currently included in the AQMA.

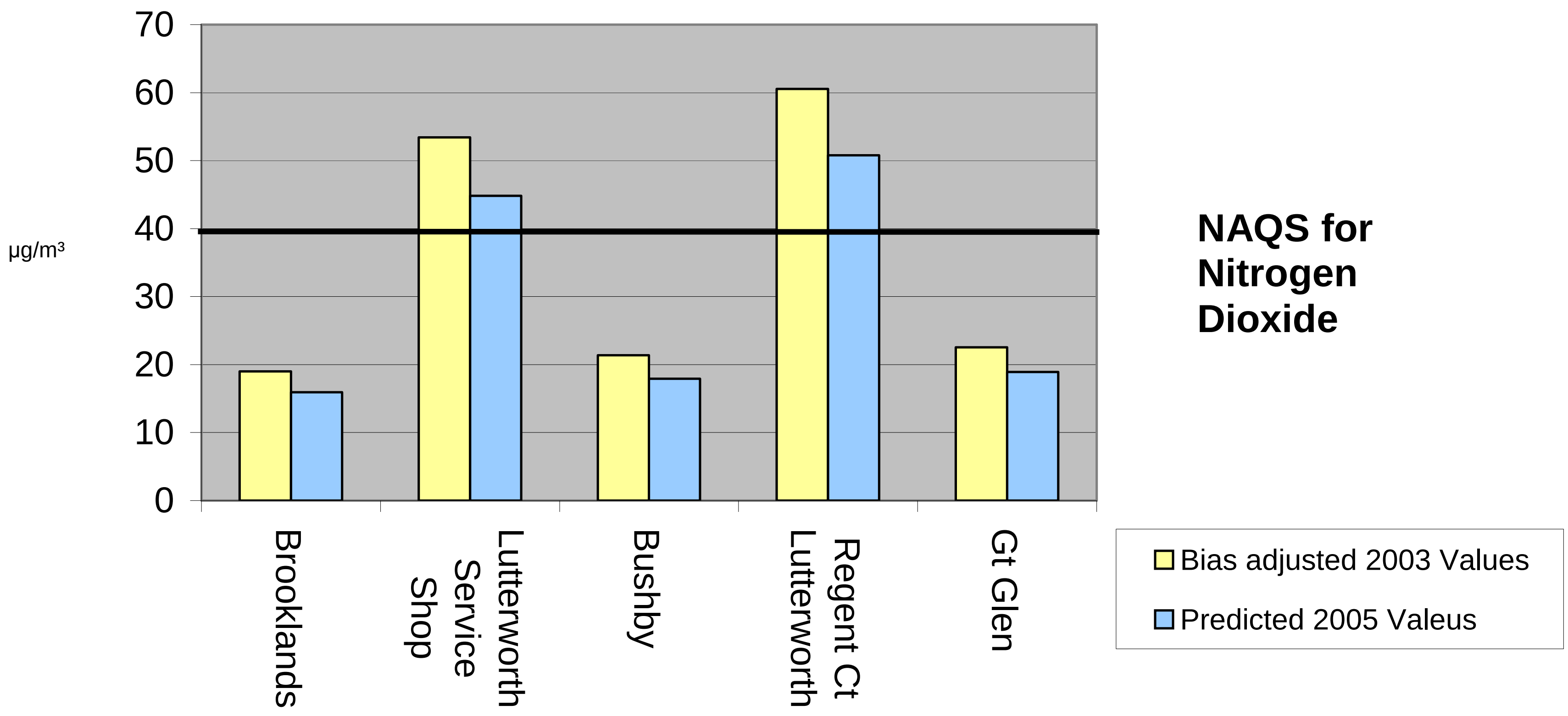
Chart 1 shows the uncorrected results of the Nitrogen Dioxide diffusion tube survey for 2002 and 2003. In addition Chart 2 highlights the effect of carrying out the bias adjustment factor for the 2003 results and the predicted corrected levels for 2005.

Chart 1 **Uncorrected Nitrogen Dioxide Diffusion Tube Data for 2002 and 2003**



The National Air Quality Objective for the Annual Average Nitrogen Dioxide level is 40µg/m³ for 2005

Chart 2 **Bias adjusted Nitrogen Dioxide Values for 2003 and 2005**



The National Air Quality Objective for the Annual Average Nitrogen Dioxide level is 40µg/m³ for 2005

Chapter 3 Dispersion Modelling

3.1 Introduction

Sophisticated equipment used for measuring pollutants is very expensive to acquire and to run. Consequently the number of places where data can be collected is often restricted. In addition even sophisticated pieces of equipment can only give a snap shot of the levels of pollution at a specific location and at a specific time. In an attempt to over come this there have been a number of air quality models developed, ranging from simple spreadsheets to complex computer based dispersion models. They provide a means to predict air pollution concentrations based on information from local emissions and likely atmospheric conditions.

3.2 Modelling Methodology

Harborough District Council commissioned Leicester City Council to carry out modelling work to form part of the Stage 4 assessment. The model used was the AIRVIRO Version 2.4.

AIRVIRO is a dispersion model, originally developed by INDIC, but now distributed, supported and further developed by the Swedish Meteorological and Hydrological Institute (SMHI). The model is capable of grid, gaussian or canyon dispersion calculations, however for the purpose of this report, the gaussian dispersion calculation method was used. Dispersion calculations are predicted using meteorological data collected from the Leicester meteorological mast together with data from the emissions database. Emission sources for modelling using AIRVIRO are defined as point (e.g. industrial and commercial buildings), line (roads) or area (residential estates or large industrial locations) sources.

3.3 Model Input

The model includes several databases, each of which contain detail of emissions from the various sources within the database. Most databases include source and emission details from a specific year using particular emission factors. The emission factors used for this model were taken from AEA and are 2005 predictions made in 2002.

The local emissions inventory that was compiled as part of the Stage 1 Review and Assessment for Harborough District Council did not identify any point sources that had the potential to effect the local levels of Nitrogen Dioxide. A review of the assessments carried out by neighbouring authorities did not identify any potential point sources of Nitrogen Dioxide.

AIRVIRO uses hourly emissions for each road link in its dispersion calculations. Hourly traffic flows are derived from daily average flows by applying the known flow pattern for the particular road type used to classify the link in question. Hourly flows are multiplied by a pollutant specific emission factor for each vehicle type included in the model database, to obtain an emission rate at different speeds. Information on traffic flows were obtained from the Leicestershire County Council and details of the break down of traffic flows and type (including traffic count points) used in the model can be found in Appendix 7

The Government and Devolved Administrations have recently released new road emission factors. These factors reflect the higher than expected NOx emissions from road traffic in future years. These revised road emission factors have been used for this model run.

3.4 Meteorological Data.

The meteorological data used for this model run was taken from the data collected by the Leicester Meteorological Mast. This mast is located on a large open traffic island in Leicester (OS no. 5583 0638). The mast was installed in 1996 specifically to collect data to be used in the AIRVIRO model. For the purpose of this model run data collected during 2001 was used.

The following data is retrieved from the meteorological mast by AIRVIRO every 15 minutes.

ID number
Year
Julian day
Time
Absolute temperature at 8m
Absolute temperature at 2m
Difference between temperatures at 8m and 2m
Wind speed at 10m
Wind direction
Standard wind direction
Standard wind speed
Standard vertical wind
Maximum wind speed integrated over 30 minutes

3.5 The Treatment of Atmospheric Chemistry by the Model

Nitrogen Oxides are formed during high temperature combustion processes from the oxidation of Nitrogen in air or fuel. The major oxides to come out of these reactions are Nitric Oxide and Nitrogen Dioxide. For AIRVIRO to produce a result in Nitrogen Dioxide, a conversion factor must be included in the model as emissions in the database are in total oxides of nitrogen. The method used to convert NOx emissions into pollutant values in NO2 is the Derwent-Middleton Correlation. When using the equation, output concentrations of NO2 are calculated from ‘raw’ NOx emissions. The concentration of NO2 is calculated using the following, where concentrations are hourly averages in ppb.

$[NO_2] = 2.166-[NOx(1.236-3.348A + 1.933A^2 - 0.326A^3)]$

Where A = log10(NOx)

This equation is valid in the range of 9ppb to 1141.5ppb (or 17µg/m² - 2180µg/m²).

3.6 Background Calculations

Before the model converts the results from NOx to Nitrogen Dioxide, it is necessary to include a suitable background level. Following discussions with the monitoring help line it was felt that the most appropriate source of background data was from the AURN monitoring station at Harwell in Oxfordshire. This site was chosen because it was felt that the data from the monitoring location was of good quality and there was sufficient data capture. A background value of 25 µg/m² NOx was used for this model run

3.7 Validation Methodology

The validation methodology was taken from “Air Quality Management Areas: Turning Reviews into Action” published by the NSCA. The Technical Guidance LAQM.TG(03) does include alternative methods to use for validation.

It was felt that the unverified data from the real time monitor at Lutterworth was not sufficiently accurate for the model using the meteorological data for 2001. Consequently the data from the monitoring station in Leicester were used. 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. Following the approach outlined in the 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 measures values. By plotting measured and corrected-modelled value, 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 to give a better fit between modelled and measured data.

In addition to the systematic error described above, there are still further uncertainties of the results that can arise from random errors, and inaccuracies or assumptions made within the input of data. These are errors that cannot be readily quantified.

Local Authorities should be aware of these additional uncertainties when interpreting the results of any dispersion calculation. They would not be expected to make further adjustments to the model output however these uncertainties are useful in assisting the authority in its decision as to the extent of the boundary of the AQMA.

There is a recommended uncertainty on +/- 2 standard deviations in the model results. For the results of the AIRVIRO model this is an uncertainty of +/- 2µg/m². Thus using this methodology, modelled values of less than 38µg/m² are very unlikely to exceed the National Air Quality Objective of 40µg/m², values between 38 and 42µg/m² may exceed the objective, and values greater than 42µg/m² are very likely to exceed the objective. The NSCA methodology recommends that AQMA's include the uncertainty region and predicted values above 38µg/m² should be considered as a predicted exceedance.

3.8 Modelling the Stage 4 Assessment

The Air Quality Management Area in Lutterworth was declared based on predicted levels from the local real time monitoring station and it was determined that the national air quality objective for the annual average Nitrogen Dioxide level was unlikely to be achieved by 2005. This was based on the contribution of Nitrogen Dioxide from traffic rather than other emission sources.

As the AQMA was declared based on the contribution from traffic, the model used for the Stage 4 assessment was based predominately on traffic information. The model required information in the form of an average annual daily flow, incorporating average speed and a percentage breakdown of traffic types. In addition time varying emission factors were determined to take into account the varying traffic flows of the day. Traffic information was collated using information provided by Leicestershire County Council. The daily traffic flow information was based on counts carried out during the period of 7am and 7pm. For the purpose of the model, a 24-hour count was required consequently assumptions were made for the time period falling outside the scope of the actual count. These assumptions were made based on local knowledge of road use.

Whilst the information provided by the County Council did not include traffic speed information, it was presumed that the speed limit was the average speed. The model does not take congestion into account during its predictions.

Appendix 7 shows the location and traffic count data used for the purpose of this model.

3.8 Modelling Results for the Air Quality Management Area

The modelling carried out as part of the Stage 4 assessment confirmed the findings of the Stage 3 Review and Assessment. It was concluded the National Air Quality Objective for the annual average of Nitrogen Dioxide will be exceeded in the Air Quality Management Area in Lutterworth. These results were in line with the predicted levels from the monitoring station and the diffusion tubes.

In addition, the model confirmed that the beyond the extent of the current air quality management area, the air quality is unlikely to meet the National Air Quality Standard for the annual average of Nitrogen Dioxide.

It is anticipated that the predicted area of exceedance is likely to follow the major road route through Lutterworth, running from the bottom of High Street up to and including the existing AQMA at Market Street.

The results of the modelling carried out are shown in Fig 3.1

The model also highlights the M1 that runs to the East of the Town. However the Stage 3 review confirmed that there were no significant receptors in close proximity to the motorway, consequently this area has been disregarded with regards to the declaration of an AQMA.

3.10 Hourly Objective For Nitrogen Dioxide.

The National Air Quality Objective for the hourly objective for Nitrogen Dioxide has been set at 200µg/m³ not to be exceeded 18 times in any 12-month period. . This equates to the 99.8th percentile of the hourly mean. Guidance suggests that Local Authorities could reliably estimate the 1-hour objective by multiplying the annual average by 3.5.

Using this estimation the calculated hourly objective for the bias adjusted 2003 values is 186.95 µg/m³. This indicated that the 1-hour objective for Nitrogen Dioxide would not be exceeded. This is confirmed by the results of the real time monitor (see appendix 5 and 6). This demonstrates that there were no exceedances of the 1-hour objective for 2003.

Fig3.1

Lutterworth centre

Annual average N02, Met year 2001, 2005 database (emission factors released 2002)

Includes background and correction factor.

(background added as NOx before converting total values to NO2)

Chapter 4 Sources of Nitrogen Dioxide and Their Apportionment

4.1 Source Apportionment

Source apportionment is the process whereby the various contributions of the relevant pollutant are determined. For Nitrogen Dioxide the relevant sources could be traffic, local background and industrial processes. Contributions from the various traffic types (e.g. cars, lorries and buses etc.) are considered to determine which class of vehicle is contributing the largest amount of the pollutant. By carrying out this assessment, the local authority can identify the most important source or sources of the pollutant and determine the most appropriate options to reduce the ambient pollution concentrations.

As part of the Stage 3 Review and Assessment for Harborough District, a detailed emissions inventory was complied. This included information on known industrial processes and road networks. As there have been no significant changes that are likely to affect the Air Quality Management Area in Lutterworth, it was decided not to repeat this exercise. Full details of the emissions inventory can be found in Appendix 1 and 2 of the Stage 3 Review and Assessment document 2000.

Nitrogen dioxide (NO2) and nitric oxide (NO) are both oxides of nitrogen and are known collectively as nitrogen oxides (NOx). All combustion processes produce NOx, mainly in the form of nitric oxide, which reacts with ozone in the atmosphere to produce nitrogen dioxide.

The principal source of nitrogen dioxide emissions is road transport, which nationally accounted for 49% of the total UK sources in 2000. The exact contribution from road traffic to the over all levels of nitrogen dioxide in Harborough district cannot be accurately calculated. However based on the information collated as part of the emissions inventory, in the absence of any other significant industrial source of nitrogen dioxide, it could reasonably be determined that the principal source of this pollutant in Lutterworth is from road transport.

It is possible to break down the relative proportion of the vehicle types within the fleet and this information is detailed in table 3 The reference to the count location points can be found in Appendix 6.

Table 3

	Classification Breakdown at Various Count Location Points (%)				
Vehicle type	**Location 1**	**Location 2**	**Location 3**	**Location 4**	**Average**
Cars	76	67	89	70	76
LGV	13	13	8	11	12
Rigid HGV	7	7	1	6	6
Artic HGV	3	12	0	3	5
Buses	1	1	2	1	1

This is a very basic source apportionment, however it provides an indication of the traffic fleet that would be affecting the levels of Nitrogen Dioxide within the AQMA.

It is clear from this table that the largest proportion of vehicles is made up of cars and light goods vehicles. However it is recognised that buses and HGV's do have a larger impact regarding adverse air quality.

In order that the most appropriate options are identified in the Action Plan it is necessary to determine the amount of reduction of Nitrogen Dioxide required in order to achieve the National Air Quality Objective.

The predicted 2005 levels for the diffusion tube at Regent's Court in Lutterworth have been used in this assessment as this represents the "worst case" situation. The predicted 2005 figure from this site was 50.79 µg/m³. Consequently the improvement required to achieve the National Air Quality Objective would be:

Predicted Level – Objective Level = Required Reduction

50.79 – 40.00 = 10.79 µg/m³

Or expressed as a percentage:

$$\frac{\textbf{Required Reduction}}{\textbf{Predicted Level}} \times 100$$

$$\frac{10.79 \times 100}{50.79} = 21.24\%$$

21.24% improvement in the levels of Nitrogen Dioxide is required in order that the National Air Quality Objective will be met.

It must be remembered that the predicted 2005 result includes a predicted background NO2 value of 28.3 µg/m³. The background concentration value is obtained from the air quality archives web site. (www.airquality.co.uk)

Using this background figure it is possible to calculate the percentage contribution of the road traffic to the overall NO2 levels within the AQMA in 2005

Road Traffic : Background concentrations

50.79 µg/m³ ; 28.3 µg/m³ or 44.3% ; 55.7%

Consequently 55.7% of the predicted total Nitrogen Dioxide levels for 2005 will be from background or ambient sources, of which Harborough District Council will have little control. It is worth noting that any national developments with regards to technological improvements will have significant effects on the ambient Nitrogen Dioxide levels for 2005 and beyond.
In addition to the technological improvements, the Governments 10 year transport plan "Transport 2010 – The Ten Year Plan" was published in July 2000. This document set out the national policy for the Government to deliver a quicker, safer, more reliable and environmentally friendly transport system for the UK. As a result of this document Multi-Modal Studies were undertaken were undertaken of the exiting traffic network. One of these studies was carried out to determine to North/South movements long the M1 corridor in the East Midlands.

As a result of this Multi-Modal study, the Transport Secretary announced a billion pound package of improvements in December 2002. The package of improvements for the M1 includes widening, junction improvements and providing climber lanes. These improvements are likely to improve the ambient air quality, which is then likely to have a knock on improvement in the air quality within Lutterworth and the surrounding area.

44.3% of the predicted levels of Nitrogen Dioxide will come from road traffic. The relative contribution from each vehicle type can be broken down using information from the National Emissions Inventory "Emission Factor Database". Table 4 shows what the percentage contribution is from each vehicle type.

Table 4

Vehicle Type	**% contribution of NOx (g/vehicle/km)**
Cars - petrol	2.2
Cars - diesel	1.1
Rigid HGV's	20.9
Artic HGV's	41.8
Buses	34

From this information it is clear that the largest proportion of vehicles in Lutterworth is made up of cars and light vehicles. However buses and HGV's are considered to be significantly more polluting when it comes to NOx emissions. Any options considered in the Action Plan will have to address all forms of transport, however it should be the aim to concentrate on areas that are the most polluting.

4.2 Summary of the Source Apportionment

- It is anticipated that the highest percentage of Nitrogen Dioxide in 2005 will come from background sources which Harborough District Council will little influence over

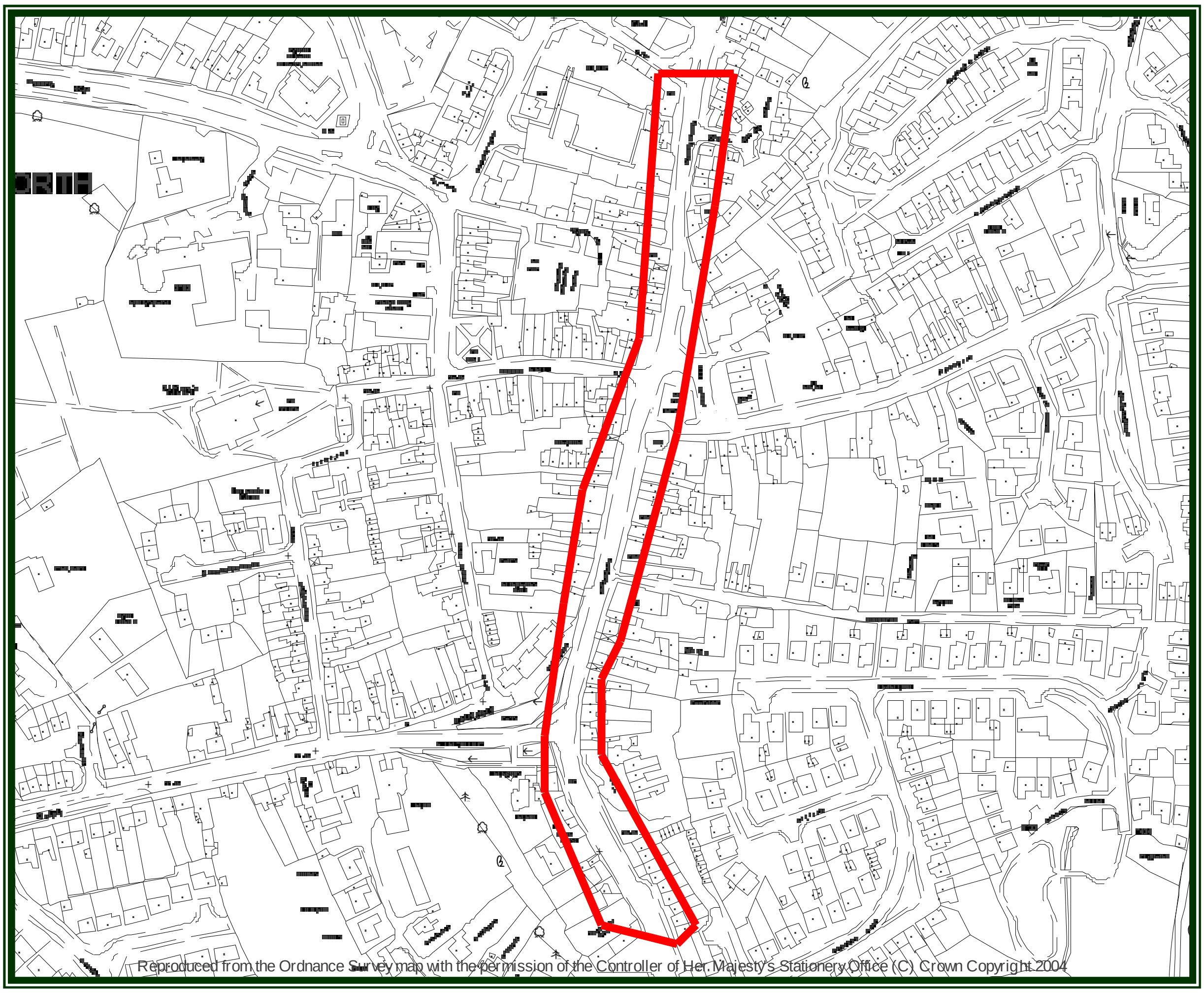
- Of the remaining Nitrogen Dioxide levels, the primary source in Lutterworth will be from road traffic.

Chapter 5 Conclusions of the Stage 4 Review and Assessment.

The policy guidance stipulates that the Stage 4 Assessment must comment on any changes that might be necessary to the existing AQMA following the completion of the review.

As a result of the Stage 4 review it is proposed that the existing AQMA is extended to incorporate the lower end of High Street in Lutterworth. The extent of the proposed AQMA is detailed in Figure 5.1

Figure 5.1 Proposed Amended Air Quality Management Area



Chapter 6 What Happens Next?

Where it is anticipated that the National Air Quality Objectives will not be met by the appropriate time scale it is necessary for the local authority to declare an Air Quality Management Area. Or in light of further investigation they may amend an existing AQMA. Following this action the local authority must develop an Air Quality Action Plan (AQAP). This plan provides the mechanism by which the local authority, in collaboration with national agencies and others, will state their intentions for working towards the air quality objectives.

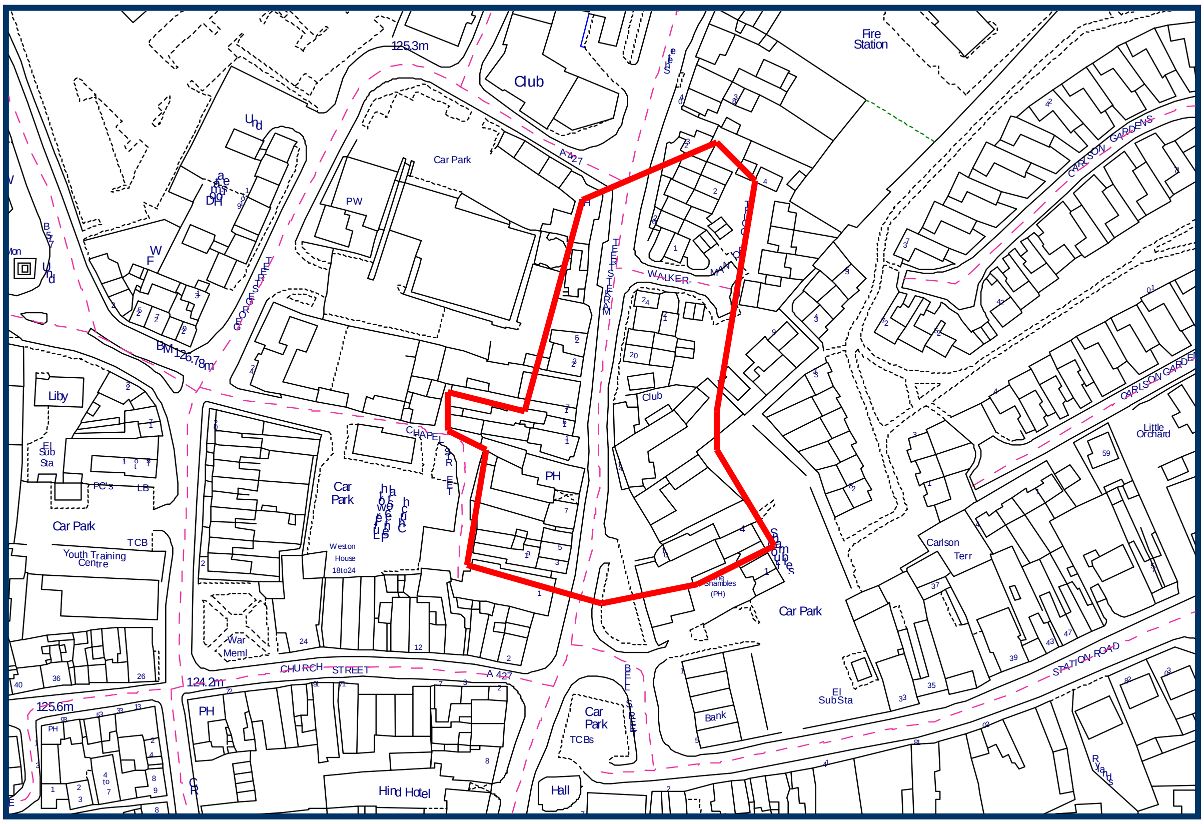
As part of the development of the Action Plan it will be vital for Harborough District Council to develop partnerships with other organisation involved with traffic management. Members of the partnership are to include Transport Planners, Leicestershire County Council and the Highways Agency.

The district council will also liase with local representatives and businesses in Lutterworth as part of the development of the AQAP.

When the local authority considers it necessary to revoke or amend an existing AQMA, Government would expect the local authority to consult all the relevant statutory consultees, local stakeholders, businesses and members of the public. Harborough District Council consider it to be appropriate to combine the consultation of the amended AQMA with the consultation of the Action Plan as it is felt that the two documents are intrinsically linked. It is anticipated that the development of the draft Action Plan will be completed by the end of April 2004. Following the consultation period, any suitable comments will be incorporated into the documents and the AQMA will be amended and the Action Plan implemented.

Appendix 1

The Air Quality Management Area – Lutterworth Town Centre.

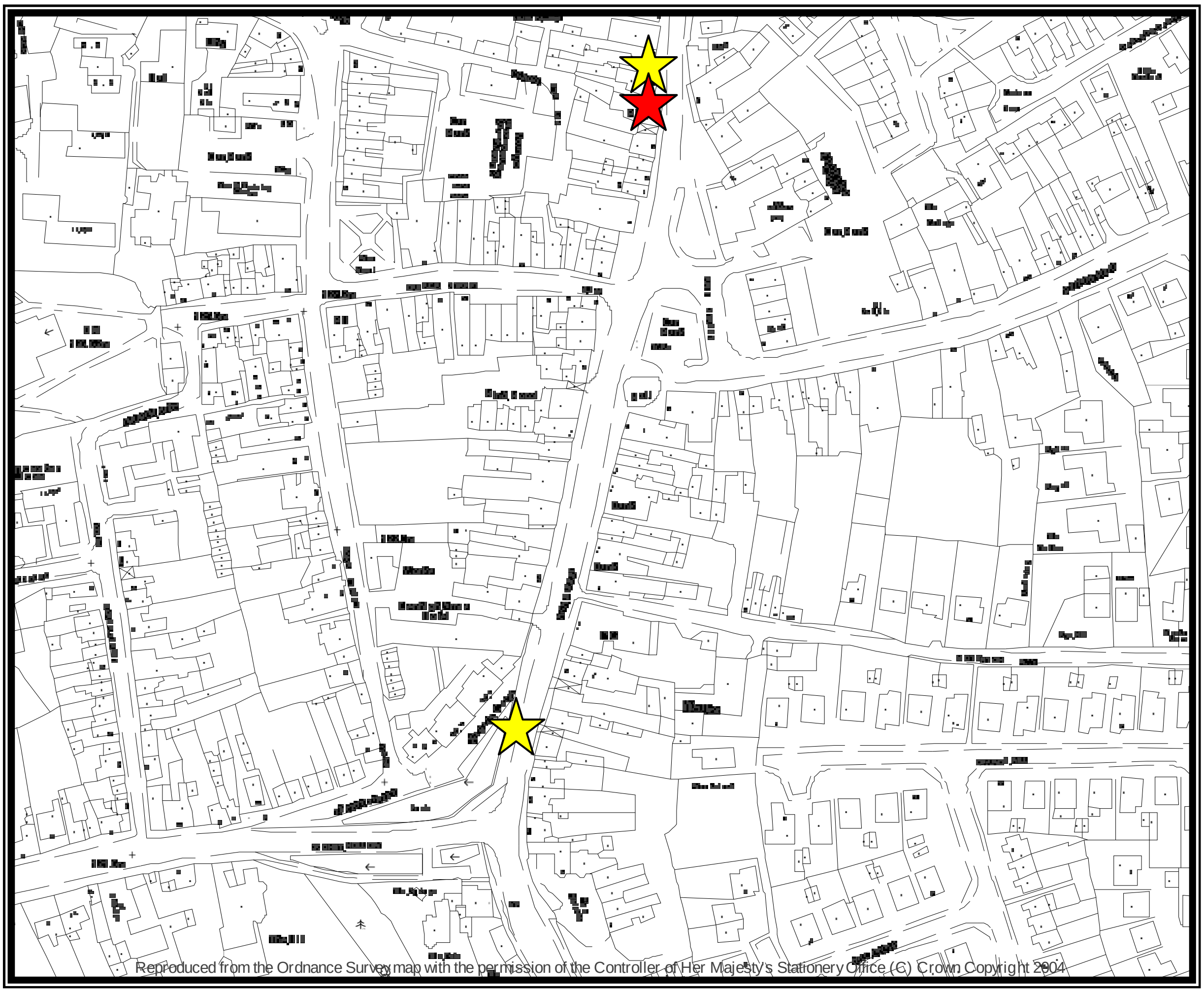


The Harborough District Council (Air Quality Management Area No 1) Order 2001

Dated 18th July 2001

Appendix 2

Location of the Monitoring Equipment in and around the AQMA



 Diffusion Tubes

 Continuous monitoring station

Appendix 3

Appendix 4

Results of the Nitrogen Dioxide Diffusion Tube Survey 2003

All results are in µg/m³

Tube Number	**Name**	Easting	**Northing**	**Jan 03**	**Feb 03**	**Mar 03**	**April 03**	**May 03**	**June 03**	**July 03**	**Aug 03**	**Sept 03**	**Oct 03**	**Nov 03**	**Dec 03**	AVE
1	Brooklands	4735	2871	19	17	22	16	6	13	10	12	16	19	A	22	16
2	LASS Lutterworth	4545	2842	31	49	39	33	26	50	40	59	60	54	56	43	45
3	Bushby	4653	2038	19	A	14	21	11	8	10	12	A	22	29	35	18
4	Regent Ct Lutterworth	4545	2842	42	A	A	A	44	17	A	72	66	55	59	50	51
5	Gt Glen	4656	2974	35	25	15	17	9	12	13	15	22	A	A	22	19

A = Tube missing

Appendix 5

Results of the Real Time Monitor - 2003

The table shows the maximum and average values for Nitrogen Dioxide as a 1 hour mean. These are then compared to the NAQS Guideline values

Month	NO2 (µg/m³) Monthly Maximum (1 Hour Avg)	NO2 (µg/m³) Monthly Average
January	137.6	45.3
February	147.6	52.3
March	158.9	47.3
April	136.9	42.9
May	137.2	44.8
June	178.4	44.3
July	221.5	62.1
August	177.8	58
September	195.2	73.2
October	171.6	53
November	157.3	58.8
December	194.7	58.9
	NO. OF EXCEEDANCES	**AVERAGE**
	0	**53.4**

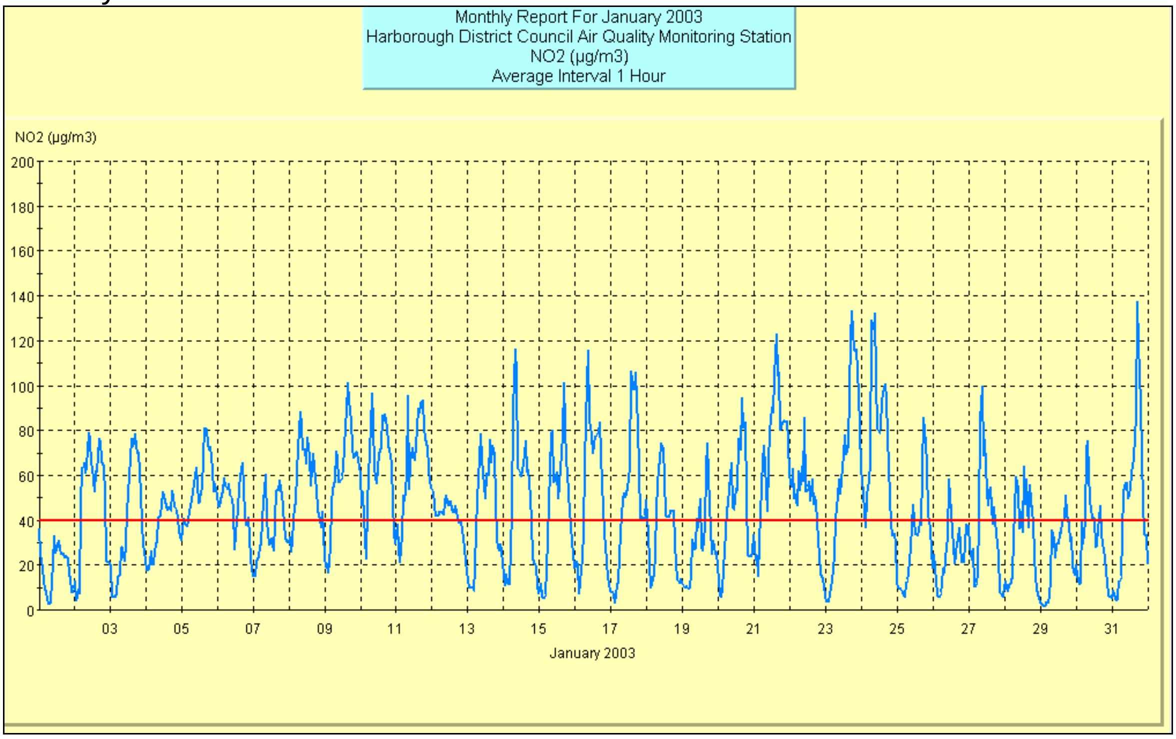
National Air Quality Strategy Annual Mean Guideline Value - 40 µg/m³

National Air Quality Strategy 1 Hour Mean Guideline Value - 200 µg/m³ (not to be exceeded more than 18 times in a year)

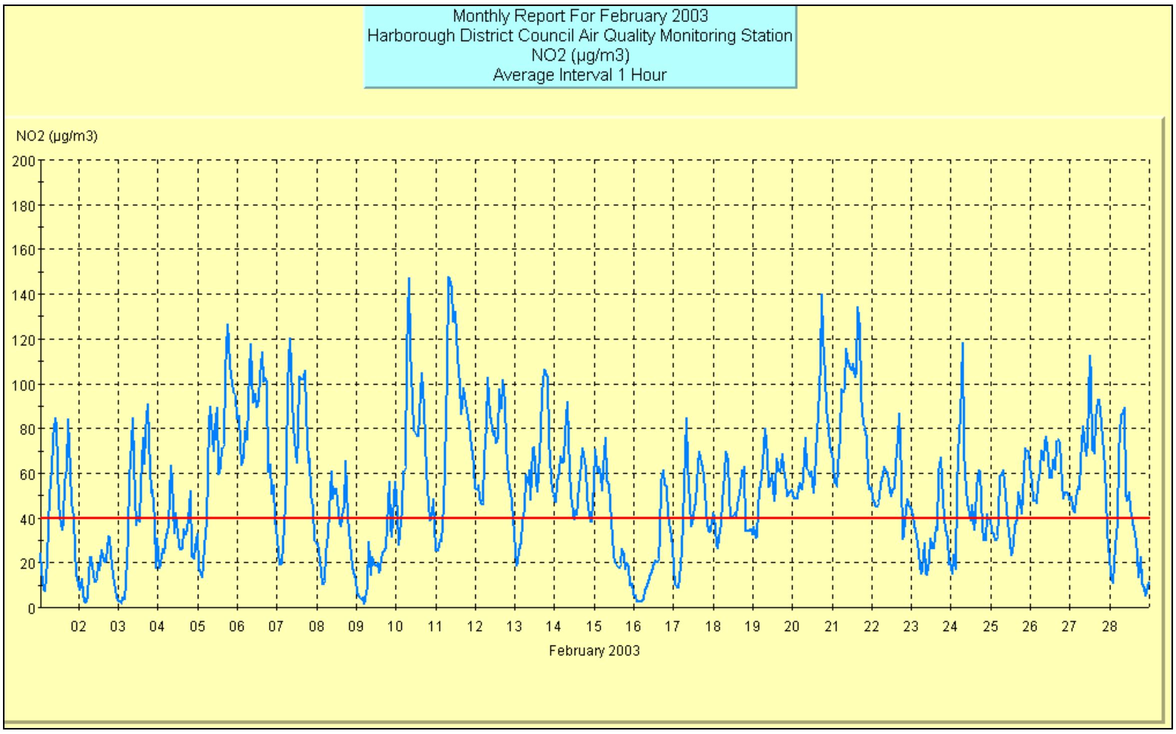
Appendix 6

Monthly Results from the Real Time Monitoring Station - 2003

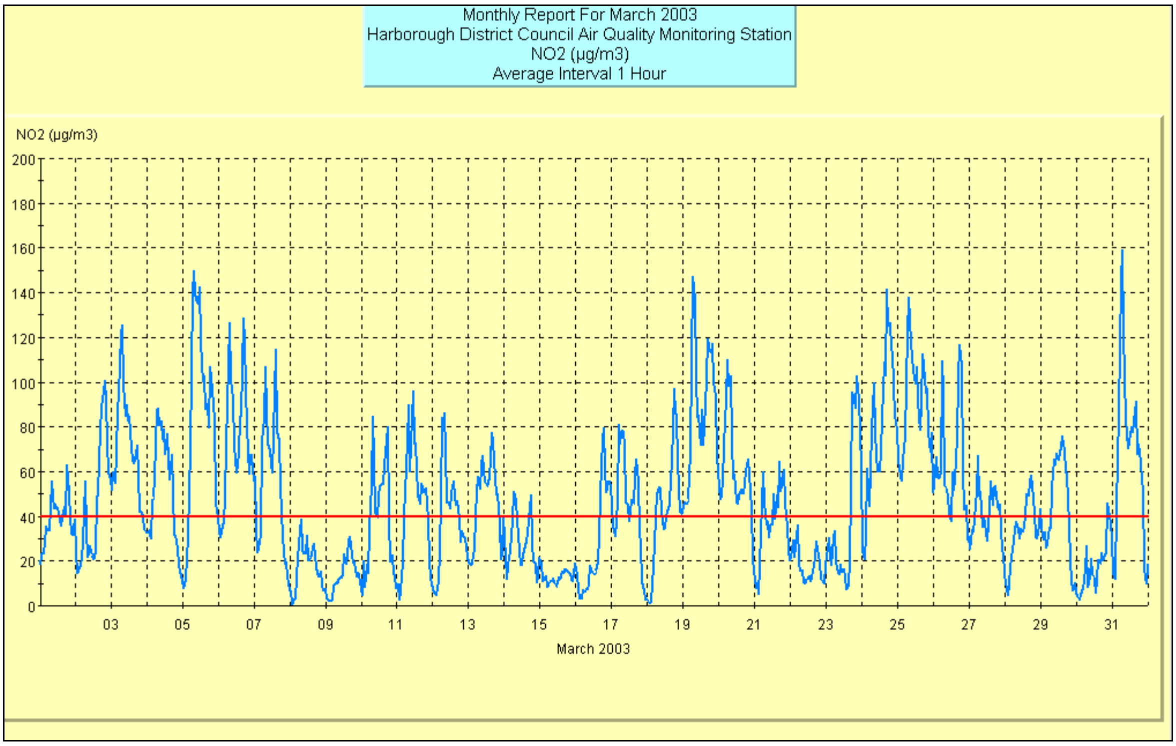
January



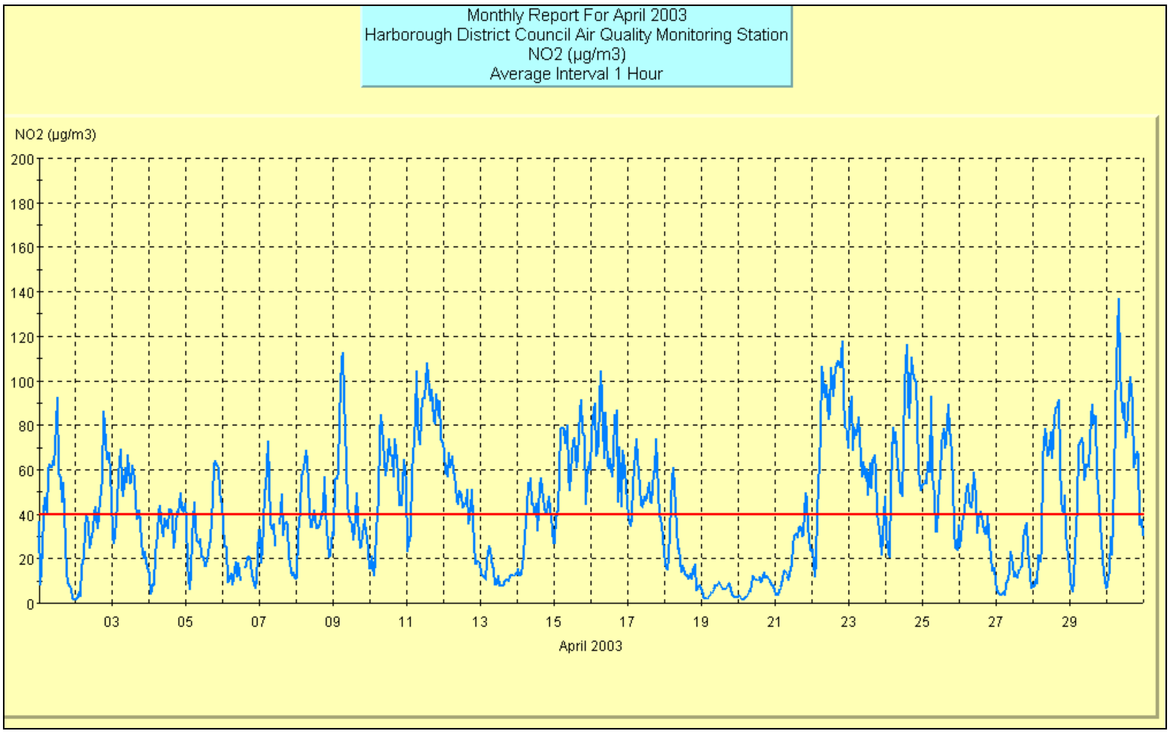
February



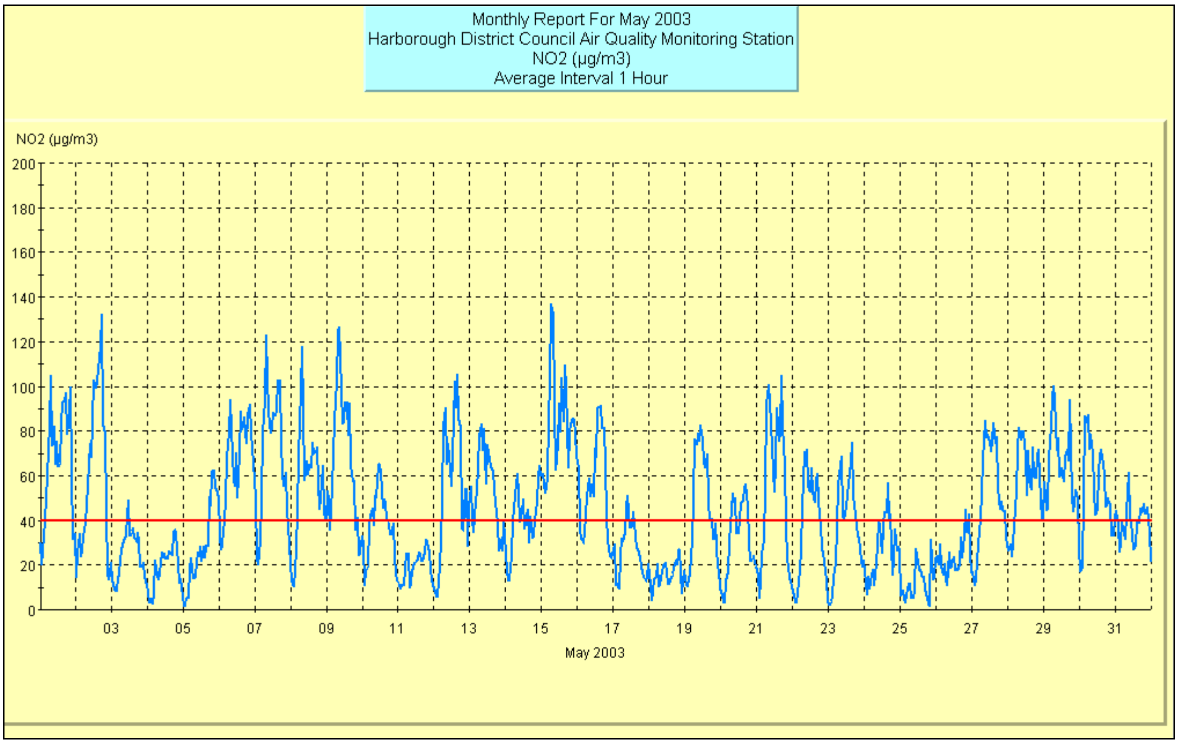
March


Monthly Report For March 2003
Harborough District Council Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 (µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
31
March 2003

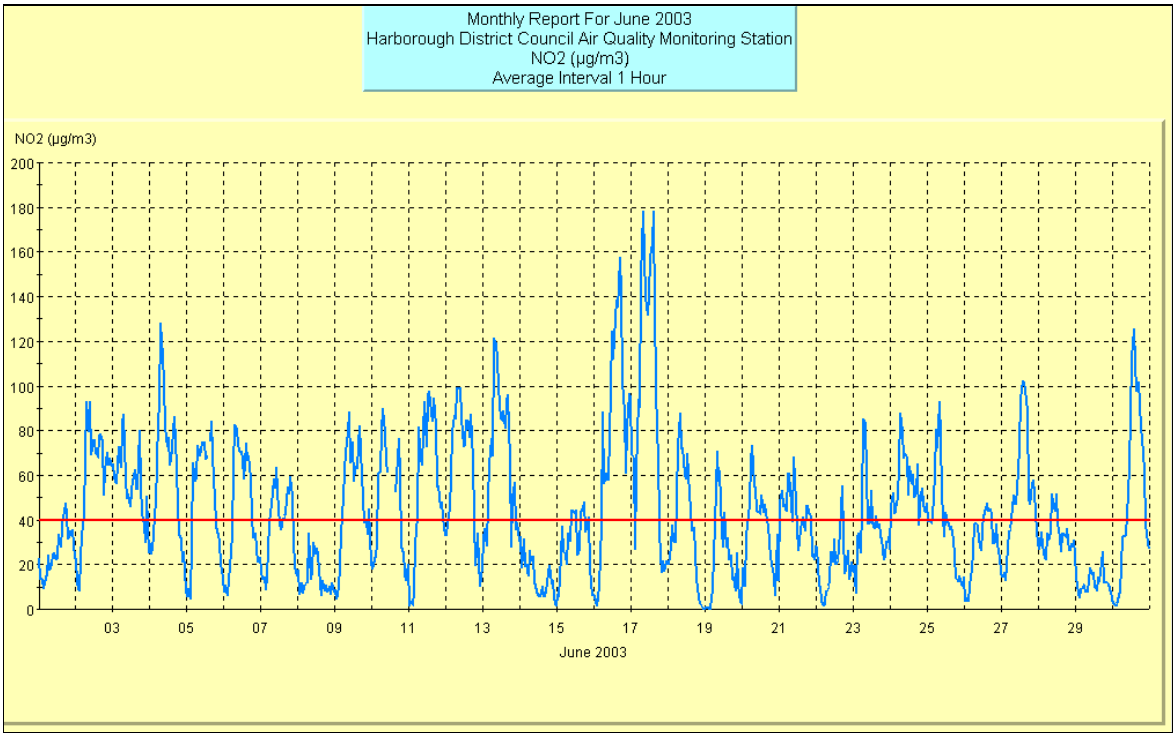
April


Monthly Report For April 2003
Harborough District Council Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 (µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
April 2003

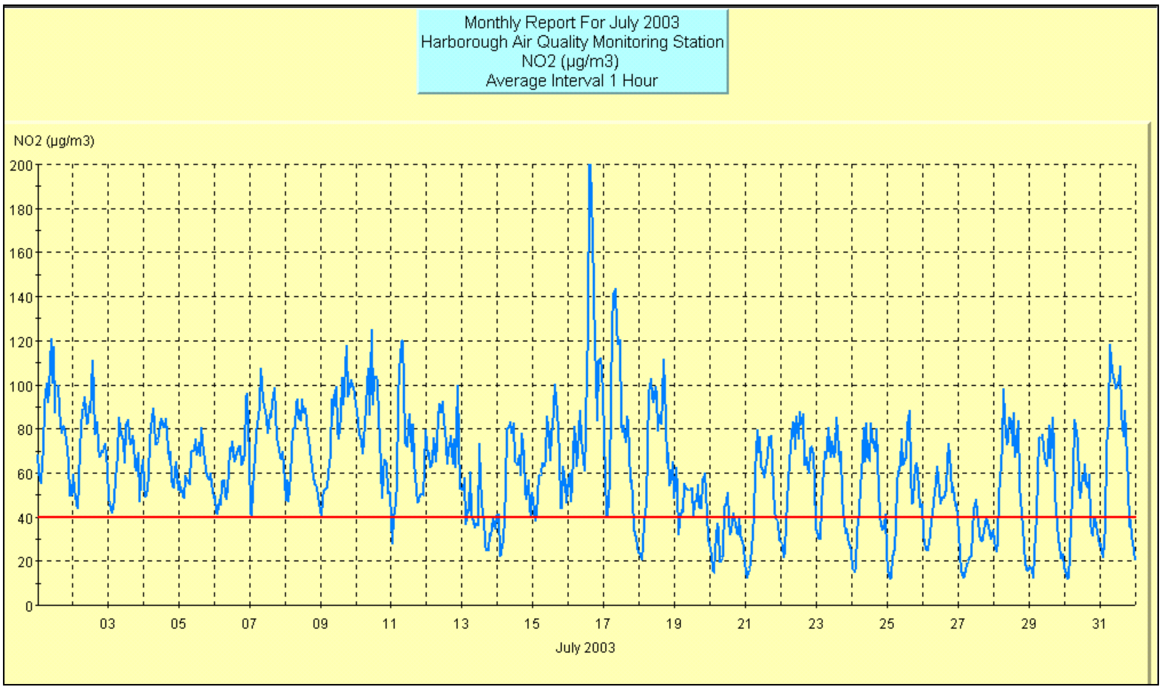
May


Monthly Report For May 2003
Harborough District Council Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 (µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
31
May 2003

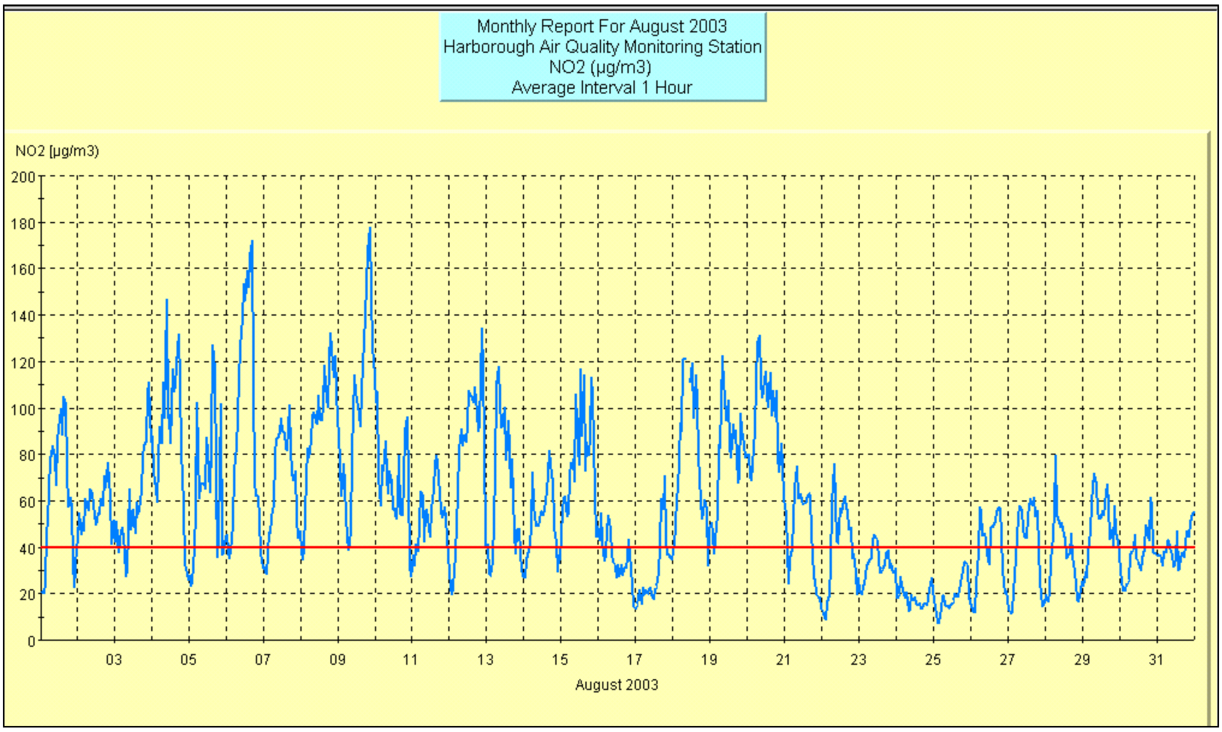
June


Monthly Report For June 2003
Harborough District Council Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 (µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
June 2003

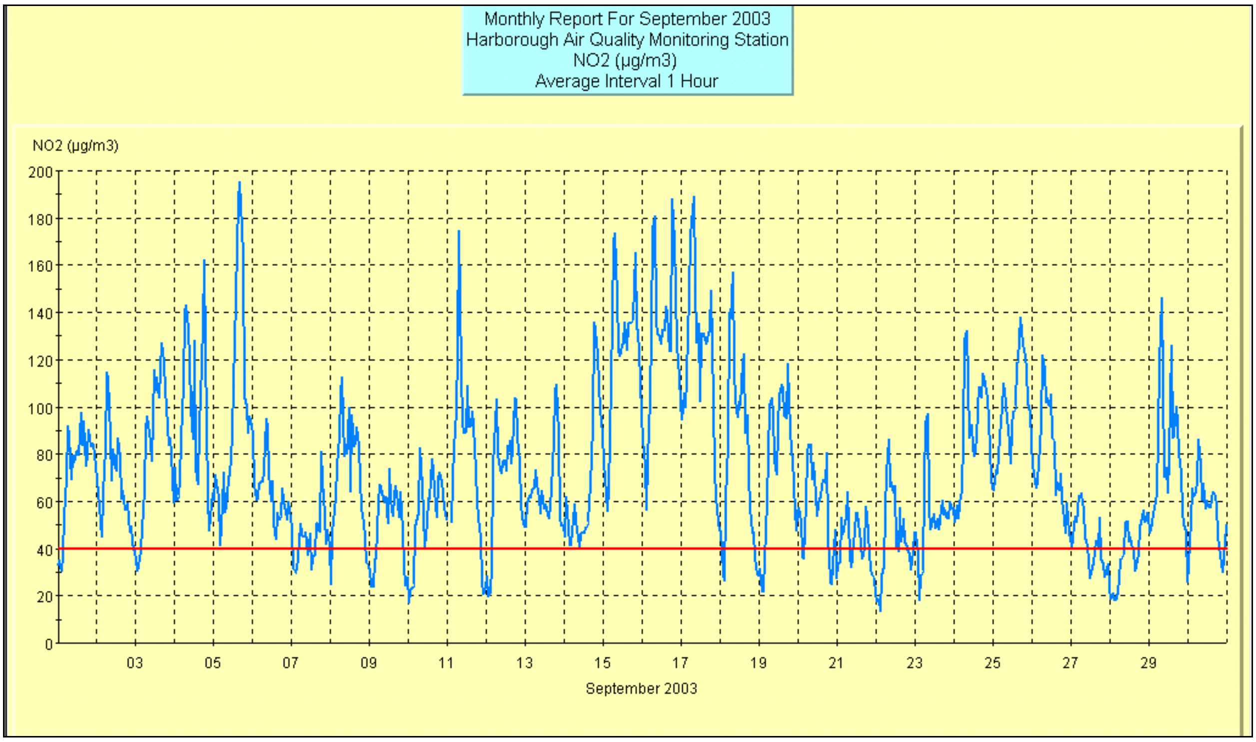
July


Monthly Report For July 2003
Harborough Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 (µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
31
July 2003

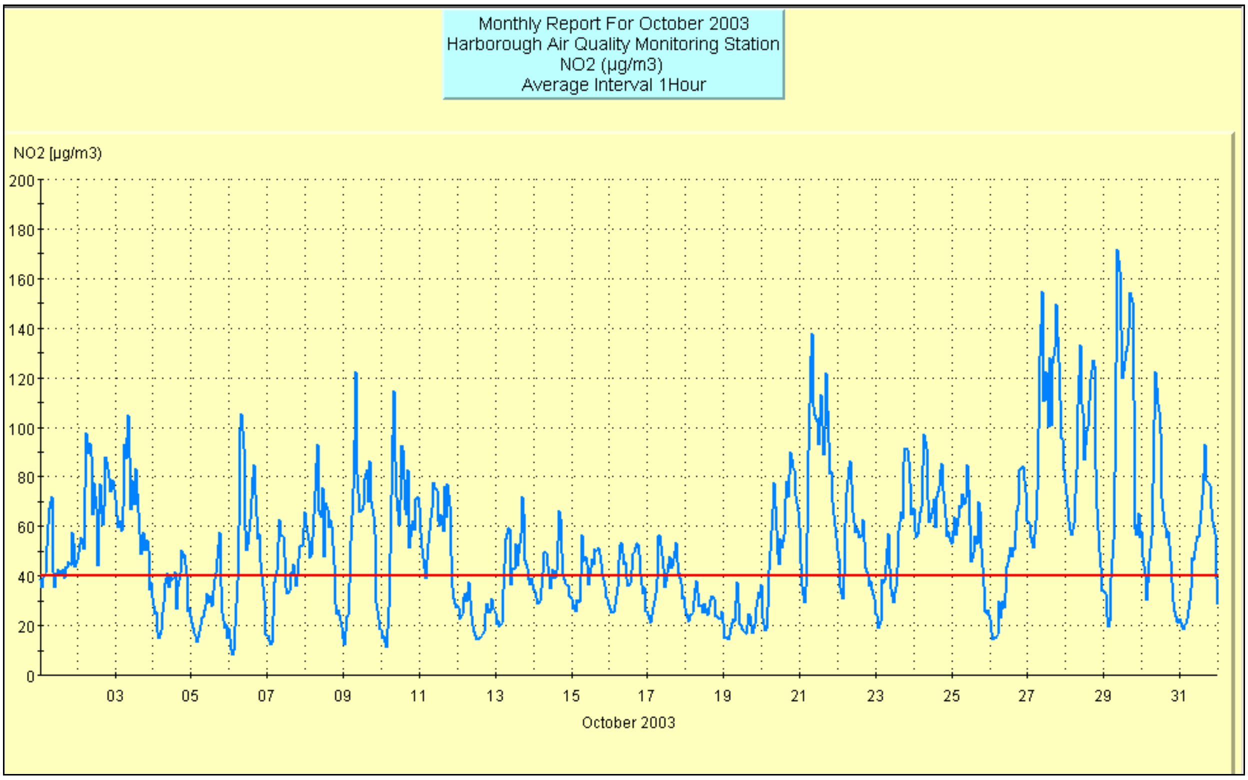
August


Monthly Report For August 2003
Harborough Air Quality Monitoring Station
NO2 (µg/m3)
Average Interval 1 Hour
NO2 [µg/m3)
200
180
160
140
120
100
80
60
40
20
0
03
05
07
09
11
13
15
17
19
21
23
25
27
29
31
August 2003

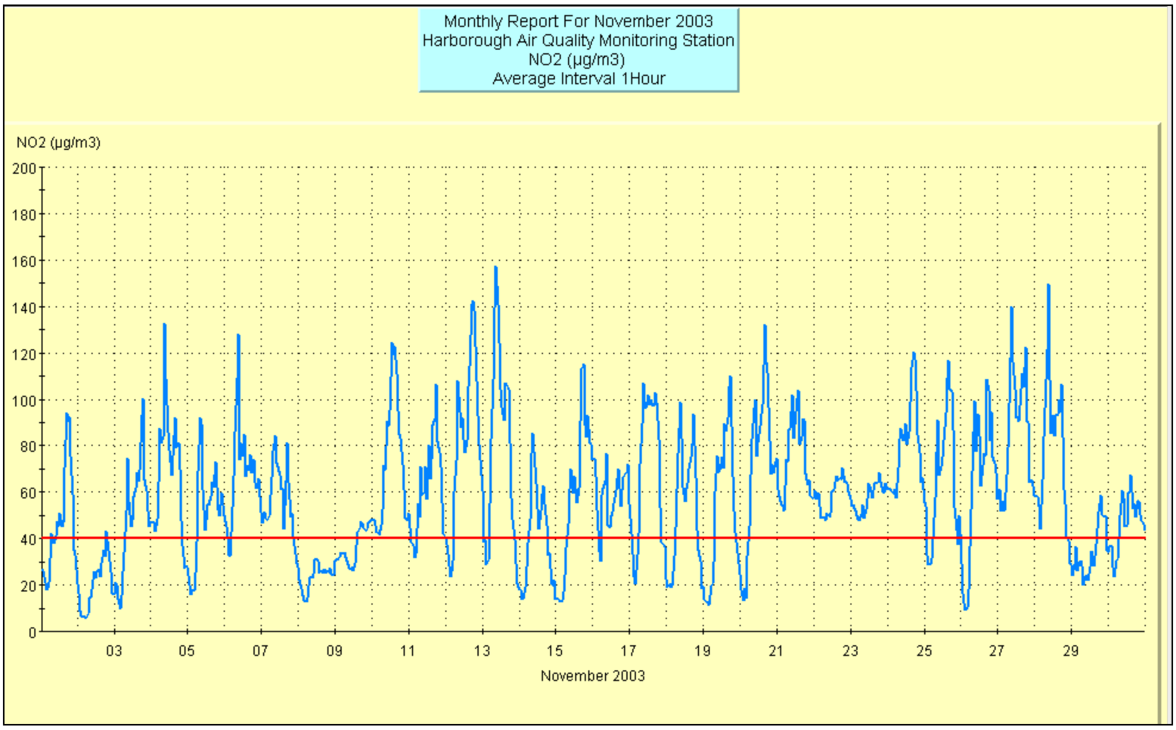
September



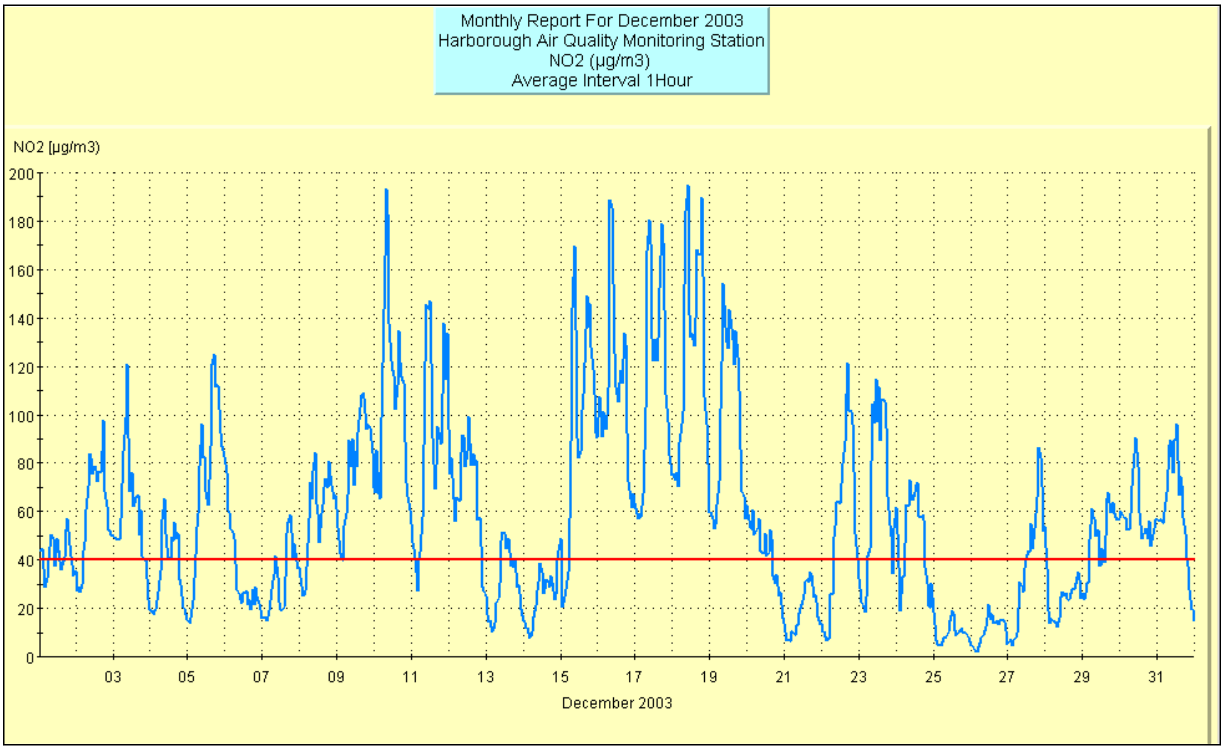
October



November



December



Appendix 7

Traffic Count Data – Location 1

Road Type – **Non built up main road – A426 Lutterworth**
Grid Ref. – **455060 290000**

Count date – **2001**

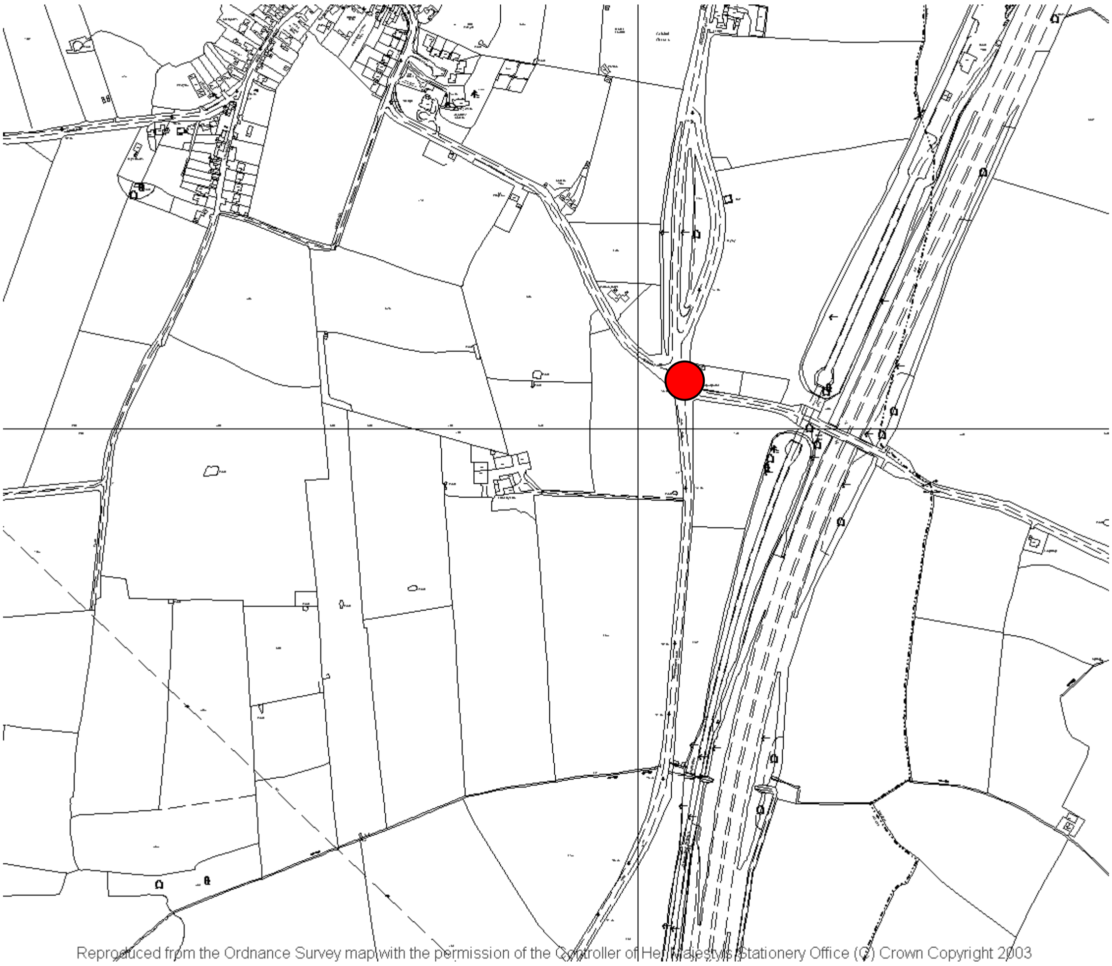
Hourly flows: *(expressed as a percentage of maximum hour, so maximum hour(s) is 100)*

Hour	**2001**	**Total numbers**		
Midnight - 1	17%	200		
1 - 2	8%	100		
2 - 3	8%	100		
3 - 4	17%	200		
4 - 5	26%	300		
5 - 6	35%	400		
6 - 7	57%	650		
7 - 8	70%	791		
8 - 9	96%	1081		
9 - 10	62%	699		
10 - 11	55%	617		
11 - 12	61%	687		
12 - 13	52%	584		
13 - 14	67%	756		
14 - 15	73%	827		
15 - 16	81%	909		
16 - 17	84%	943		
17 - 18	100%	**1128**		
18 - 19	77%	864		
19 - 20	75%	850		
20 - 21	48%	550		
21 - 22	35%	400		
22 - 23	31%	350		
23 - midnight	22%	250		

Proportion of different vehicle types: *(percentage of each vehicle for this road type)*

Vehicle type	**Percentage of each type**	
	12 hr Count	**AADTF 2001**
Cars	76%	79%
LGV	13%	12%
Rigid HGV	7%	6%
Articulated HGV	3%	2%
Buses	1%	1%

A426 Lutterworth – Non built up main road



● Count point

Traffic Count Data –Location 2

Road Type – **Non built up main road – A4303 Lutterworth**
Grid Ref. – **454300 283920**

Count date – **2001**

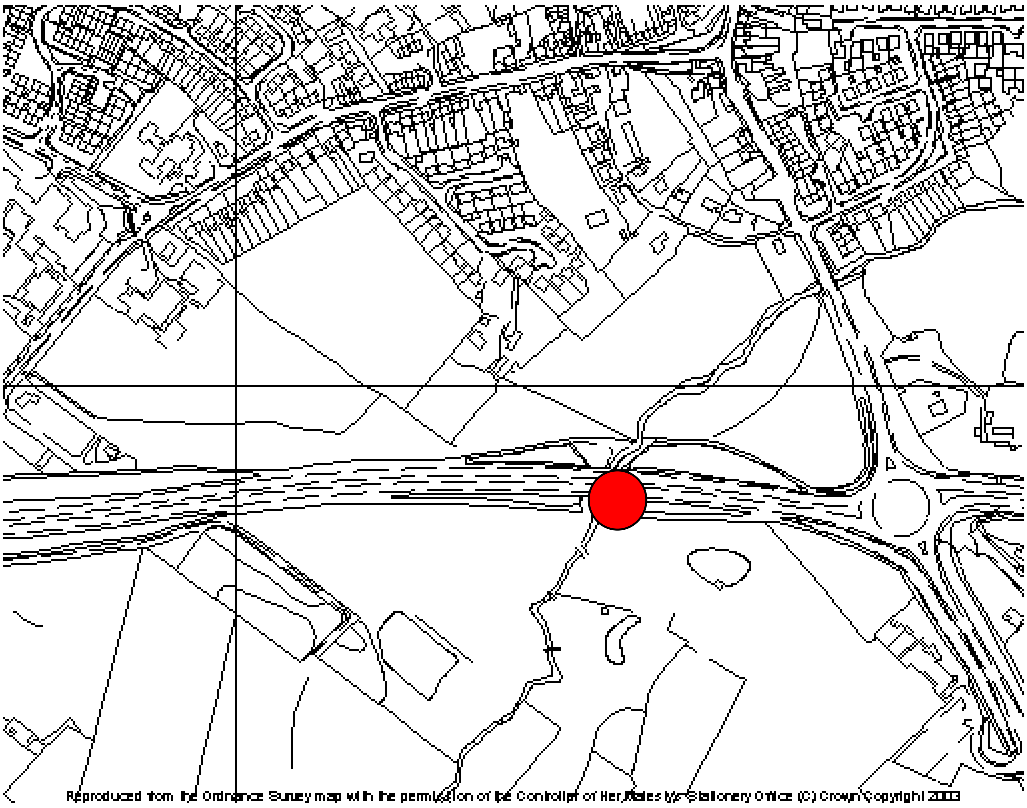
Hourly flows: *(expressed as a percentage of maximum hour, so maximum hour(s) is 100)*

Hour	**2001**	**Total numbers**		
Midnight - 1	21	225		
1 - 2	18	200		
2 - 3	14	150		
3 - 4	14	150		
4 - 5	18	200		
5 - 6	30	325		
6 - 7	32	350		
7 - 8	64%	687		
8 - 9	84%	898		
9 - 10	53%	564		
10 - 11	43%	458		
11 - 12	45%	482		
12 - 13	40%	426		
13 - 14	47%	506		
14 - 15	100%	**1071**		
15 - 16	59%	636		
16 - 17	77%	821		
17 - 18	92%	981		
18 - 19	53%	571		
19 - 20	37	400		
20 - 21	27	298		
21 - 22	24	264		
22 - 23	23	250		
23 - midnight	21	235		

Proportion of different vehicle types: *(percentage of each vehicle for this road type)*

Vehicle type	**Percentage of each type**	
	12 hr Count	**AADTF 2001**
Cars	67%	69%
LGV	13%	11%
Rigid HGV	7%	6%
Articulated HGV	12%	12%
Buses	1%	1%

Non Built up main road - A40303 Lutterworth



Count point

Traffic Count Data – Location 3

Road Type – **Built up Unclassified – Bitteswell Road Lutterworth**
Grid Ref. – **453829 284962**

Count date – **2001**

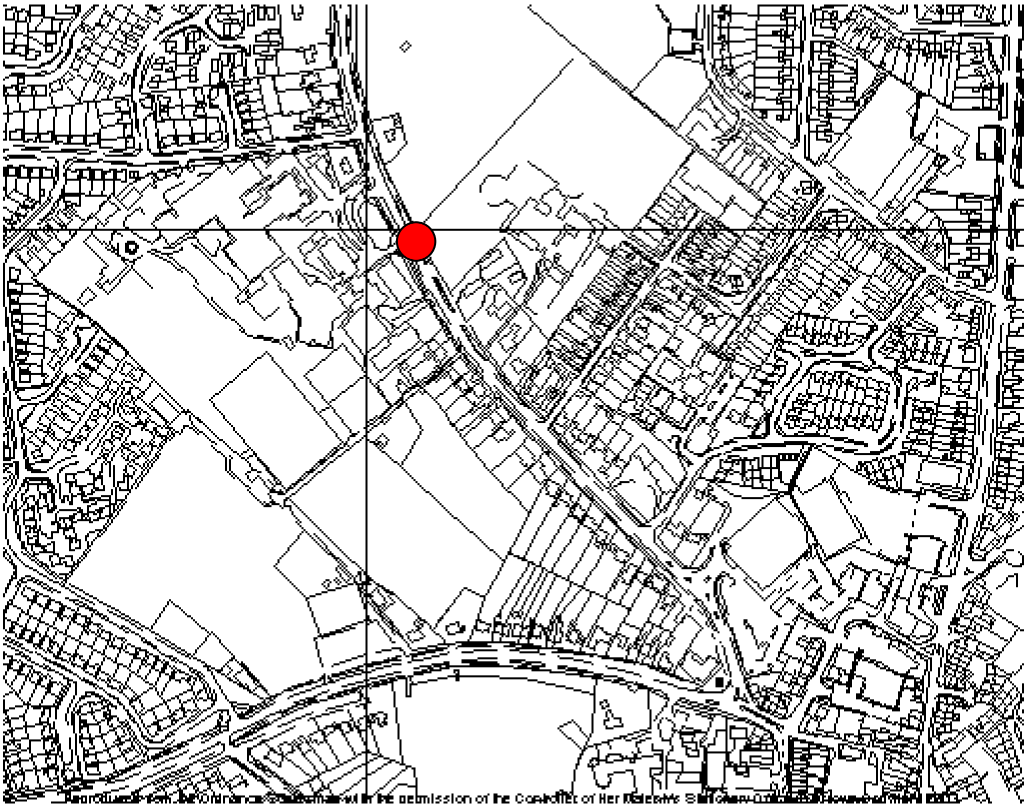
Hourly flows: *(expressed as a percentage of maximum hour, so maximum hour(s) is 100)*

Hour	**2001**	**Total numbers**		
Midnight - 1	11	15		
1 - 2	7	10		
2 - 3	3	5		
3 - 4	7	10		
4 - 5	14	20		
5 - 6	21	30		
6 - 7	35	50		
7 - 8	43%	61		
8 - 9	100%	**141**		
9 - 10	48%	67		
10 - 11	52%	73		
11 - 12	67%	94		
12 - 13	47%	66		
13 - 14	66%	93		
14 - 15	60%	84		
15 - 16	80%	113		
16 - 17	65%	92		
17 - 18	84%	119		
18 - 19	68%	96		
19 - 20	59	84		
20 - 21	42	60		
21 - 22	28	40		
22 - 23	21	30		
23 - midnight	14	20		

Proportion of different vehicle types: *(percentage of each vehicle for this road type)*

Vehicle type	**Percentage of each type**	
	12 hr Count	**AADTF 2001**
Cars	89%	89%
LGV	8%	7%
Rigid HGV	1%	1%
Articulated HGV	0%	0%
Buses	2%	2%

Built up Unclassified – Bitteswell Road Lutterworth



Traffic Count Data – Location 4

Road Type – **A426 – Built up Primary Road**
Grid Ref. – **454439 284100**

Count date – **June 2002**

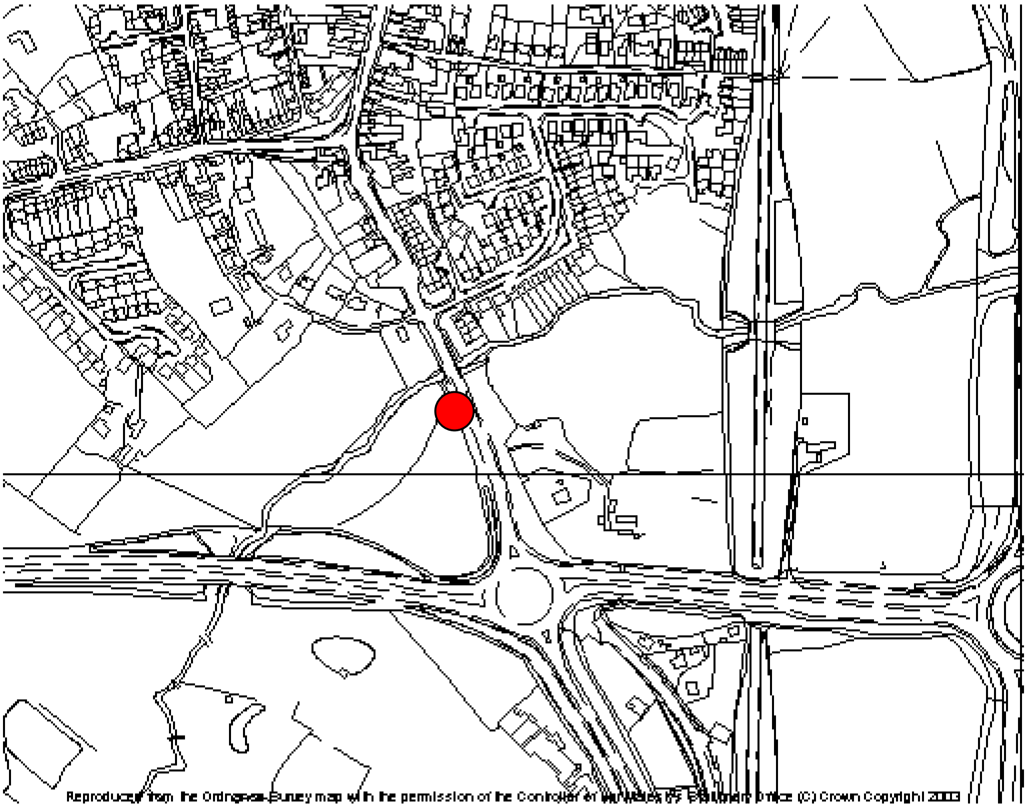
Hourly flows: *(expressed as a percentage of maximum hour, so maximum hour(s) is 100)*

Hour	**Tuesday 11 June**	**Total numbers**		
Midnight - 1	18	250		
1 - 2	18	250		
2 - 3	12	200		
3 - 4	36	600		
4 - 5	48	800		
5 - 6	57	950		
6 - 7	60	1000		
7 - 8	81%	1347		
8 - 9	100%	**1663**		
9 - 10	66%	1098		
10 - 11	63%	1041		
11 - 12	61%	1022		
12 - 13	64%	1061		
13 - 14	63%	1040		
14 - 15	65%	1078		
15 - 16	71%	1187		
16 - 17	85%	1409		
17 - 18	99%	1648		
18 - 19	74%	1225		
19 - 20	71	1195		
20 - 21	57	952		
21 - 22	45	750		
22 - 23	38	642		
23 - midnight	21	364		

Proportion of different vehicle types: *(percentage of each vehicle for this road type)*

Vehicle type	**Percentage of each type**
Cars	70%
LGV	11%
Rigid HGV	6%
Articulated HGV	3%
Buses	1%

A426 – Built up Primary Road Lutterworth



Count point