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UPDATING AND SCREENING ASSESSMENT OF AIR QUALITY IN CHARNWOOD

MAY 2003

EXECUTIVE SUMMARY

In December 2000 Charnwood Borough Council completed a first review and assessment of air quality within the Borough. The object of the project was to determine whether concentrations of seven pollutants identified by the UK government as being of most concern to public health were likely to be above air quality objectives set in the National Air Quality Strategy. The objectives within the Strategy are based on levels at which there are considered to be no effect on human health.

As a result of the review and assessment three Air Quality Management Areas were declared within Charnwood. These areas were declared because the review and assessment predicted that levels of nitrogen dioxide would exceed those stated in the National Air Quality Strategy. Work is currently being undertaken in more detail to refine predictions of how air quality will change in each of these three areas with the intention of producing and Action Plan to implement changes that will ensure that the objectives are met.

The purpose of this Updating and Screening Assessment is to review the findings of the original project looking at the whole of the Borough and to

- take into account changes that have or will occur outside the Air Quality Management Areas.
- take into account the improvements that have been made in the methods of predicting air quality changes.

The outcomes of the Updating and Screening Assessment confirm many of the findings of the original project. Specifically in relation to each of the seven relevant pollutants the results are as follows;

Benzene

the air quality objective for benzene is not currently being breached and will not be exceeded in 2004.

1, 3 butadiene

the air quality objective for 1,3 butadiene is not currently being breached and will not be exceeded in 2004.

Carbon monoxide

the air quality objective for carbon monoxide is not currently being breached and will not be exceeded in 2004.

Lead

the air quality objective for lead is not currently being breached and will not be exceeded in 2005 or 2009.

Nitrogen dioxide

Some locations in Charnwood may experience levels of nitrogen dioxide in excess of the annual average nitrogen dioxide objective. No locations in Charnwood are likely to be subject to levels above the hourly mean nitrogen dioxide objective. The locations that need to be subject to a more detailed assessment are:

- **Properties very close to the A6 corridor on Derby Road, High Street and Leicester Road in Loughborough.**
- **Properties on Ratcliffe Road in Loughborough.**
- **All roads within the current Loughborough AQMA that will be affected by the Epinal Way extension and any other roads outside the AQMA that are predicted to experience significant traffic increases due to the new road.**
- **The A6 corridor through the village of Birstall.**
- **The Melton Road corridor through the village of Syston.**

Sulphur dioxide

Some locations within the borough are at risk of being subject to exposure to breaches of the air quality objectives. Specifically these include receptor points close to the engine sheds of the Great Central Railway in Loughborough.

Respirable particles (PM10)

Some locations in Charnwood may experience levels of respirable particulate in excess of the annual average objective or more than 35 exceedences of the 24 hour mean objective. These locations are:

- **All roads within the existing Air Quality Management Areas in Charnwood.**
- **Properties around the Lafarge Aggregates quarry in Mountsorrel.**

CONTENTS

1.INTRODUCTION

1.1 BACKGROUND

From the mid 1980's there has been a growing public awareness of environmental issues which, combined with increasing incidence of childhood asthma, and traffic congestion, has led to general concern regarding air quality. In recognising this concern the scientific community also appreciated that there is a multiplicity of factors, which determine air quality in a given area. The 'simple' solutions applied to preventing the 'pea-soup' smog prevalent in urban areas up until the 1950s and 1960s are no longer available and any solution to the air quality dilemma of the new millennium requires a coherent national strategy applied flexibly at a local level. Addressing the issues will also require the participation of all members of the community and specialist input from many professional groups.

In the early 1990s the Expert Panel on Air Quality Standards (EPAQS) was set up by the Secretary of State for the Environment following the publication of the Government White Paper "Our Common Inheritance". The remit of the Panel was to advise on the establishment and application of Air Quality Standards based on the effects of pollutants on human health and the wider environment.

The Environment Act 1995 required the Secretary of State to produce a National Air Quality Strategy (NAQS), and this was initially published in April 1997. The NAQS was reviewed in 1999 with the amended revision being published in January 2000. It contained air quality objectives for 7 key airborne pollutants, which are to be achieved in all areas of the UK by various target dates. The objectives have been subject to further changes since 2000 and are summarised below.

A first review and assessment was completed for Charnwood in December 2000. This concluded that three areas within the borough were likely to be subject to breaches of the air quality objectives at the relevant dates. Specifically the review and assessment concluded that the annual average nitrogen dioxide levels in these three areas would be above the levels set as air quality objectives due to emissions from road traffic vehicles.

In June 2001 three Air Quality Management Areas were declared in Charnwood, one in Loughborough, one in Syston and one in Birstall. A more detailed assessment of the air quality in each of these areas (a Stage 4 review and assessment) is still being undertaken and was originally due for completion by mid 2002. Air quality action plans that will seek to ensure that the air quality objectives are complied with will be developed based on the findings of the Stage 4 results for each of the three areas.

The purpose of this report is to undertake an updating and screening assessment of the whole of the borough in order to establish if there have been any significant changes in the sources of pollution in Charnwood since the first review and assessment. It is also to take account of new guidance on how to identify possible pollution hot spots which has been developed over the past three years on the basis of experience from the first round of review and assessments.

1.2 STATUTORY REQUIREMENTS

Section 82 of the Environment Act imposes a duty on all local authorities within the UK to periodically review air quality within their districts to assess compliance with the air quality objectives contained in the National Air Quality Strategy. The air quality objectives that must not be exceeded are outlined in table 1.1.

If it is considered likely that there will be a breach of one or more of the objectives the local authority must issue a legal order designating an Air Quality Management Area (AQMA), and develop through consultation an action plan to ensure that the relevant objective(s) will be met. The Act and its associated regulations recommend time scales for completion of these duties.

1.3 NATIONAL AIR QUALITY OBJECTIVES

The table below provides a summary of the air quality objectives contained within the National Air Quality Strategy.

Table 1.1 Objectives for Protecting Human Health

Pollutant	Concentration Limit	Measured As	Date to be achieved By
Benzene (C_6H_6)	16.25µg m^{-3}	Running annual mean	31 December 2003
	5µg m^{-3}	Annual mean	31 December 2010
1,3 Butadiene	2.25µg m^{-3}	Running annual mean	31 December 2003
Carbon Monoxide (CO)	1160µg m^{-3}	Maximum daily running 8 hour mean	31 December 2003
Lead (Pb)	0.5µg m^{-3}	Annual mean	31 December 2004
	0.25µg m^{-3}	Annual mean	31 December 2008
Nitrogen Dioxide (NO_2)	200µg m^{-3} (Not to be exceeded more than 18 times a year)	1 hour mean	31 December 2005
	40µg m^{-3}	Annual mean	31 December 2005
Respirable particulates (PM_{10})	50µg m^{-3} (Not to be exceeded more than 35 times a year)	24 hour mean	31 December 2004
	40µg m^{-3}	Annual mean	31 December 2004
Sulphur Dioxide (SO_2)	350µg m^{-3} (Not to be exceeded more than 24 times a year)	1 hour mean	31 December 2004
	125µg m^{-3} (Not to be exceeded more than 3 times a year)	24 hour mean	31 December 2004
	266µg m^{-3} (Not to be exceeded more than 35 times a year)	15 minute mean	31 December 2005

2. OBJECTIVES OF THE REPORT

a) To review and assess air quality in Charnwood by gathering information about all sources of air pollution and analysing this information based on the methodology outlined in Technical Guidance LAQM.TG(03) published by the Department for the Environment Food and Rural Affairs.

b) To establish which areas of Charnwood require a more detailed assessment of air quality.

c) To update the data currently being used to produce Charnwood's Stage 4 review and assessment of air quality.

3.THE BOROUGH OF CHARNWOOD

The Borough of Charnwood is located in Leicestershire in the heart of the East Midlands and is situated on the northern county boundary with Nottinghamshire. The Borough covers an area of 108 square miles and consists of a mix of urban settlements and rural farmland.

3.1 The Borough of Charnwood Map

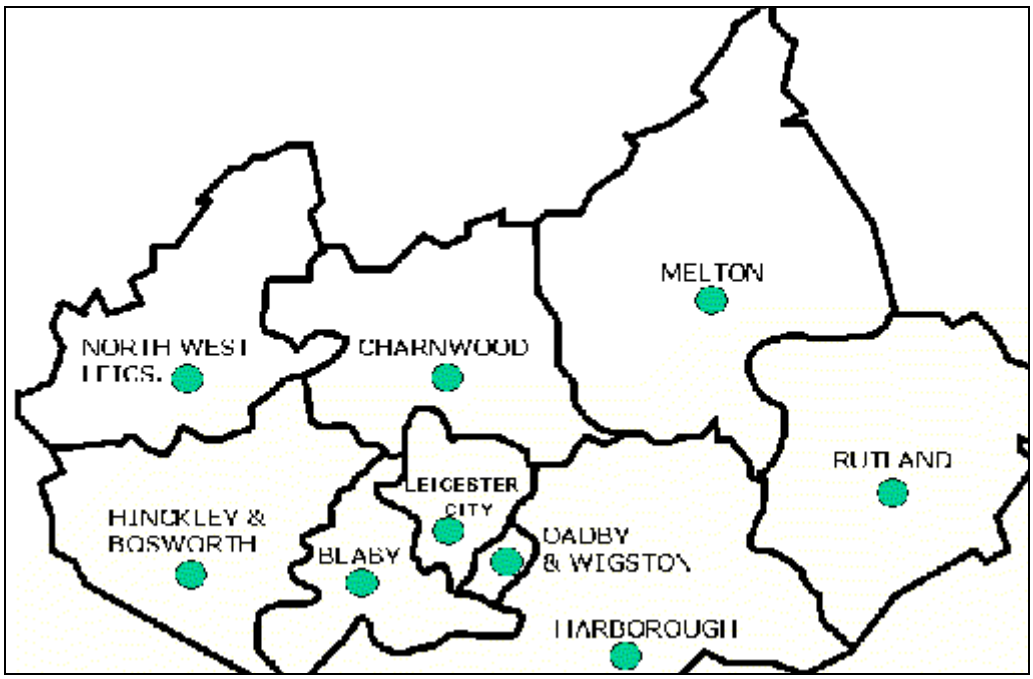
The population of the Borough totals approximately 156,000 residents distributed between the northern towns of Shepshed and Loughborough, the southern towns and villages on the outskirts of the city of Leicester including Anstey, Birstall, Thurmaston and Syston and the villages located along the Soar and Wreake river valleys.

Charnwood has a wide range of commercial and industrial activities. Loughborough is traditionally associated with the engineering sector, whilst the villages along the Soar and Wreake have long associations with the footwear, hosiery and knitwear industries. High technology industries are being rapidly attracted into the Borough, mirroring the national experience of the contraction of the traditional heavy industries. The changing industrial infrastructure of the Borough will continue to create challenges in relation to air quality management.

A substantial and varied transport network serves the Borough. The major road links include the M1 motorway, the A6 and the A46 all of which run to a greater or lesser extent through the Borough. The Ivanhoe and Great Central railway lines run through the central spine of the Borough, and the East Midlands airport is located approximately three miles from the north western boundary of Charnwood.

Generally ambient air pollution has never been considered to be of excessive concern for local residents in the Borough. However, as is the case in many parts of the country, the atmospheric emissions from certain individual point sources have caused considerable nuisance for those residents in the immediate vicinity. Some of these individual point sources will not have been highlighted through this report, as they are not producers of any of the seven key pollutants highlighted in the National Air Quality Strategy. This does not indicate a lack of concern by the authors of the report to generate solutions to these problems, but is simply due to the fact that they fall outside the remit of this report.

3.2 Map of Charnwood Borough in Leicestershire



4.REVIEW AND ASSESSMENT OF BENZENE

4.1 INTRODUCTION

Benzene (C_6H_6) is a volatile aromatic hydrocarbon composed of a ring of carbon atoms with single hydrogen atoms attached to each.

In the UK the main source of benzene is the combustion and distribution of petrol of which it is a constituent. Petrol vehicles are the main source (67% of total emissions) where benzene is released either as an unburnt constituent of the fuel or as the product of the combustion of other hydrocarbons. Other significant sources include other motor vehicles (8%), stationary combustion sources (7%), some industrial activities (7%) and evaporation due to spillage or other loss (5%). Due to the nature of its source and its propensity to rapidly disperse in air, benzene is seen only of concern to human health in the immediate vicinity of its production, transfer and combustion.

Benzene is a carcinogen and long-term exposure to this pollutant can cause leukaemia. There is therefore no level of exposure at which there is zero risk. Two air quality objectives have been set. Initially a concentration of 16.25 $\mu g/m^3$ measured as a running annual mean must be achieved by the end of 2003. A concentration of 5 $\mu g/m^3$ must be achieved by the end of 2010.

4.2 Conclusions of the Original Review and Assessment

The original review and assessment of benzene completed in 2000 concluded that:

The absence of any identified significant point sources of benzene emissions either within or immediately outside the Borough, combined with historical long term monitoring data, leads to the conclusion that the air quality objective for benzene is not currently being breached and will not be exceeded in 2004.

4.3 Conclusions of the Update Screening and Assessment

The Updated Screening and assessment review concludes that **the air quality objective for benzene is not currently being breached and will not be exceeded in 2004.**

4.4 Evidence to Support the Conclusions of the USA

The following evidence is based on the checklist contained within Chapter 3 of Technical Guidance document LAQM.TG(03);

Monitoring Data

Table 4.1 presents historical data derived from monitoring of benzene in Charnwood using passive diffusion tubes and calculated estimates of future benzene levels based on LAQM.TG(03) paragraph 3.23.

Table 4.1

		Year				Predicted Concentrations based on 2001 as a base year*	
Location	OS Reference	1999	2000	2001	2002	2003	2010
Leicester Road, Loughborough		4.5	5.4	5.2	4.2	4.53	3.36
Shelthorpe Road, Loughborough	SK5424218661	3.9	4.5	4.6	3.2	4.01	2.98
Market Place , Loughborough	SK5360819540	2.3	1.7	2	1.5	2.00	2.00
Ratcliffe Road, Loughborough	SK5407720402	3.6	3.3	3.4	2.8	2.96	2.20
Britannia Street, Shepshed	SK4783819632	3.2	2.8	2.6	3.6	2.26	1.68
Melton Road, Rearsby	SK6512914384	2.9	3.5	3	2.4	2.61	1.94

* - based on box 3.4, chapter 3 LAQM(TG)03

Monitoring of ambient benzene levels at a variety of sites around the Borough has been undertaken since 1996. The results strongly indicate that existing levels of benzene are below those specified in the National Air Quality Strategy in that none of the monthly average benzene concentrations monitored were above that of the 16.25µg m^{-3} objective. Monitoring is carried out using Perkin Elmer samplers and Chromosorb 106 as the benzene absorbent. The exposure time at each site is one month. The sampling sites and handling techniques comply with the requirements of clause 3.3.1 of LAQM.TG1 (00) with the exception that no travel blank has historically been used as part of the monitoring regime. The laboratory used up until the end of 1999 was AEA Technology who are accredited to BSEN ISO 9001. Since 1999 Gradco have been used who are accredited to UKAS. Assuming a maximum under read of 40% the results for the period between 1997 and 1999 are still well below the objective.

Industrial Sources

LAQM.TG(03) cites various types of industry source that may pose a risk of emitting significant quantities of benzene. None of the process types identified in Annex 2 appendix E of the guidance is found in or near the boundary of Charnwood Borough Council.

Petrol Stations

LAQM.TG(03) suggests that petrol filling stations with a petrol throughput of more than 2000 litres per year adjoining roads with traffic flows greater than 30,000 AADT and with relevant receptor locations less than 10 meters away may be a risk of a breach of the air quality objective. None of the petrol filling stations in Charnwood meet these criteria.

Major Fuel Storage Depots

There are no major fuel storage depots either within or near the boundary of Charnwood Borough Council.

Very Busy Roads

There are no roads that can be defined as ‘very busy’ within Charnwood – namely single carriageway roads with flows greater than 80,000 vehicles per day, dual carriageways with more than 120,000 vehicles per day or motorways with more than 140,000 vehicles per day.

5. REVIEW AND ASSESSMENT OF 1,3 BUTADIENE

5.1 INTRODUCTION

1,3 Butadiene is a volatile hydrocarbon composed of four carbon and six hydrogen atoms.

In the UK the main source is from road vehicles, with petrol engines emitting 67% of the total annual mass and diesel a further 11%. The compound is not present itself in fuel, but is formed as a product of the combustion of the olefines in the fuel. Approximately 17% of 1,3 butadiene is derived from a few industrial sources primarily specialising in the production of synthetic rubber for tyres. Similar to benzene, 1,3 butadiene disperses fairly rapidly in air and is only of concern in the immediate vicinity of its source.

1,3 butadiene is a carcinogen which can cause cancers of the bone marrow, lymphomas, and leukaemia. There is therefore no level of exposure at which there is zero risk. EPAQS set a level of 2.25μg m^{-3} as a running annual mean as representing an exceedingly small risk to health. This is reproduced as the air quality objective in the National Air Quality Strategy to be achieved by 31 December 2003.

5.2 Conclusions of the Original Review and Assessment

Charnwood's previous air quality review and assessment concluded that;

The absence of any significant identified point source of 1,3 butadiene emissions combined with national monitoring data and predictions, leads to the conclusion that the air quality objective for 1, 3 butadiene is not currently being breached and will not be exceeded in 2004.

5.3 Conclusions of the Update Screening and Assessment

The Updated Screening and assessment review concludes that **the air quality objective for 1,3 butadiene is not currently being breached and will not be exceeded in 2004.**

5.4 Evidence to Support the Conclusions of the USA

The following evidence is based on the checklist contained within Chapter 4 of Technical Guidance document LAQM.TG(03);

Monitoring Data

There is no current and has been no historical monitoring of 1, 3 butadiene in

Charnwood.

New Industrial Sources

Annex 2 Appendix E to LAQM.TG(03) summarises the likely sources of 1,3 butadiene. No new industrial installations of the types described in the guidance have been introduced into Charnwood or the surrounding area since 2000.

Industrial Sources with Substantially increases emissions

During the original Review and Assessment one installation was located in Charnwood that falls within the descriptions of relevant processes in Annex 2 Appendix E to LAQM.TG(03), namely Astra Charnwood (now AstraZenica), Bakewell Road, Loughborough (organic chemical manufacture, Authorisation AX 3991). Information from the Environment Agency again demonstrates that this process does not generate any emissions of 1,3 butadiene and as such can be ignored as a likely significant source.

6.REVIEW AND ASSESSMENT OF LEAD

INTRODUCTION

Lead is an elemental metal. Most lead found in the atmosphere is in the form of very fine particulates of less than 1 micron (one thousandth of a millimetre) although some sources of lead generate larger particulates that tend to fall relatively quickly out of the atmosphere. The lead in particulates may be in its elemental form or as an alloy or compound.

The majority of lead emissions in the UK used to come from petrol driven road vehicles. However leaded fuel has been banned from sale in the UK since 1 January 2000 and so emissions of lead are now restricted to a variety of industrial activities such as battery manufacture, pigments in paints and glazes, alloys, radiation shielding, tank lining and piping. Human exposure to lead is primarily through ingested food. However, whilst the percentage absorption of lead in the gastrointestinal tract is only 10% in adults, the level of absorption through the respiratory tract may be as high as 60%. Consequently, the inhalation of airborne lead has the potential to act as a significant vector for lead exposure.

Lead is bio-accumulative, concentrating within body tissue once absorbed, primarily in the bones, teeth, skin and muscle. It exhibits toxic effects by interfering with haemoglobin synthesis, causing neurological damage and affecting the kidneys, gastrointestinal tract, joints and reproductive system.

A 1987 a World Health Organisation (WHO) Guideline for lead set a figure of 0.5 µg m^{-3} as an annual mean, and it is this figure that was adopted for the purposes of the Strategy to be achieved by 2005.

The current air quality objectives for lead are 0.5 µg m^{-3} as an annual mean to be achieved by 31 December 2004, and 0.25 µg m^{-3} as an annual mean to be achieved by 31 December 2008.

6.2 Conclusions of the Original Air Quality Review & Assessment

Charnwood's previous air quality review and assessment concluded that;

The absence of any significant identified point sources of lead emissions combined with regional predictions of relatively low level background concentrations, leads to the conclusion that the air quality objective for lead is not currently being breached and will not be exceeded in 2005 or 2009.

6.3 Conclusions of the Update Screening and Assessment

The Updated Screening and assessment review concludes that **the air quality objective for lead is not currently being breached and will not be exceeded in either 2005 or 2009.**

6.4 Evidence to Support the Conclusions of the USA

The following evidence is based on the checklist contained within Chapter 5 of Technical Guidance document LAQM.TG(03).

Monitoring Data

There is no current and has been no historical monitoring of lead in Charnwood.

New Industrial Sources

Annex 2 Appendix E to LAQM.TG(03) summarises the likely sources of lead. No new industrial installations of the types described in the guidance have been introduced into Charnwood or the surrounding area since 2000.

Industrial Sources with Substantially increases emissions

During the original Review and Assessment two installations were located in Charnwood that fell within the descriptions of relevant processes in Annex 2 Appendix E to LAQM.TG(03), namely;

> Fisher Scientific (UK) Ltd, Bishop Meadow Road, Loughborough (inorganic chemical manufacture, Authorisation no AO 2639).
>
> Trent Valley Water Systems Ltd, Swingbridge Industrial Estate, Loughborough (inorganic chemical manufacture, Authorisation no AQ3385).

Information from the Environment Agency again demonstrates that the process at Fisher Scientific (UK) Ltd does not generate any emissions of lead and as such can be ignored as a likely significant source. Trent Valley Water Systems Ltd has now closed.

7.REVIEW AND ASSESSMENT OF CARBON MONOXIDE

7,1 INTRODUCTION

Carbon Monoxide (CO) is a colourless and odourless gas consisting of one carbon atom and one oxygen atom.

Carbon monoxide is largely produced due to the incomplete combustion of fuels containing carbon. The main source of emissions in the UK is road transport that produces 67% of total UK emissions. Current projections suggest that emissions from this source will decline by nearly half between 2000 and 2005.

CO is best known as a pollutant in restricted areas with poor ventilation - in particular domestic houses with badly maintained gas fired appliances where it can reach dangerously high concentrations. However, these sources only contribute 6% of the total CO generated in the UK. Similarly, CO is only a significant pollutant in the wider environment near to heavily trafficked or congested roads. Concentrations fall away rapidly with distance from roads and CO is only therefore a pollutant of concern in the immediate vicinity of its production.

Prolonged exposure to high levels of CO can lead to death as it inhibits the distribution of oxygen around the body by blocking the carrier molecule in red blood cells. At lower levels the effect, whilst not fatal, can lead to impaired mental performance and coronary stress. Short-term exposure causes reversible effects whilst long-term exposure may lead to chronic health effects.

The current air quality objective for CO is 10 μg m^{-3} measured as a maximum daily running 8 hour average to be achieved by 31 December 2003.

7.2 Conclusions of the Original Review and Assessment

Charnwoods previous air quality review and assessment concluded that;

The absence of any significant road or point sources of carbon monoxide emissions combined with regional predictions of relatively low level background concentrations, leads to the conclusion that the air quality objective for carbon monoxide is not currently being breached and will not be exceeded in 2004.

7.3 Conclusions of the Update Screening and Assessment

The Updated Screening and assessment review concludes that **the air quality objective for carbon monoxide is not currently being breached and will not be exceeded in 2004.**

7.4 Evidence to Support the Conclusions of the USA

The following evidence is based on the checklist contained within Chapter 2 of Technical Guidance document LAQM.TG(03);

Monitoring Data

There is no current and has been no historical monitoring of carbon monoxide in Charnwood.

Very Busy Roads & Junctions in Built up Areas

Box 2.2 in Chapter 2 of LAQM.TG(03) summarises the traffic flows that are likely to generate significant quantities of carbon monoxide. Table 7.1 below summarises these traffic flows and whether any roads in Charnwood are considered likely to be subject to such heavy traffic use in 2003.

Table 7.1

Definition of very busy roads & junctions	Locations of such roads in Charnwood
Single carriageways with an Annual Average Daily Traffic Flow (AADT) of more than 80,000 vehicles	None
Dual carriageways with an AADT of more than 120,000 vehicles	None
Motorways with an AADT of more than 140,000 vehicles	None
Junctions with a cumulative AADT of more than 80,000	None

8.REVIEW AND ASSESSMENT OF NITROGEN DIOXIDE

8.1 INTRODUCTION

Nitrogen dioxide (NO_2) is a gas formed from one nitrogen atom and two oxygen atoms.

Nitrogen dioxide is formed to a small extent directly in combustion processes. However, most nitrogen based combustion products are emitted as nitric oxide (NO). Nitric oxide is relatively unstable and is rapidly oxidised to nitrogen dioxide in air. When low level ozone (another atmospheric pollutant) is present, it is often the ozone molecule that contributes to this process. The relative proportions of nitric oxide and nitrogen dioxide generated from any source can be very variable and as such when both gases are being emitted they are often referred to as 'oxides of nitrogen' (NOx) The most significant source of these gases is road transport which accounts for 49% of the total UK emission although this is expected to nearly halve by 2010. The electricity supply industry produces another 24%, while other industrial and commercial sources contribute 23%.

The principal health effects of nitrogen dioxide relate to impaired lung performance from changes in structure and function and suspected hyper reactivity to allergens (causes of allergic response). Effects are reversible; however, ongoing exposure may lead to poorer lung function later in life. Exposure to high concentrations for short periods is considered more toxic than low concentration exposure for long periods.

EPAQS recommended that short-term concentrations below 287µg m^{-3} should be avoided. They did not recommend a desirable level over a longer averaging period but commented on the possibility of the cumulative effects of longer-term exposure. In response to this the National Air Quality Strategy has two objectives for nitrogen dioxide. To avoid the potentially significant effects of short-term exposure the objective is 200µg m^{-3} as an hourly mean that should not be exceeded more than 18 times a year. To combat the cumulative effect of low level long-term exposure the Strategy also gives an annual mean of 40µg m^{-3}. Both are to be achieved by 2006.

8.2 Conclusions of the Original Review and Assessment

The original review concluded that there were not likely to be any breaches of the hourly mean air quality objective but breaches of the annual mean were predicted at a number of roadside locations in the Borough. As a consequence three Air Quality Management Areas were declared in Loughborough, Syston and Birstall covering a total of approximately 660 properties.

8.3 Conclusions of the Updating & Screening Assessment

The USA suggests that some locations in Charnwood may experience levels of nitrogen dioxide in excess of the annual average nitrogen dioxide objective. These locations must be subject to a more detailed review and assessment. These locations are summarised below. No locations in Charnwood are likely to be subject to levels above the hourly mean nitrogen dioxide objective.

- Properties very close to the A6 corridor on Derby Road, High Street and Leicester Road in Loughborough.
- Properties on Ratcliffe Road in Loughborough.
- All roads within the current Loughborough AQMA that will be affected by the Epinal Way extension and any other roads outside the AQMA that are predicted to experience significant traffic increases due to the new road.
- The A6 corridor through the village of Birstall.
- The Melton Road corridor through the village of Syston.

8.4 Evidence to Support the Conclusions of the USA

Monitoring Data

Nitrogen dioxide is monitored at 25 different locations in Charnwood. All of these locations were chosen based on either the results of the original Review and Assessment or to meet long term commitments to provide data for a national nitrogen dioxide survey. All 25 locations are monitored using passive diffusion tubes, one of these tubes is co-located with a chemiluminescent analyser.

Results from these locations were assessed based on the guidance in LAQM.TG(03) and are expressed in detail in Appendix 1 along with a summary of all of the correction factors and biases that have had to be applied to the data. Based on these assessments, the likelihood of a breach of the hourly mean objectives at each of these locations is not predicted, however a breach of the annual objective is possible at the monitoring locations on Derby Road, High Street & Leicester Road in Loughborough.

Narrow Congested Streets with Residential Properties Close to the Kerb

The only street that falls within this definition in LAQM.TG(03) is Ratcliffe Road in Loughborough. This was originally considered in the first Review and Assessment and was declared as an Air Quality Management Area. This street will need to be subject to a more detailed review and assessment although it is shortly due to be bypassed by a new link road.

Road Traffic Junctions

Box 6.2 in Chapter 6 of LAQM.TG(03) summarises the junctions that may generate significant quantities of nitrogen dioxide. Junctions that require a screening assessment are those with an AADT of more than 10,000 vehicles per day and with exposure locations within 10meters of kerbside. All of the junctions within Charnwood that meet these criteria are summarised in Appendix 2 along with DMRB

calculations of the predicted annual mean nitrogen dioxide concentrations at the nearest receptor points in 2005. Of these only one, namely the junction of Leicester Road and Shelthorpe Road in Loughborough, is predicted to lead to a breach of the annual mean objective at the nearest residential property.

Busy Streets where people may spend more than one hour

There are no such streets within Charnwood with a traffic flow in excess of 10,000 vehicles per day.

Roads with relatively high flows of buses or HGVs

There are no roads in Charnwood that have a composition of greater than 25% of buses and / or HGVs.

New Roads Constructed or Proposed since the original Review & Assessment

The only significant new road that has received planning permission or commenced construction since the original Review and Assessment is the Epinal Way extension in Loughborough. This will have a significant impact on traffic flows through and around the Loughborough conurbation. An environmental assessment was undertaken in respect to this road in 2000 although it was limited in scope to assessing the air quality impact based on the Design Manual for Roads and Bridges (DMRB) method. Construction of the road began in 2002, traffic flows are likely to be above 10,000 vehicles per day and the road will impact on traffic flows in existing Air Quality Management Areas in the town. The road and its impacts will therefore need to be subject to a more Detailed assessment.

Roads Close to the Objective During the Original Review and Assessment

All roads predicted to contribute to an annual mean nitrogen dioxide concentration of between 36 and 40 $\mu g\ m^{-3}$ at relevant receptors were covered within Charnwoods Air Quality Management Areas and must be the subject of a stage 4 review and assessment.

Roads with Significantly Changed Traffic Flows

A number of developments have been identified following the completion of the original review and assessment that will impact on traffic flows within the borough. These include:

Development	Likely Impact
Hallam Fields, Birstall	Increase in traffic along the A6 corridor in Birstall (an existing AQMA)
Epinal Way Extension, Loughborough	Impact on general traffic flows around Loughborough (an existing AQMA)
Meadow Lane Link road,	Diversion of traffic away from Ratcliffe Road in

Loughborough	Loughborough (an existing AQMA)
Barkby Lane development, Syston	Increase in traffic along Barkby Lane (not an AQMA) and Melton Road (an existing AQMA)

An environmental impact assessment in relation to the **Hallam Fields** development suggests that the development will not impact on road traffic until late in the decade by which time improvements in engine emissions are predicted to negate the air quality impact of the increase in traffic flow. The A6 corridor that runs alongside this development was declared as an AQMA following the original review and assessment and a stage 4 review is still pending on this road link. Therefore despite the findings of the environmental impact assessment a detailed review of this road length is still necessary.

The **Epinal Way extension** has been the subject of an environmental impact statement but this only involved using DMRB to estimate the impact of the road on other major routes in the town and is not detailed enough to meet the needs of this assessment.

The Meadow Lane Link road will divert existing traffic away from Ratcliffe Road – an existing AQMA. Although the project is not yet confirmed as a certainty, funding has been allocated to it and construction is expected to commence in the 2004/5 financial year.

The **Barkby Lane development** is currently only a proposal within the County Councils structure plan and therefore there is insufficient detail to be able to assess the likely traffic implications and therefore the air quality implications of the development. No further assessment work can be undertaken until more information becomes available.

Bus Stations

Since the closure of the Loughborough bus station there are no significant bus stations within Charnwood.

New Industrial Sources

No new industrial sites likely to generate significant quantities of nitrogen dioxide have come into Charnwood since the original review and assessment.

Industrial Sources with Substantially Increased Emissions

Based on evidence from the Environment Agency and the Councils own records no industrial source within the borough generates any substantially increased amounts of nitrogen dioxide.

Aircraft

The East Midlands airport is located approximately 5km north of the Charnwood boundary. However LAQM.TG(03) suggests that once aircraft are 200m above ground level they make no significant contribution to ground level nitrogen dioxide. Impacts of the emissions from aircraft using East Midlands airport can therefore be discounted. There are no other sources of aircraft emissions in Charnwood.

9.REVIEW AND ASSESSMENT OF SULPHUR DIOXIDE

9.1 INTRODUCTION

Sulphur dioxide (SO_2) is a soluble gas consisting of one sulphur and two oxygen atoms. On dissolving in water it gives rise to an acidic solution of sulphuric acid.

The principal source of SO_2 is the electricity generating power stations (71%) followed by other industrial combustion plant - in particular refineries and iron and steel processes. Domestic sources of SO_2 can be significant in areas where there is still extensive use of solid fuel fires.

Sulphur dioxide gives rise to concerns due to its local and global effect. Trans-national transportation of SO_2 in the atmosphere followed by its dry and wet deposition ("acid rain") has accounted for deforestation and lake acidification in continental Europe. In terms of its health effects the acidic nature of dissolved SO_2 causes irritation to lung tissue and may provoke attacks of asthma. The onset of these clinical effects can be very rapid after exposure to a sufficiently high concentration of the gas. With these points in mind, the following air quality standards were set that incorporates a short averaging time and an ambient concentration below which levels of SO_2 are unlikely to have any significant health effects.

266µg m^{-3} expressed as a 15-minute mean, which must not be exceeded more than 35 times a year by 2006.

350µg m^{-3} expressed as a 1-hour mean, which must not be exceeded more than 24 times a year by 2005.

125µg m^{-3} expressed as a 24-hour mean, which must not be exceeded more than 3 times a year by 2005.

9.2 Conclusions of the Original Review and Assessment

The original review concluded that **most individual point sources within the Borough are not considered likely to cause any exceedences of the objectives. The Environment Agency was consulted with regard to individual point sources outside the boundaries of the Borough, which they consider may have the potential to produce emissions, which may impact on the Charnwood area. Their response indicates that there are no sources that are of concern.**

The possibility of the steam heritage locomotives of the Great Central Railway leading to air quality breaches emerged as a possible cause for concern. Considerable further work involving monitoring and possibly modelling will need to be undertaken to provide a robust stage 3 review of this source.

9.3 Conclusions of the Updating & Screening Assessment

The USA indicates that there are some locations within the borough that are at risk of being subject to exposure to breaches of the air quality objectives. Specifically these are receptor points close to the engine sheds of the Great Central Railway in Loughborough. This source will need to be subject to a Detailed Assessment.

9.4 Evidence to Support the Conclusions of the USA

Monitoring Data outside an AQMA

Charnwood currently monitors sulphur dioxide at three locations. One location has a UV flourescence real time analyser, one location has both a diffusion tube and a real-time electrochemical analyser and one location just a diffusion tube. The use of 8 port samplers ceased following the last review and assessment.

The UV analyser is located in a position in the borough which modelling by the Environment Agency suggests is likely to be most significantly affected by emissions from the Ratcliffe on Soar power station. Data from the last two years is summarised below and there have been no breaches of the air quality objectives within this time.

Table 9.1 Summary of sulphur dioxide monitoring data at Durham Road, Loughborough

2001	
Maximum 15 minute mean concentration	107.3ppb (296.2 $\mu g\ m^{-3}$)
Maximum 1 hour mean concentration	65.5ppb (180.8 $\mu g\ m^{-3}$)
Maximum 24 hour mean concentration	15.4ppb (42.5 $\mu g\ m^{-3}$)
Data capture	93.1%
2002	
Maximum 15 minute mean concentration	82 ppb (226.3 $\mu g\ m^{-3}$)
Maximum 1 hour mean concentration	69 ppb (190.4 $\mu g\ m^{-3}$)
Maximum 24 hour mean concentration	20.6 ppb (56.9 $\mu g\ m^{-3}$)
Data capture	97.7%

Monitoring Data inside an AQMA

Charnwood does not have an AQMA declared in respect of sulphur dioxide.

New Industrial Sources

There are no new industrial sources in the borough considered likely to emit significant amounts of sulphur dioxide.

Industrial Sources with Substantially Increased Emissions

Based on information from the Environment Agency and the Councils own records there are no existing industrial sources that have substantially increased emissions.

Areas of Domestic Coal Burning

There is very little use of solid fuel appliances in Charnwood for domestic heating. As an illustration only 49 of the total Council owned stock of 6900 properties have any form of solid fuel appliance. Although there is no available data to prove it, this is thought to reflect the amount of solid fuel appliances found in the private sector. It is not considered likely that any part of the borough has more than 50 houses in a 500 squared meter area using solid fuel as a primary heating source.

Small Boilers > 5 MW (thermal)

Information from an emissions inventory obtained from the original review and assessment confirm that there are two boiler plant sources greater than 5 MW within the borough both of which operate at Loughborough University. Both of these burn natural gas, which is not considered to be a significant source of sulphur dioxide. To the knowledge of the local authority no other new plant or changes to existing plant have occurred since the original review and assessment that requires other boiler plant to be considered further.

Shipping

There are no sources of emissions from shipping in Charnwood.

Railway Locomotives

Charnwood has two railway links within the borough. Firstly the Ivanhoe line for freight and passenger transport which runs through Thurmaston, Syston, Sileby, Barrow and Loughborough. Secondly the Great Central Railway which operates steam heritage locomotives and diesels and which runs through Birstall, Rothley, Quorn and Loughborough.

Diesel locomotives operate on the Ivanhoe line however there are no locations on the line where locomotives are likely to be stationary for more than 15 minutes and where there is a receptor within 15 meters.

Diesels and steam locos operate on the Great Central Railway. Locos are only likely to be stationary for periods of more than 15 minutes at the engine sheds in Loughborough or the stations in Birstall, Rothley, Quorn and Loughborough. There are no receptors within 15 meters of any of the stations however there are receptors within 15 meters of the Loughborough engine sheds. A detailed review of the impact of stationary steam locomotives at the GCR Loughborough engine sheds is therefore necessary.

10.REVIEW AND ASSESSMENT OF PARTICLES (PM10)

10.1 INTRODUCTION

A wide range of emission sources contributes to PM10 (respirable dust) in the UK. Sources can be roughly divided into three main categories. *Primary particle emissions* come directly from combustion sources such as power generation and road traffic. *Secondary sources* are formed by chemical reactions in the atmosphere and consist mainly of sulphates and nitrates. Course particles come from a wide range of sources such as road traffic, construction work, mineral extraction, wind blown dusts, soils sea salt and pollen.

The National Air Quality Strategy has two objectives for respirable particles. The Objectives are 40 $\mu g/m^3$ as an annual mean and 50 $\mu g/m^3$ as a 24 hour mean to be exceeded on no more than 35 days a year. Both are to be achieved by 31 December 2004 and both are based upon measurements carried out using the European gravimetric transfer reference sampler or equivalent.

Provisional more stringent Objectives have also been introduced to be achieved by 31 December 2010 although these are not formally due for adoption until after the review of the EU First Daughter Directive in 2004. These Provisional Objectives are a 24-hour mean of 50 $\mu g/m^3$ to be exceeded on no more than 7 days a year and an annual mean of 23 $\mu g/m^3$.

10.2 Conclusions of the Original Review and Assessment

The original review concluded that **there is no current evidence that the objective for PM10 will be breached. However Charnwood Borough Council remains concerned that traffic derived PM10 will impact on the same areas as is predicted for traffic derived nitrogen dioxide.**

10.3 Conclusions of the Updating & Screening Assessment

The USA suggests that some locations in Charnwood may experience levels of respirable particulate in excess of the annual average objective. These locations must be subject to a more detailed review and assessment. These locations are summarised below.

All roads within the existing Air Quality Management Areas in Charnwood.
Properties around the Lafarge Aggregates quarry in Mountsorrel.

10.4 Evidence to Support the Conclusions of the USA

Monitoring data outside an AQMA

All PM10 monitoring within Charnwood has to date been carried out outside the existing AQMAs. Specifically this has involved a TEOM located at a fixed point near to the A6 corridor in Loughborough and two portable light scatter devices deployed at

various locations around the borough. The light scatter devices have been primarily used as means of investigating public complaints about various point sources and are often deployed for only short time intervals of one to two months. Much of the data gathered has therefore not been used for the purposes of this report.

Monitoring Year - 2001

Location	Equipment	Duration & data capture rate	Annual mean (1)	Number of exceedences of the 24 hour mean (2)	Estimated 2010 mean (3)
Durham Road Loughborough	TEOM	Whole year 95%	22.6	7	21.3
Hawcliffe Road, Mountsorrel	Light scatter device	Whole year 65%	25.0	32	24

Monitoring Year - 2002

Location	Equipment	Duration	Annual mean (1)	Number of exceedences of the 24 hour mean (2)	Estimated 2010 mean (3)
Durham Road Loughborough	TEOM	Whole year 97%	22.5	5	21.6
Pasture Lane, Barrow on Soar	Light scatter device	March to December 86%	23.9	11	21.5

Notes
1. This is based on a calculation from LAQM.TG(03) box 8.4 approach 2 & 3
2. This is based on a calculation from LAQM.TG(03) box 8.4 approach 4 (see Appendix 3)
3. This is based on a calculation from LAQM.TG(03) box 8.4 approach 5

In general the data gives no cause for significant concern. However the Hawcliffe Road site was subject to a high number of breaches of the 24 hour mean which when considered against the relatively low data capture rate (65%) would suggest the strong possibility that the objective for the 24 hour objective is being breached at this location. The site was chosen as it is the closest to the Lafarge Aggregates quarry in Mountsorrel, which had been identified as a source requiring further investigation from the original review and assessment. This data suggests that the quarry should be the subject of a more detailed review and assessment.

Monitoring data inside an AQMA

No PM10 monitoring has been carried out within an AQMA.

Road Junctions

Box 6.2 in Chapter 6 of LAQM.TG(03) summarises the junctions that are may generate significant quantities of PM10. Junctions that require a screening assessment are those with an AADT of more than 10,000 vehicles per day and with exposure locations within 10meters of kerbside. All of the junctions within Charnwood that meet these criteria are summarised in Appendix 2 along with DMRB calculations of the predicted annual mean PM10 concentrations at the nearest receptor points in 2004. None of the residential properties located closest to these junctions are predicted to be subject to a breach of the annual mean objective or more than 35 exceedences of the daily mean.

Roads with high flows of buses and/ or HGVs

Box 8.4 in Chapter 8 of LAQM.TG(03) summarises the roads that due to high bus or HGV flow may generate significant quantities of PM10. Roads that require a screening assessment are those with a AADT of which more than 20% is attributable to buses or HGVs and with exposure locations within 10 meters of kerbside. There are no such roads in Charnwood.

New roads constructed or proposed since the last round of review and assessment

The only significant new road that has received planning permission or commenced construction since the original Review and Assessment is the Epinal Way extension in Loughborough. This will have a significant impact on traffic flows through and around the Loughborough conurbation. An environmental assessment was undertaken in respect to this road in 2000 although it was limited in scope to assessing the air quality impact based on the Design Manual for Roads and Bridges (DMRB) method. Construction of the road began in 2002, traffic flows are likely to be above 10,000 vehicles per day and the road will impact on traffic flows in existing Air Quality Management Areas in the town. The road and its impacts will therefore need to be subject to a more Detailed assessment.

Roads Close to the Objective During the Original Review and Assessment

All roads predicted to result in a significant emission of PM10 were declared as Air Quality Management Areas following the stage 3 review and assessment.

Roads with significantly changed traffic flows

A number of developments have been identified following the completion of the original review and assessment that will impact on traffic flows within the borough. These include:

Development	Likely Impact
Hallam Fields, Birstall	Increase in traffic along the A6 corridor in Birstall (an existing AQMA)
Epinal Way Extension, Loughborough	Impact on general traffic flows around Loughborough (an existing AQMA)
Meadow Lane Link road, Loughborough	Diversion of traffic away from Ratcliffe Road in Loughborough (an existing AQMA)

Barkby Lane development, Syston	Increase in traffic along Barkby Lane (not an AQMA) and Melton Road (an existing AQMA)

An environmental impact assessment in relation to the **Hallam Fields** development suggests that the development will not impact on road traffic until late in the decade. The A6 corridor that runs alongside this development was declared as an AQMA following the original review and assessment and a stage 4 review is still pending on this road link. Therefore despite the findings of the environmental impact assessment a detailed review of this road length is still necessary.
The **Epinal Way extension** has been the subject of an environmental impact statement but this only involved using DMRB to estimate the impact of the road on other major routes in the town and is not detailed enough to meet the needs of this assessment.
The Meadow Lane Link road will divert existing traffic away from Ratcliffe Road – an existing AQMA. Although the project is not yet confirmed as a certainty, funding has been allocated to it and construction is expected to commence in the 2004/5 financial year.
The **Barkby Lane development** is currently only a proposal within the County Councils structure plan and therefore there is insufficient detail to be able to assess the likely traffic implications and therefore the air quality implications of the development. No further assessment work can be undertaken until more information becomes available.

New industrial sources

There are no new industrial sources in the borough considered likely to emit significant amounts of PM10.

Industrial Sources with Substantially Increased Emissions

Based on information from the Environment Agency and the Councils own records there are no existing industrial sources that have substantially increased emissions.

Areas of Domestic solid fuel burning

There is very little use of solid fuel appliances in Charnwood for domestic heating. As an illustration only 49 of the total Council owned stock of 6900 properties have any form of solid fuel appliance. Although there is no data to prove it, this is thought to reflect the amount of solid fuel appliances found in the private sector. It is not considered likely that any part of the borough has more than 50 houses in 500 squared meter area using solid fuel as a primary heating source.

Sources of fugitive emissions

A number of sources within the borough may contribute to fugitive emissions of PM10. Box 8.4 of LAQM.TG(03) suggests that the significance of these sources will be dependant on the predicted background concentrations of PM10 at these locations and the distance from the main sources of fugitive PM10 emission to the nearest receptors. It also suggests that if complaints have been received about the sources or if

local authority officers have witnessed dust emissions from the sites then they need to be considered in more depth. Table 10.2 below summarises the main sources and their possible significance based on these criteria.

Table 10.2 Potential sources of fugitive PM10 in Charnwood

Source	Estimated 2004 background concentrations	Previous complaints?	Location of & distance to nearest receptor
Swithland sand & gravel	18.5	No	5 Swithland Lane, Rothley 375 meters
Wanlip sand & gravel	20.5	No	River House, Church Road, Wanlip, 175 meters
Lafarge Aggregates quarry, Mountsorrel	21.3	Yes	55 Hawcliffe Road, Mountsorrel, 95 meters

On this basis fugitive emissions from the sand extraction processes at Swithland and Wanlip are not considered likely to lead to breaches of the air quality objectives. However some doubt remains regarding emissions from the quarry in Mountsorrel. This will need to be subject to a more detailed assessment.

11.CONCLUSIONS OF THE UPDATING AND SCREENING REVIEW AND ASSESSMENT

Based on the Updating and Screening methodology prescribed by the Department for Environment, Food and Rural Affairs further detailed assessments of air quality are required in order to establish whether a breach of the air quality objectives of the following pollutants is likely;

Pollutant	Areas that require a more detailed assessment of air quality
Nitrogen dioxide	**Properties very close (within 10 meters of the kerb) to the A6 corridor on Derby Road, High Street and Leicester Road in Loughborough.** **Properties on Ratcliffe Road in Loughborough.** **All roads within the current Loughborough AQMA that will be affected by the Epinal Way extension and any other roads outside the AQMA that are predicted to experience significant traffic increases due to the new road.** **The A6 corridor through the village of Birstall.** **The Melton Road corridor through the village of Syston.**
Sulphur dioxide	**Receptor points close to the engine sheds of the Great Central Railway in Loughborough**
Respirable particles	**All roads within the existing Air Quality Management Areas in Charnwood.** **Properties around the Lafarge Aggregates quarry in Mountsorrel.**

Appendix 1 – Summary of the projected 2006 annual mean nitrogen dioxide concentrations at various locations in Charnwood based on the methodology outlined in box 6.2, pages 6.15 – 6.16 of LAQM.TG(03)

NO2 Diffusion tube summary 2000-2002		Projected 2006 Annual Average based on box 6.6, LAQM TG(03)			
Location	OS Reference	from 2000	from 2001	from 2002	**Highest**
RATCLIFFE RD,LOUGHBOROUGH	SK54072040	27.5	32.7	38.9	38.9
SHELTHORPE RD,LOUGHBOROUGH	SK54241866	27.6	37.3	38.3	38.3
FOREST RD,LOUGHBOROUGH	SK52831878		28.6	29.1	29.1
NOTTINGHAM RD,LOUGHBOROUGH	SK54212019	25.6	29.1	35.9	35.9
HAYDON RD, LOUGHBOROUGH	SK52311962		24.4	32.0	32.0
ALAN MOSS RD/EPINAL WAY, LOUGHBOROUGH	SK52081990		28.3	34.4	34.4
LEICESTER RD,LOUGHBOROUGH (2)			37.1	40.9	40.9
DERBY RD, LOUGHBOROUGH	SK53281996		35.6	40.9	40.9
ALAN MOSS RD/A6	SK52892022		33.0	40.7	40.7
DURHAM RD, LOUGHBOROUGH	SK52352069		23.2	26.9	26.9
DURHAM RD, LOUGHBOROUGH (real time)	SK52352069		25.0	27.1	27.1
HIGH ST,LOUGHBOROUGH	SK53731958	40.0	46.3	56.1	56.1
MARKET PLACE,LOUGHBOROUGH	SK53601954	22.5	25.6	28.4	28.4
ASHBY RD, LOUGHBOROUGH	SK53221970		34.9	38.3	38.3
BEACON RD,LOUGHBOROUGH	SK53451880	16.3	20.4	21.0	21.0
ROSEBERY ST,LOUGHBOROUGH	SK52681991	15.8	20.4	22.3	22.3
MELTON RD TOWN CENTRE,SYSTON	SK62761167	23.0	27.2	31.1	31.1
MELTON RD/ADJ ST PETERS RD, SYSTON	SK62341121		29.6	36.5	36.5
LOUGHBOROUGH RD,BIRSTALL	SK59239570	26.0	28.2	31.9	31.9
BIRSTALL A6	SK59179980		32.2	34.6	34.6
HUMBERSTONE LANE,THURMASTON	SK60828756	27.2	33.4	36.8	36.8
THE NOOK,ANSTEY	SK55108642	22.4	26.6	32.2	32.2
MELTON RD,REARSBY	SK65121438	27.6	28.5	32.4	32.4
BRITANNIA ST,SHEPSHED	SK47831963	20.6	24.4	31.0	31.0
ASHBY RD CENTRAL,SHEPSHED	SK48121825		29.3	35.3	35.3
LOUGHBOROUGH RD,HATHERN	SK50262192	28.2	33.2	34.6	34.6
COTSWOLD CLOSE LOUGHBOROUGH		18.5			18.5
SOUTHFIELDS,LOUGHBOROUGH		16.1			16.1
ASHBY RD EAST, SHEPSHED		26.6			26.6
SNELLS NOOK LODGE,LOUGHBOROUGH		26.7			26.7
BENTLEYS NURSERIES,A6 BIRSTALL		22.6			22.6
HOBBY HORSE INN,SYSTON		22.6			22.6
SHEPSHED LODGE,SHEPSHED		25.6			25.6
FOREST RD,LOUGHBOROUGH		23.3			23.3

Note; The correction factors used to amend the diffusion tube data for each year was as follows
2000 – no correction factor applied as there were no real time results against which to compare
2001 – multiplied by 1.0151 as the diffusion tube under-read the real-time analyser by 1.5%.
2002 - multiplied by 1.0786 as the diffusion tube under-read the real-time analyser by 7.8%.

This data was further corrected to predict forward to 2006 as follows;
2000 – multiplied by 0.835
2001 – multiplied by 0.863
2002 – multiplied by 0.891

Appendix 2 – Predicted air quality levels around busy road junctions in Charnwood based on the Design Manual for Roads & Bridges methodology.

Note : 'busy road junctions' in this context are those with annual average daily traffic flows greater than 10,000 and human receptor locations approximately 10meters from kerbside.

Junction of:	and	Nearest receptor	Predicted NO2 annual mean in 2005	Predicted PM10 level in 2004
Shelthorpe Road (A6004)	Leicester Road (A6)	149 Shelthorpe Road	40.6	30.8 with 30 exceedences of the daily mean
Ashby Road Central, Shepshed (A514)	Inglenook Lane	2 Ashby Road	38.3	29.7 with 26 exceedences of the daily mean
Ashby Road (A514)	Epinal Way (A6004)	216 Ashby Road	38.7	29.3 with 25 exceedences of the daily mean 29.3
Ashby Road (A514)	Broad Street	47A Ashby Road	36.7	27.7 with 20 exceedences of the daily mean
Ashby Road (A514)	Greenclose Lane	22 Ashby Road	34.5	26.1 with 15 exceedences of the daily mean
Derby Road (A6)	Alan Moss Road	114 Derby Road	37.6	28.0 with 21 exceedences of the daily mean
Leicester Road (A6)	King Street	80A Leicester Road	38.4	29.1 with 24 exceedences of the daily mean
Melton Road, Syston	Barkby Road	1 Barkby Road, Syston	34.9	26.6 with 17 exceedences of the daily mean
Epinal Way (A6004)	Forest Road	145 Forest Road	38.9	29.7 with 26 exceedences of the daily mean

Appendix 3 – Predicted PM10 concentrations in 2004 based on measured historical data

Monitoring Year 2001

Location	CG_{2001}	$C_{sec2001}$	$C_{prim2001}$	$C_{prim2004}$	$C_{sec2004}$	CG_{2004}
Durham Road	22.6	7.9	4.2	3.9	7.4	21.8
Hawcliffe Road	25.0	7.85	6.7	6.2	7.3	24

Monitoring Year 2002

Location	CG_{2002}	$C_{sec2001}$	$C_{sec2002}$	$C_{prim2002}$	$C_{prim2004}$	$C_{sec2004}$	CG_{2004}
Durham Road	22.5	7.9	7.7	4.3	4.1	7.5	22.1
Hawcliffe Road	22.6	7.85	7.7	4.4	4.2	7.5	22.2

Appendix 4 – Predicted PM10 concentrations in 2010 based on measured historical data

Monitoring Year 2001

Location	CG_{2001}	$C_{sec2001}$	$C_{prim2001}$	$C_{prim2010}$	$C_{sec2010}$	CG_{2010}
Durham Road	22.6	7.9	4.2	3.4	7.4	21.3
Hawcliffe Road	25	7.85	6.7	5.5	6.2	22.2

Monitoring Year 2002

Location	CG_{2002}	$C_{sec2001}$	$C_{sec2002}$	$C_{prim2002}$	$C_{prim2010}$	$C_{sec2010}$	CG_{2010}
Durham Road	22.5	7.9	7.7	4.3	3.6	7.5	21.6
Hawcliffe Road	22.6	7.85	7.7	4.4	3.5	7.5	21.5

CGx = Mean annual PM10 concentration for year x based on the gravimetric monitoring technique
Csecx = Estimated local secondary PM10 concentration for year x
Cprimx = Estimated primary PM10 concentration for year x