North West LEICESTERSHIRE DISTRICT COUNCIL

AIR QUALITY REVIEW AND ASSESSMENT

STAGE 1

Environmental Health Department
Council Offices, Coalville,
Leicestershire, LE67 3FJ

DECEMBER 1998

1. Introduction

1.1 Background

Growing public awareness of environmental issues and increasing incidence of childhood asthma and traffic congestion has led to general concern regarding air quality. Previous simple solutions applied to preventing the heavy smog type image prevalent in urban areas up until the 1950s and '60s are no longer applicable and any solution to the air quality dilemma of the '90s and beyond requires a coherent national strategy applied flexibly at a local level. We are all stakeholders in our air quality and improvements will require the participation of all members of the community as well as the specialist input from scientific and professional groups and the support of government locally, nationally and internationally.

In the early 90's the Expert Panel on Air Quality Standards (EPAQS) was set up by the Secretary of State for the Environment following the publication of the 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.

In 1995 the Environmental Act was passed of which Section 80 required the Secretary of State to publish a National Air Quality Strategy. Following consultation, this Strategy was published in April 1997. Included within it were air quality objectives for 8 key airborne pollutants which the Strategy considered necessary to achieve nation-wide by 2005. These objectives were derived primarily from the EPAQS findings.

1.2 Statutory Requirements

Section 82 of the Environment Act imposes a duty on all local authorities within the UK to review air quality within their boroughs. Further, having reviewed air quality an assessment must be made of the likelihood of the standards quoted in the Strategy being breached in the year 2005. If such a breach is likely then the local authority must issue an order designating an Air Quality Management Area (AQMA) and develop through community consultation an action plan. The Act dictates specific time scales for completion of these duties.

Duty	Completion Date
Complete review and assessment of local air quality	Dec 1999
Issue, if necessary, Air Quality Management Order	Dec 1999
Produce Air Quality Action Plan	Dec 2000
Complete second review and assessment	Dec 2005

1.3 National Air Quality Standards

Pollutant	Concentration Limit	Averaging Period	Objective
Benzene	5ppb	Running annual mean	5ppb
1,3 Butadiene	1ppb	Running annual mean	1ppb
CO	10ppm	Running 8 hour mean	10ppm
Pb	0.5μgm^{-3}	Running 24 hour mean	0.5μgm^{-3}
NO_2	150ppb 21ppb	1 hour mean Annual mean	150ppb hourly mean 21ppb annual mean
Ozone	50ppb	Running 8 hour mean	50ppb as 97th percentile
PM_{10}	50μgm^{-3}	Running 24 hour mean	50μgm^{-3} as 99th percentile
SO_2	100ppb	15 minute mean	100ppb as 99.9th percentile

1.4 Framework for Review and Assessment

This framework is based on the methodology outlined in the Department of the Environment, Transport and the Regions' consultation Paper entitled 'Review and Assessment : Pollutant Specific Evidence' (LAQM.TG4 (98).

1.4.1 First Stage

Every authority is expected to undertake a first stage review and assessment for all the pollutants of concern. Information is to be compiled and collated on any existing or proposed sources of the pollutants of concern. Significant pollutant sources outside of the authority's area which could lead to an exceedance of the air quality objective within its area should also be included.

The first stage review and assessment expects local authorities to:

- Consider all sources of the air quality strategy pollutants that could have a significant impact within its locality.
- Conduct a thorough search of existing information and, where information is unavailable, make reasonable attempts to collect missing information.
- Use the information collected as the basis for a decision on whether to proceed to a second or third stage of review and assessment.

Information requirements are:

- Details of any significant transport related sources including, any existing or proposed roads which in the year 2005 could generate significant quantities of a pollutant of concern
- Details of industrial sources regulated under part 1 of the EPA 1990, including the name, address and geographical location and whether the process is under part A or B.
- Details of any other existing or proposed sources of the pollutants of concern, including the location of the process
- Details of any significant sources of the pollutants of concern which are outside the authority's area, which could lead to the authority failing to achieve the air quality objectives by 2005.
- A description of the sources of information used to compile the report.
- Details of any surveys or investigations undertaken to obtain information to compile the report

Once this information has been collected the authority should then identify those existing or proposed processes or activities which have the potential to emit significant quantities of the pollutants of concern. They must be expected to be in existence in the year 2005 and have potential of exposure of the pollutants to the general public.

1.4.2 Second Stage

The aim of the second stage is to provide a further screening of pollutant concentrations in local authority areas. Locations with the highest likely concentrations of each air pollutant and where exposure to the public could take place should be selected and at these locations the authority should assess whether there is a significant risk of the air quality objective not being achieved by the year 2005.

If an air quality objective is currently being achieved in the location with the highest likely pollutant concentration, and there is no significant risk that the objectives will not continue to be achieved then an AQMA (Air Quality Management Area) will not be necessary.

The report of the second stage should list the pollutants which the authority has concluded require further examination. For each pollutant the following information should be provided:

- Details of any monitoring activities undertaken, including:

  The pollutants measured.
  The pollutant concentrations.
  The monitoring period.
  An estimation of the accuracy and precision of the measurements.
  The monitoring technique employed.
  Gas or particulate sampling system.
  Site details including ordinance survey co-ordinates and site description.
  Quality control, including site maintenance, calibration and service of analysers.
  A description of any data processing techniques employed.

- Details of any modelling techniques employed.

- Details of the review and assessment methodology.

1.4.3 Third Stage

In the third stage, the authority is expected to undertake an accurate and detailed review and assessment of the current and future air quality. Local authorities will need to predict whether a failure to achieve an air quality objective by 2005 is likely. This will be the crucial factor which will trigger the designation of AQMA's. AQMA's should not be declared unless a third stage review and assessment has indicated that air quality objectives are likely to be exceeded by 2005.

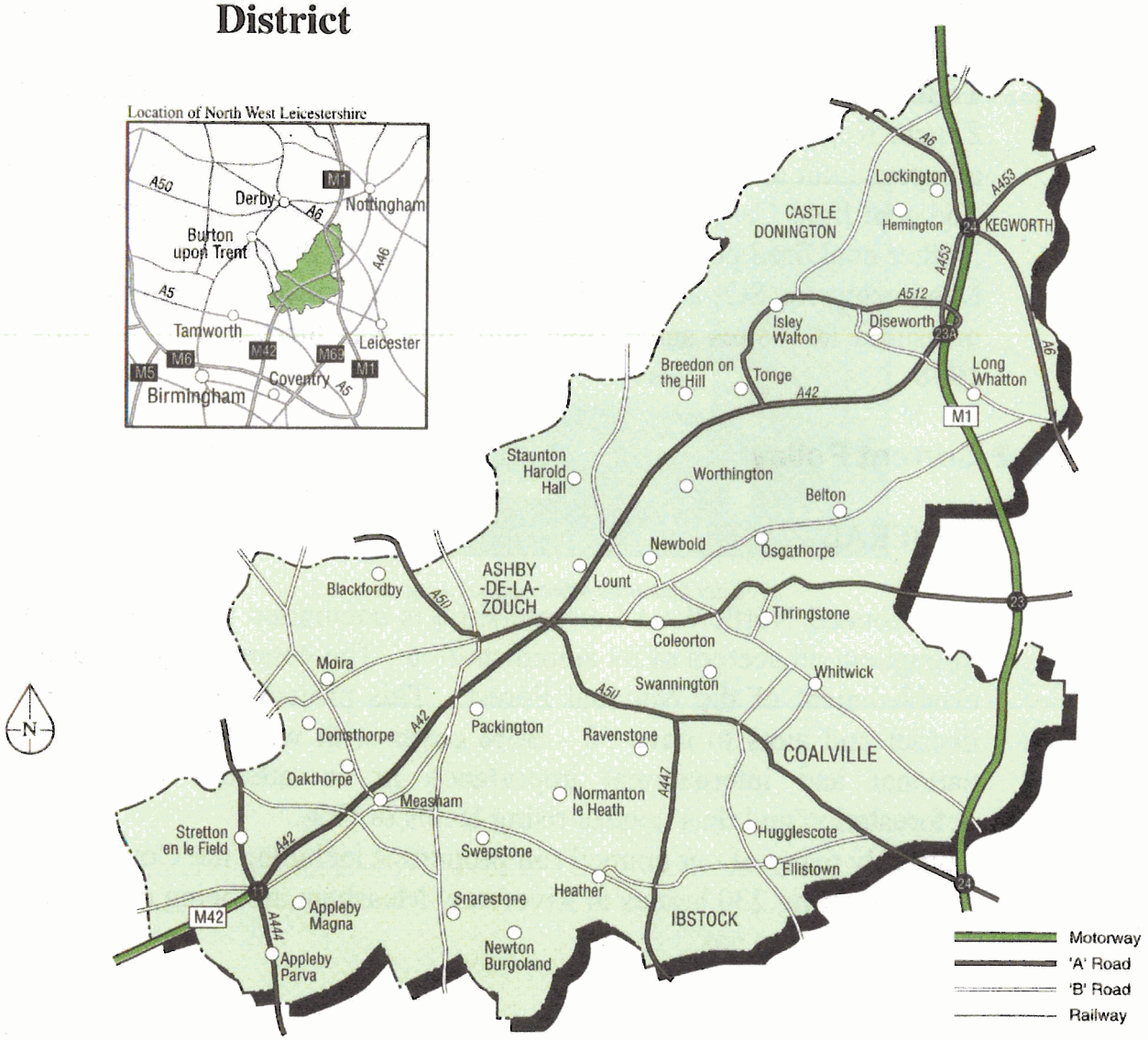
For each pollutant in question, the authority should investigate in which areas a failure of the air quality objectives is likely and where exposure of the public could take place.

This stage will include a detailed emissions inventory for all the pollutants of concern over an area which could reasonably be expected to contribute to the potential area of exceedance. This would be calculated using validated dispersion models which will predict the current and future air quality.

2. North West Leicestershire District

2.1 Introduction

North West Leicestershire District



North West Leicestershire is both the name and geographical location. The district lies between Leicester, Burton-on-Trent, Derby and Nottingham. The district covers 105 square miles and is mostly rural with a large extent of industry both historically from coal mining, and more recently with East Midlands Airport and large opencast mines and quarries. The population of 84,600 (1997) mainly live in the principle towns of Coalville and Ashby-de-la-Zouch and within the large villages of Castle Donington, Kegworth and Ibstock. Three established main roads run through the District the M42/A42 between Birmingham and Nottingham, the M1 and the A50/A511 from Leicester to Burton-on-Trent. As does the recently completed Stoke / Derby by-pass. The district lies in the East Midlands Region.

2.2 Air Quality in the District

2.2.1 History

The coal mining heritage of the district means that there is still heavy reliance on coal with 3% of the population receiving concessionary coal and many other properties (including 30% of council housing) yet to be converted from solid fuel.

Traffic congestion has been a problem in the centres of Coalville, Ashby-de-la-Zouch, Kegworth, Ibstock and around junction 24 of the M1. Despite having a bypass built in 1987 Coalville centre continues to get heavily congested.

The coal fired Castle Donington Power Station closed in September 1994 but 3 other coal fired power stations remain close to the district.

Monitoring for SO_2 and smoke has continued since the 1980's and NO_2 was measured at 7 sites since 1994 until this was increased to 12 sites in April 1998.

2.2.2 Current Policy

GENERAL

As a council North West Leicestershire is committed to improving air quality throughout all sectors of its administration. The council is fully supporting the establishment of the National Forest. This project includes some ¾ of the district and aims to have 50 - 60% cover with woodland. This is of local, national and international importance in an attempt to reverse global deforestation and thus control rising levels of CO_2.

Currently many of our council run properties including the Council Offices and a unit covering 230 homes in Riverway, Measham are being converted from coal fired fuel to gas.

TRANSPORT

The Transport Choice Strategy being implemented by the council is committed to reducing air pollution and congestion by supporting public transport and cycling. Planning for housing and industry is centred around the reopening of the Ivanhoe railway line (the main passenger line between Leicester and Burton-on-Trent) and on the existing industrial branch lines and the non-urban road network. Planning restrictions also safeguard disused canals and railways that may be able to be used again for transport corridors.

The cycling development group is helping to develop the Inverness to Dover Cycle Route through the district and an employee cycle scheme also exists.

There are also smaller scale schemes such as testing the possibilities of using gas powered vehicles and the Walk to School Campaign.

2.2.3 Future Plans and Developments

GENERAL

Plans are underway to convert all our district run vehicles to using city diesel. The council's "planning" Structure Plan for the district published on 7 Dec. 1998 includes provisions for commercial / industrial growth. The premises that could be built may include those that this council will need to authorise under Part 1 of the Environmental Protection Act 1990 (EPA 90).
There are no current plans or proposals to open any new open-cast mines or quarries in the district. Any extensions of existing mines and quarries will have to show dust (particulate) prevention methods in the planning applications.

TRANSPORT

Plans are finalised for the provision of a by-pass around the town of Ashby-de-la-Zouch. This is due to be completed (depending on funding) by Dec 2000. The by-pass together with proposed traffic calming measures will dramatically improve air quality within Ashby town centre.

There has been a long campaign to provide a by-pass to the A6 through Kegworth to reduce air pollution and congestion. Proposals are in conjunction with road improvements on the M1 between junction 23 and 25. This proposal is currently awaiting further study for inclusion in the "New Deal for Trunk roads Scheme".

Other new road plans are improvements to the A512 at Thringstone and Coleorton and a small by-pass from Bardon roundabout to Birch Tree roundabout on the A511. These improvements will improve air quality by reducing congestion and reducing the number of dwellings in close proximity to major roads. The planned new link road from Bridge Road to London Road will allow for pedestrianisation of the presently highly congested upper part of Belvoir Road thus reducing the amount of people exposed to pollution from congested traffic.

Local plans include provision for a Regional Storage and Distribution Centre to be based in the north of the district with good access to junction 24 of the M1. This will have an impact on traffic flows but development will only be permitted if satisfactory and environmentally acceptable improvements are

provided. However, roads used for this development will not include those going through residential areas.

Planning permission has been granted for extensions to the runway at East Midlands Airport and a new DHL air express facility is being built. There are also proposals for a second passenger terminal. These developments will have an effect on air quality due to increased traffic and larger and more frequent planes. The proposed impacts of these developments have been modelled to 2006 and have been produced as part of the environmental statement for the DHL Facility.

The A453 which serves the airport and may serve the proposed Regional Storage and Distribution Centre has a designated maximum capacity of 18,000 vehicles per day. Any development which would increase this load would need to use other options.

The opening of the 'Ivanhoe' railway line and planned new bus and possible train services for the airport will reduce congestion and road usage and thus should help to improve air quality in the district.

2.3 Aims and Objectives of this Report

2.3.1 Aims

a) To investigate present and potential air quality in North West Leicestershire District

b) To provide an initial assessment of air quality based on the Stage 1 methodology outlined in the Department of the Environment, Transport and the Regional consultation Paper entitled 'Review and Assessment: Pollutant Specific Evidence'.

2.3.2 Objectives

a) To identify the principal sources of pollutant emissions affecting air quality in the district.

b) To indicate whether present and potential future levels of pollution may breach the objectives of the National Air Quality Strategy.

c) To provide a baseline of data on which to initiate, if necessary, a Stage 2 and 3 Review.

2.4 Methods and Data Used in This Report

This section deals with the data collected and data interpretation methods used for this report. This is grouped by the main sources of pollutants (authorised processes and traffic) and a section on the monitoring results used for this report.

2.4.1 Industrial Processes

A, Details of Environmental Protection Act. 1990 Part 1 (A and B) authorised processes were collated from following bordering and surrounding districts

Erewash Borough Council
Hinkley and Bosworth Borough Council
East Staffordshire Borough Council
Rushcliffe Borough Council
North Warwickshire Borough Council
Lichfield District Council
Derby City Council
Nottingham City Council
Broxtowe Borough Council
Charnwood Borough Council
Liecester City Council
Tamworth District Council
South Derbyshire District Council

B, Details of emissions from all integrated pollution control (IPC) sites within the region were collected from the Environment Agency. All emissions over 1,000,000 tonnes per year of NO_x or SO_2 within a 20 mile radius of the district were looked at in detail.

C, Information for current and predicted atmospheric emissions from East Midlands Airport for various future development scenarios was taken from the environmental statement for DHL : Worldwide Express EMA 2000 Air Express Facility produced by Stanger Science 9 March 1998.

2.4.2 Traffic Data

Details of traffic flows from roads within the district that form part of the 'Specified Road Network' were obtained from Leicester County Council and the Highways Agency.

Roads include	M1	A50	M42/A42
	A444	A512	A6
	A564A	A511	B591
	453 (N of J24)		B5324
	A447 (South of Coalville)		
	A447/A453 (Tonge to Finger Farm)		

The data was in the form of annual average daily traffic flows for 1998 and predicted flows for 2005 based on national trends. This data has been entered into a simple modelling program (DMRB; Design Manual for Roads and Bridges) to predict the concentrations of specific pollutants for the roads within the district for 2005. This program is based on empirical relationships derived from real time studies. The worst case scenario was always chosen. The inputs needed were

A, Total vehicles per hour :

This figure is the annual average daily flows divided by 10

B, % HGV:

An estimate was made from 15 minute traffic counts at each site during office hours avoiding the peak hours.

C, Speed (km/hr):

Average speed was taken to be the maximum speed limit for the road. Worst case scenarios were also modelled using a speed of 10 km/hr to represent congested traffic. When this was implemented traffic flows were adjusted to represent the lower possible vehicle flows during congestion based on :

$$\text{No. of vehicles/hr.} = \frac{\text{km travelled per hr}}{\text{vehicle length + distance}} \times \text{lanes}$$

Average vehicle distance = 4 metres (10 km/hr)
= 6 metres (20 km/hr)

D, Year: = 1998 (to compare with current monitoring)
= 2005 (to predict)

E, Distance to receptor:

Kerbside concentrations were determined using a 5 metre distance to receptor. These are best applied for the NO_2 data as the figures are based on a 1 hour mean which would represents average exposure time at the kerbside.

Workplace concentrations were determined using a distance to receptor of the distance (m) between the centre of the road and the nearest workplace (Eg. Shops, schools, service stations). These are best applied to CO results which are based on an 8 hour average and would represent work/school-time exposure.

Residential concentrations were determined using a receptor distance (m) of the distance between the centre of the road and the nearest dwellings. These figures are best applied to the particulate and benzene results which are based on total daily/annual average exposures.

For roads with shops and homes lining the street these 3 concentrations will be the same.

The outputs can be directly compared to the air quality objectives assuming that the 99th percentile of the 24 hr running averages for the particulate results are greater than the 95th percentile. Annual average mean for NO_x can be converted to max 1 hr mean by dividing by 6. The outputs of the derived emission estimates can be assumed to have a generally accuracy of ± 30%.

2.4.3 Monitoring Results

Results of both national and local monitoring were used.
National results for background concentrations of pollutants were taken from the Department of the Environment, Transport and the Regions website.
www.environment.detr.gov.uk/airq/aqinfo.htm
and the Netcen website
www.aeat.co.uk/netcen/airqual

Results from the surrounding Automatic Monitoring Stations were used

Leicester Centre (a town centre site)
Nottingham Centre (a town centre site)
Birmingham East (an urban background site)

Locally we monitor for :

Sulphur dioxide (SO_2) and Smoke on a daily basis using an automatic 8 port sampler.

Nitrogen dioxide (NO_2) is measured on a monthly basis by use of 12 Diffusion tubes located at the following sites.

These results are assumed to have an accuracy of ± 10%

Town / Village	Street	Pollution source being monitored
Coalville	Belvoir Rd.	Coalville town centre traffic
Coalville	Jackson St.	Coalville intermediate location traffic
Coalville	Oxford St.	Coalville background levels
Coalville	Abbot's Oak Drive	Coalville background levels
Ibstock	Melbourne Rd.	A447
Measham	High St.	B4116
Ashby	Ulleswater Crescent	A42
Ashby	Marlborough Way	Ashby background levels
Ashby	Market St.	A511
Castle Donington	High St.	Castle Donington Traffic
Castle Donington	Stonehill	East Midlands Airport
Kegworth	Derby Rd.	A6

Table 1 Nitrogen dioxide diffusion tube monitoring locations.

3. Review and Assessment of Benzene

3.1 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.

Benzene is a carcinogen that can cause leukaemia over long term exposure. There is therefore no level of exposure at which there is zero risk. EPAQS considered the medical evidence and decided that a level of **5ppb as a running annual mean** represented an exceedingly small risk to health. This is reproduced as the air quality objective in the National Air Quality Strategy. There are currently no new Air Quality Daughter Directives for Benzene from the EU Environment Council.

The Government is currently reviewing data collected from the monitoring of benzene around large petrol filling stations. The findings on the completion of this study will dictate whether such installations are considered likely significant sources of the pollutant. However, benzene emissions from petrol filling stations will continue to decrease due to implementation of Directive (94/63/EC) designed to control emissions of all volatile organic compounds (VOC's) which includes benzene. Implementation of vapour recovery systems for loading and unloading of petrol are required for stations with an annual throughput over 1,000 m^3 (219,970 gallons) by 31 Dec. 1998. Petrol stations with annual throughput of between 500 m^3 (109,985 gallons) and 1,000 m^3 (219,970 gallons) have until the end of 2001 to install these systems. A further directive (stage II) to reduce VOC emissions from vehicle refuellings at petrol stations is also to be prepared. All petrol stations with a throughput of more than 2500 m^3 (549,925 gallons) a year together with those in "sensitive areas" would be required to fit vapour recovery equipment initially capable of recovering 70% of the vapour. By 1 Jan. 2006 compatibility of filling necks

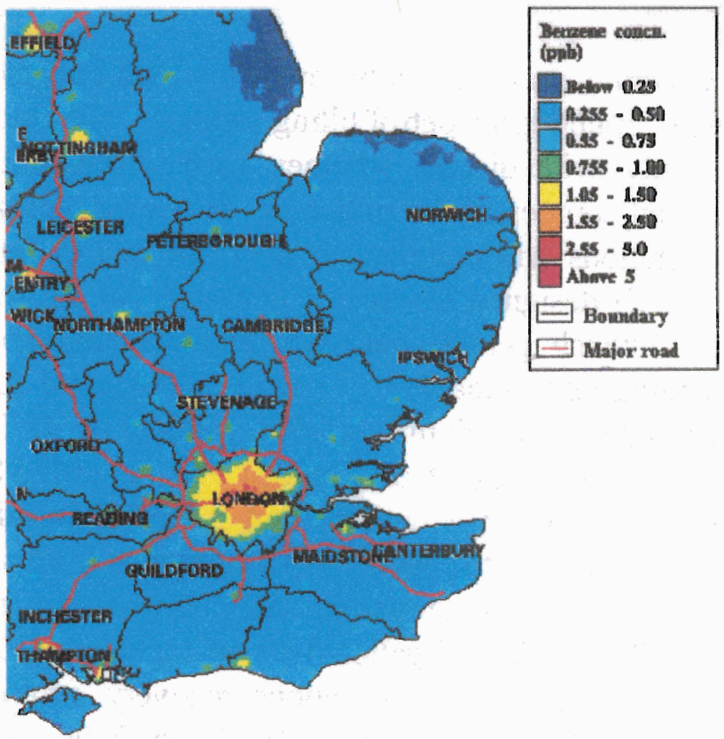
and petrol pump nozzels to ensure a hermetic seal will be mandatory, thus enabling 95% vapour recovery.

3.2 National Trends

Monitoring in London suggests that there has been a substantial decline in benzene over the past 20 years. The adoption by the UK of European Directives controlling traffic emissions are likely to result in a continued decrease in benzene in the atmosphere to about 35% of its current levels by the year 2005. In view of this, national policies are likely to deliver the prescribed air quality objective for benzene by 2005 unless there are significant local sources of the pollutant.

3.3 Exposure and Background Levels

The Pollutant Specific Guidance (LAQM.TG4 [98]) states that the authorities review should focus on non-occupational near ground level outdoor locations with elevated benzene concentrations in areas where a person might reasonably be expected to be exposed over a year (e.g. In the vicinity of housing, schools, or hospitals etc.).
The background levels of benzene in the district are between 0.255 and 0.75 ppb. This is similar to most of central England except around the cities (see below).



3.4 Emissions

3.4.1 Authorised Processes

There are no authorised (under part 1 of the Environmental Protection Act 1990) petrol storage and distribution facilities in the district and the nearest is the Kingsbury Terminal within North Warwickshire District, some 8 miles from this district.

East Midlands Airport emissions such as from refueling of aircraft and storage of aviation fuel have been predicted to create hydrocarbon levels (of which benzene will be a small proportion) in 2006 of maximum 8.0 $\mu g/m^3$ (3.2 ppb) immediately adjacent to the airport and 5.0 $\mu g/m^3$ (2 ppb) in Castle Donington.

Of the 32 petrol filling stations in the district 17 are currently fitted with vapour recovery systems for loading and unloading of fuel and the further 15 will have the systems installed by 2004. At present there are no petrol stations fitted with vehicle refuelling vapour recovery systems though conversion of others in neighbouring districts suggest that this may soon change.

3.4.2 Road Traffic Emissions

The results of predictions for 1998 and 2005 using DMRB are shown below.

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	2.02	15.25	0.65	4.94
A42 Stretton (97)	2.06	15.25	0.62	4.58
A42 Breedon	1.84	16.22	0.55	4.87
A42 Long Whatton	1.89	15.72	0.57	4.73
A444 Appleby Parva	0.23	7.82	0.21	7.39
A447 Ibstock	0.68	8.84	0.68	8.84
A453 Isley Walton	0.24	8.37	0.24	8.37
A511 Ashby	1.20	8.51	1.14	8.05
A511 Bardon	0.60	7.87	0.57	7.44
A512 Coleorton	0.24	8.55	0.22	8.09
A6 Kegworth (village)	1.55	8.55	1.55	8.55
A6 Kegworth (Jtn 24)	0.59	8.49	0.59	8.49
B591 Bawdon Lodge	0.18	8.73	0.18	8.73
B5324 Long Whatton	0.33	8.63	0.33	8.63
M1 Copt Oak (97)	3.46	24.36	1.04	7.32
M1 Copt Oak (98)	3.17	24.36	0.95	7.32
M1 Long Whatton (97)	3.47	25.06	1.04	7.53
M1 Long Whatton (98)	4.60	25.06	1.38	7.53

Table 2. Predicted concentrations of benzene (ppb) for 1998 using DMRB

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	0.92	7.77	0.29	1.8
A42 Stretton (97)	0.94	7.77	0.30	1.8
A42 Breedon	0.74	5.64	0.30	1.7
A42 Long Whatton	0.81	5.83	0.30	1.8
A444 Appleby Parva	0.10	2.93	0.10	2.9
A447 Ibstock	0.22	2.54	0.22	2.5
A453 Isley Walton	0.09	2.72	0.09	2.7
A511 Ashby	0.42	2.67	0.30	2.5
A511 Bardon	0.26	2.91	0.30	2.8
A512 Coleorton	0.09	2.65	0.09	2.5
A6 Kegworth (village)	0.54	2.65	0.54	2.7
A6 Kegworth (Jtn 24)	0.22	2.67	0.22	2.7
B591 Bawdon Lodge	0.06	2.58	0.06	2.6
B5324 Long Whatton	0.11	2.62	0.11	2.6
M1 Copt Oak (97)	1.38	8.45	0.44	2.5
M1 Copt Oak (98)	1.25	8.45	0.40	2.5
M1 Long Whatton (97)	1.31	8.18	0.41	2.5
M1 Long Whatton (98)	1.73	8.18	0.55	2.5

Table 3. Predicted concentrations of benzene (ppb) for 2005 using DMRB.

3.5 Monitoring Results

The nearest monitoring station for benzene is Birmingham East. This is an urban background site situated in a school playground in Castle Bromwich approximately 20 miles South West from the district's border. The annual mean has been 1.0 ppb (1996) and has remained constant since the station was installed in 1994. This compares to the mapped background levels of 0.75 ppb for the district. However the maximum hourly average (1996) was 29.1 ppb suggesting that there is considerable fluctuation of concentrations with some high peaks.

3.6 Discussion and Conclusions

The National Air Quality objective is 5 ppb as an annual average. The predicted emissions from East Midlands Airport of 3.2 ppb for total hydrocarbons in 2006 are unlikely to exceed the objective even with large errors on this figure as benzene is likely to constitute only a small proportion of this total.

Although some petrol stations are close to housing areas they are unlikely to cause exceedances to the objectives as only 5% of the total benzene comes from spillages and lost vapour and new vapour recovery systems will continue to decrease the amount of lost vapour.

Predictions for benzene levels are higher for 1998 than for 2005. This is because the increase in emissions due to higher traffic flows is smaller than the decrease in emissions due to catalytic converters and engine improvements. Although the 5ppb limit is predicted to be broken during congestion, this would require congestion for 24 hrs per day and for every day of the year, which is unlikely, but the figures give some idea of the peaks expected such as those seen at the Birmingham East monitoring station. Some kerbside predictions are close to 5ppb however there are no people living at these kerbsides, the nearest gardens being at 30 metres from the M1 and 20 metres from the M42/A42. For the residential distances the maximum prediction is for the M1 at 1.38 ppb, which falls well below the 5ppb limit and properties here are also well screened by earthworks and trees.

In conclusion it is unlikely that the annual average of 5 ppb is being broken or will be broken by 2005 in any areas of the district where people are expected to be exposed over a year even with a large error margin. There are no areas where combined effects from the airport, filling stations and major roads overlap and intercept with residential, school or hospital uses. There is no need to proceed to stage 2 or further assessment unless there is a change in threshold.

4 Review and Assessment of 1,3 – Butadiene

4.1 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 of which there is zero risk. EPAQS set a level of **1ppb 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.

4.2 National Trends

Due to the increase in the use of olefines in petrol, the amount of 1,3 butadiene in the atmosphere is thought to be increasing. However, three-way catalytic converters have been shown to decrease emissions by 90%, and as such 1,3 butadiene emissions across the UK should reduce by 55% by the year 2000, and 73% by 2010. In view of this, national policies are likely to deliver the predicted air quality objective by 2005 unless there are significant local sources of the pollutant.

4.3 Exposure and Background Levels

The Pollutant Specific Guidance (LAQM TG4 [98]) states that the authority's focus for review and assessment should be non-occupational near ground level outdoor locations in areas where a person may be reasonably expected to be exposed over a year. Also if there are no industrial processes that emit 1,3 –

butadiene in the district (or in a neighbouring district in such a location that could lead to exceedance of the objective within the authority's own area) then the risk of the air quality objective being exceeded by the end of 2005 should be considered to be negligible and the authority need not consider the possibility of an air quality management area for this pollutant.

The limited amount of national data for this pollutant mean that background levels would not be justifiable.

4.4 Emissions

There are no authorised processes within the district that emit 1,3 – Butadiene, the nearest processes are the Pirelli tyre factory and Unipoly Silvertown Ltd. both located within East Staffordshire District and over 15 miles from North West Leicestershire.

Due to increasing control of emissions from road traffic by catalytic converters these emissions are considered to be of negligible effect by 2005.

4.5 Monitoring Results

The nearest monitoring station for 1,3-Butadiene is Birmingham East. This is an urban background site situated in a school playground in Castle Bromwich approximately 30 kilometres South West from the district's border. The annual mean for this site was 0.2 ppb for 1996

4.6 Discussion and Conclusions

As vehicle emissions are considered to be negligible and emissions from the processes in East Staffordshire are likely to only affect adjacent areas then further assessment to stage 2 will not be necessary for this pollutant.

5 Review and Assessment of Lead

5.1 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 which 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 emissions of lead in the UK come from petrol driven road vehicles (72%) where the lead is emitted as fine particulates in the exhaust fumes. Lead in the form of tetraethyl lead is added to petrol to enhance its octane rating. The other important source of airborne lead is primarily from smelting activities (9%). 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%.

Lead is bio-accumulative, namely, it concentrates 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, gastrointestinol tract, joints and reproductive system.

At the time of the production of the National Air Quality Strategy, no EPAQS Report had been published relating to lead. A revised 1987 WHO Guideline for lead set a figure of 0.5 μm^{-3} as an annual mean, and it is this figure that was adopted for the purposes of the Strategy. In 1998 EPAQS published their report on lead which recommended an air quality standard of 0.25μgm^{-3} as an annual average.

The Air Quality Daughter Directive agreed by the EU Environment Council 16 June 1998 has an annual limit value of 0.5$\mu g/m^3$.

5.2 National Trends

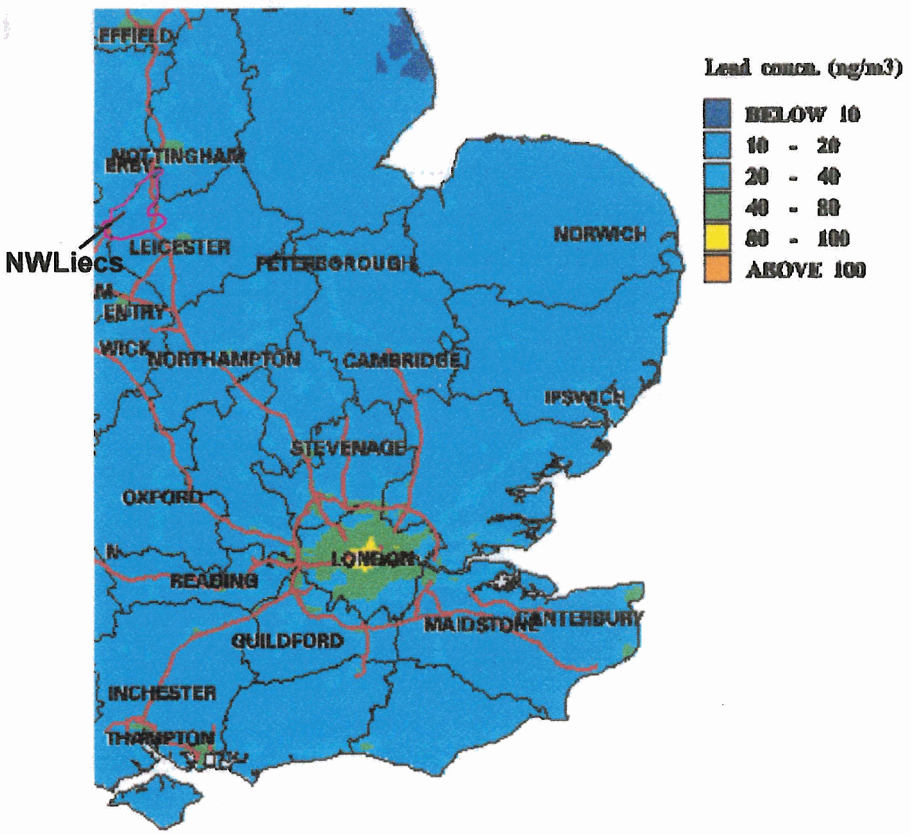
Levels of atmospheric lead have dropped dramatically in the UK since the early 1980s due to a reduction in the permissible concentration in lead in petrol combined with the necessity to remove lead altogether from petrol used in cars

equipped with catalytic converters. As catalytic cars replace the leaded petrol fleet, then lead will continue to reduce. By 2005 emissions of lead are likely to have decreased by 90% based on 1995 levels. In view of this, national policies are likely to deliver the Air Quality objective by 2005 unless there are significant local sources of lead.

5.3 Exposure and Background Levels

The Pollutant Specific Guidance (LAQM TG4 [98]) states that the authority's focus for review and assessment should be non-occupational near ground level outdoor locations in areas where a person may be reasonably expected to be exposed over a year. Also if there are no industrial processes or planned industrial processes that emit lead in the district (or in a neighbouring district in such a location that could lead to exceedance of the objective within the authority's own area) then the risk of the air quality objective being exceeded by the end of 2005 should be considered to be negligible and the authority need not consider the possibility of an air quality management area for this pollutant.

Background levels in North West Leicestershire range from between 10 to 20 ng/m^3 for non-motorway locations to 20 – 40 ng/m^3 around the M42/A42 and the M1 (see map below). This compares to the air quality objective of 500 ng/m^3 (0.5 μg/m^3) or the EPAQS standard of 250 ng/m^3 (0.25 μg/m^3).



5.4 Emissions

5.4.1 Authorised Processes within the District

There is one foundry process (Pegson Ltd., Mammoth Street, Coalville.) within the district which is authorised by this council under part 1 of the Environmental Protection Act 1990. More specifically 4 government guidance notes apply to it controllling emissions to the atmosphere.

Iron, Steel and non-ferrous metal foundry process [PG 2/4]
Hot and cold blast cupola [PG 2/6
Aluminium and aluminium alloy processes [PG 2/6]
Copper and copper alloy processes [PG 2/8]

The foundry process involves casting operations which create only small quantities of emissions and as such are exempt [PG 2/4 clause 17] from any emissions limits.

The actual cold blast cupola has a capacity of less than 4 tonnes per hour. This makes the process exempt [PG 2/6 clause 17b] from emission control providing simple wet arrestment equipment is installed. This cupola is used for all ferrous and non-ferrous (including copper and aluminium) materials.

5.4.2 Authorised Processes Surrounding the District

Within South Derbyshire District there is a lead smelting process some 150 metres from the border of North West Leicestershire and about 250 meters from the edge of the residential area of Albert Village which is within North West Leicestershire.

The operators are Midland Lead Manufacturers Limited, Kiln Way, Woodville, Swadlincote.
The process is a secondary lead smelting process authorised under part 1 of the Environmental Protection Act 1990

On the opposite side of the district there is also a bell foundry in Loughborough in the neighbouring Borough of Charnwood.

The operators are John Taylor Bell Foundry, Freehold Street, Loughborough
The process is a lead, steel and non-ferrous metal foundry process, Authorisation No.020

5.5 Monitoring Results

There is no local monitoring of Lead in the district. The nearest national monitoring sites are in Walsall.

5.6 Discussion and Conclusions

Although the largest source of lead has been from road traffic emissions, increasing use of unleaded fuel means that it is unlikely that the air quality objectives are being exceeded or will be exceeded in 2005 by this source. This is confirmed by the background data which shows levels well below the objective even around the motorway sites which sites are also distanced from residential school or hospital uses.

Due to the size of the Pegson foundry operations there is likely to be only negligible emissions of lead from this process. Similarly the size and distance away from the district of the bell foundry in Loughborough means that a breach of the objectives is unlikely from this process.

The secondary lead smelter in Woodville is likely to have significant emissions of lead to warrant a further assessment to stage 2. This will require liaison with South Derbyshire District Council as they proceed to stage 2 particularly regarding concentrations likely to impact upon the residents of Albert Village.

6. Review and Assessment of Carbon Monoxide

6.1 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 which produces 75% of total UK emissions. 71% of the total national emission comes from petrol vehicles.

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. 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.

At high levels of CO, prolonged exposure 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.

EPAQS recommended a level of CO at which there is insignificant risk to health to be **10ppm as an 8 hour average**. This is reproduced as the air quality objective in the National Air Quality Strategy.

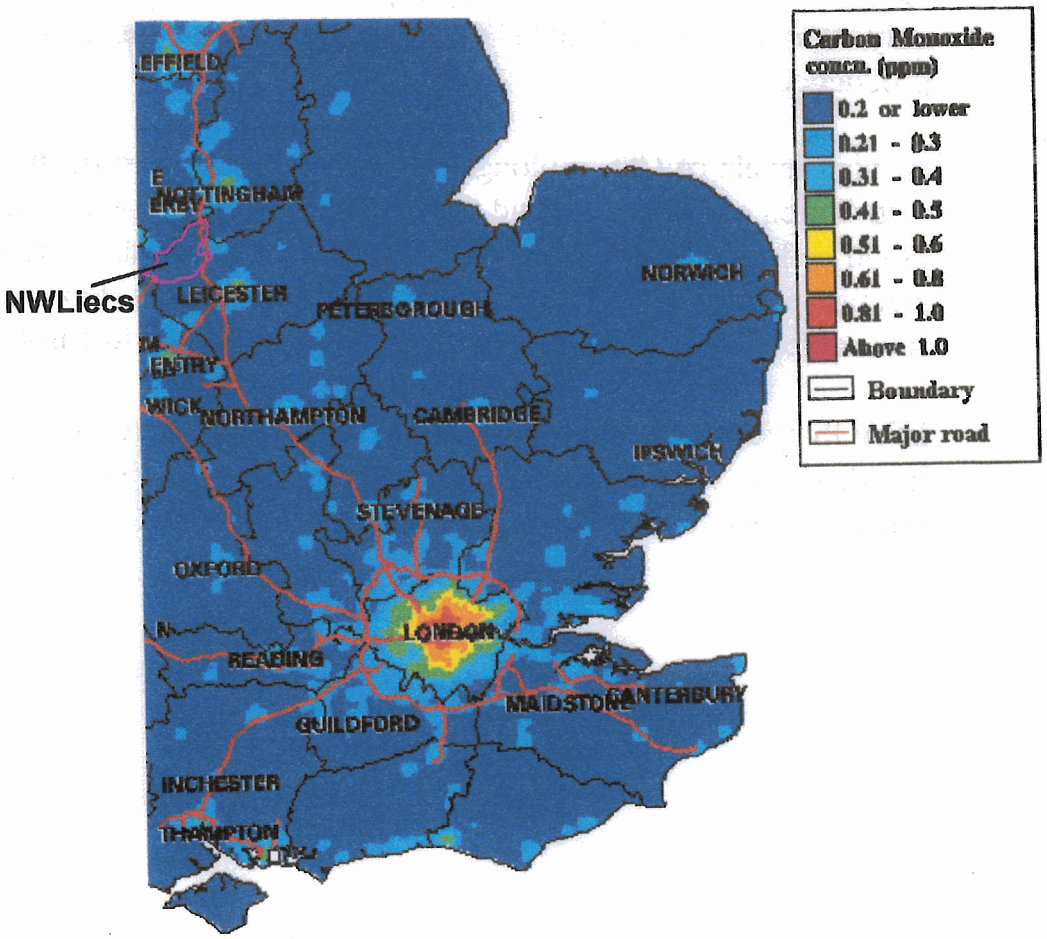
6.2 National Trends

Emissions of CO in the UK increased by 13% between 1970 and 1990. However, they have been decreasing every since. There is clear evidence of this in rural areas, but less so in urban areas. The improvements in emissions is largely attributed to stricter emission standards for road vehicles. Tighter fuel standards from the EU Auto-Oil directives (for all new cars sold from 2001 to 2006) will deliver an emission reduction of 30% for carbon monoxide compared to 1997 levels.

6.3 Exposure and Background Levels

The Pollutant Specific Guidance (LAQM TG4 [98]) states that the authority's focus for review and assessment should be non-occupational near ground level outdoor locations in areas where a person may be reasonably expected to be exposed over an eight hour averaging period.

Background levels in the district are less than 0.3 ppm (see map below)

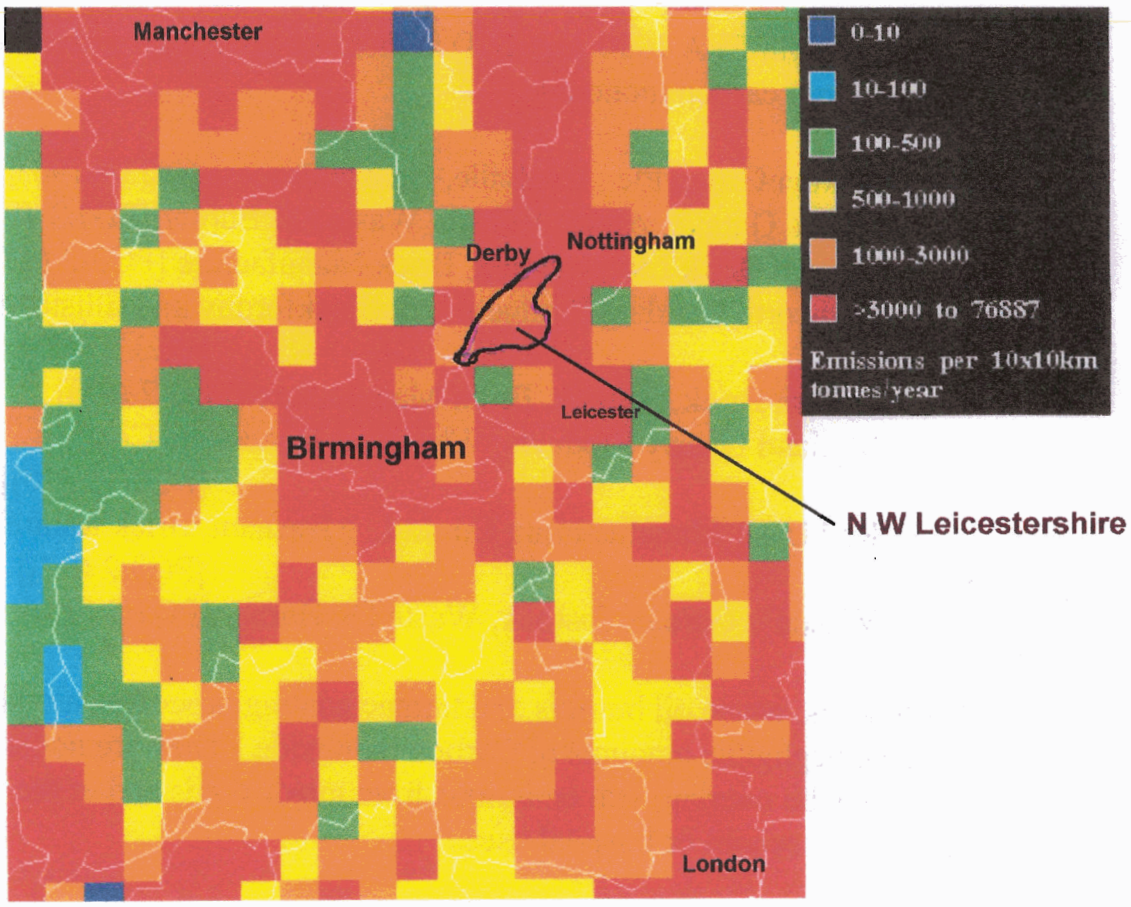


6.4 Emissions

6.4.1 General Emissions

Published emission maps based on a 100km^2 grid show that the district is covered by 6 grid squares. The middle sections and far SW of the district have emissions of between 1000 and 3000 tonnes per year. The northern and southern parts have emissions of over 3000 tonnes per year. The northern square actually has emissions of 7237 tonnes per year. This is similar to values for the majority of the region (see map below)

Map of Carbon Monoxide Emissions in the Midlands



6.4.2 Emissions from Authorised Processes

There are no processes authorised under EPA 1990 part 1 (A) within the district however, the Ratcliffe-on-Soar power station lies 250 meters from the border of North West Leicestershire. Emissions from this power station are 3,303,000 tonnes of carbon monoxide per year. The nearest residential area is Kegworth which is about 2 miles to the south east of the power station. The plume from the stack will carry exhaust gases for long distances generally in a westerly direction. Some meteorological conditions will give local elevated levels of carbon monoxide however for similar power stations this has been predicted to be a maximum of 10 ppb (1000^{th} of 10 ppm). It is also in the interests of power generating companies to minimise levels of carbon monoxide produced as this means the combustion process is running inefficiently.

There are eight EPA 1990 part 1(B) authorised processes within the district that will emit carbon monoxide.

Bardon Group Plc., Coalville, Quarry Process [PG3/8 (96)]
Fearns Garage, Albert Village, Waste Oil Burner [PG1/1 (95)]
Hanson Brick Ltd., Heather, Brick Manufacture [PG3/2 (97)]
Hepworth Building Products Ltd. Blackfordby and Ellistown [PG3/2 (97)]
Ibstock Brick, Ibstock, Brick Manufacture [PG3/2 (97)]
Midland Quarry Products, Whitwick, Roadstone Coating [PG3/15 (96)]
Red Bank Manufacturing Co. Ltd., Measham, Brick Manufacture [PG3/2 (97)]
Wilson's Garage, Ibstock, Waste Oil Burner [PG1/1 (95)]

These kilns, waste oil burners and tarmac coating processes are likely to only produce negligible amounts of Carbon monoxide. They are not situated where there may be overlap with emissions from major roads and in the vicinity of residential, school or hospital uses.

6.4.3 Road Traffic Emissions

Simple modelling results using the traffic flow data and DMRB for predicted concentrations 1998 and 2005 (see tables on page 29).

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	5.30	31.13	2.48	10.83
A42 Stretton (97)	5.39	31.13	2.37	10.12
A42 Breedon	4.80	34.21	2.20	11.05
A42 Long Whatton	4.97	32.64	2.24	10.57
A444 Appleby Parva	1.48	16.71	1.46	15.87
A447 Ibstock	2.24	19.98	2.24	19.98
A453 Isley Walton	1.48	18.48	1.48	18.48
A511 Ashby	2.98	18.92	2.87	17.96
A511 Bardon	2.14	16.87	2.09	16.03
A512 Coleorton	1.47	19.06	1.45	18.09
A6 Kegworth (village)	3.74	19.06	3.74	19.06
A6 Kegworth (Jtn 24)	2.08	18.86	2.08	18.86
B591 Bawdon Lodge	1.38	19.63	1.38	19.63
B5324 Long Whatton	1.65	19.29	1.65	19.29
M1 Copt Oak (97)	8.08	50.90	3.18	16.07
M1 Copt Oak (98)	7.51	50.90	3.01	16.07
M1 Long Whatton (97)	8.01	53.12	3.16	16.74
M1 Long Whatton (98)	10.27	53.12	3.84	16.74

Table 4. Predicted Concentrations of Carbon Monoxide (ppm) for 1998 using DMRB.

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	3.24	15.22	1.76	4.26
A42 Stretton (97)	3.28	15.22	1.78	4.26
A42 Breedon	2.71	11.70	1.78	4.27
A42 Long Whatton	2.93	11.68	1.78	4.27
A444 Appleby Parva	1.27	6.38	1.27	6.38
A447 Ibstock	1.46	6.41	1.46	6.41
A453 Isley Walton	1.24	6.40	1.24	6.40
A511 Ashby	1.75	6.40	1.78	6.12
A511 Bardon	1.60	6.38	1.78	6.09
A512 Coleorton	1.23	6.40	1.23	6.12
A6 Kegworth (village)	2.02	6.40	2.02	6.40
A6 Kegworth (Jtn 24)	1.47	6.40	1.47	6.40
B591 Bawdon Lodge	1.18	6.41	1.18	6.41
B5324 Long Whatton	1.27	6.41	1.27	6.41
M1 Copt Oak (97)	4.14	17.02	2.05	5.87
M1 Copt Oak (98)	3.85	17.02	1.96	5.87
M1 Long Whatton (97)	3.88	17.04	1.97	5.88
M1 Long Whatton (98)	4.79	17.04	2.26	5.88

Table 5. Predicted Concentrations of Carbon Monoxide (ppm) for 2005 using DMRB.

6.5 Monitoring Results

There is no local monitoring of carbon monoxide. The automatic monitoring station in Leicester Centre (an urban centre location) has had an annual mean of 0.5ppm for 1994, 1995 and 1996. The maximum hourly average in 1996 was of 5.3 ppm with the 98th percentile of the hourly averages being 1.7 ppm.

6.6 Discussion and Conclusions

The traffic data predicts that the air quality objectives for carbon monoxide will not be exceeded in 2005 unless there is severe continual congestion. Even should this occur the concentrations are predicted to still be below the limit at residential locations. Predictions for 1998 are higher and suggest that during continued congestion there may be peaks above 10ppm however, these levels resulting from congestion are unlikely to be sustained for the full 8 hours.

Results from the Leicester monitoring station confirm that even in a busy town centre close to a major ring road average carbon monoxide levels fall well below the objective.

Although road traffic emissions may be presently close to the objective during congestion and adverse weather conditions emissions are decreasing to an extent that in 2005 it is unlikely that the objective will be exceeded.

Emissions from the power station are not likely to cause exceedance of the national objectives in areas where people may be exposed to emissions over an 8 hour averaging period as effects are seen only in the immediate vicinity of production. Other industrial sources within the district are negligible and do not overlap with major traffic flows and residential areas.

Further assessment to stage 2 will not be necessary.

7. Review and Assessment of Nitrogen Dioxide

7.1 Introduction

Nitrogen dioxide is a gas formed from one nitrogen molecule and two oxygen molecules. In sufficient concentrations in air it appears as a red/brown colour and it is in part this coloration which creates the discoloured 'smog' which can often be seen in the skyline of cities.

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 relatively rapidly oxidised to nitrogen dioxide in air. The most significant source of these gases is road transport which accounts for 46% of the total UK emission. The electricity supply industry produces another 22%, other industrial sources 12% and domestic sources 3%. Nitrogen dioxide is of concern both locally and globally. Accumulations of the gas in the vicinity of sources can give rise to direct health effects whilst the gas also acts indirectly as greenhouse gases.

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 150 parts per billion 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:- **150ppb for one hour and 21ppb as an annual mean**.

The EU air quality daughter directive defines the same limits but also specifies a limit of 18 exceedances of the hourly limit in any one year.

7.2 National Trends

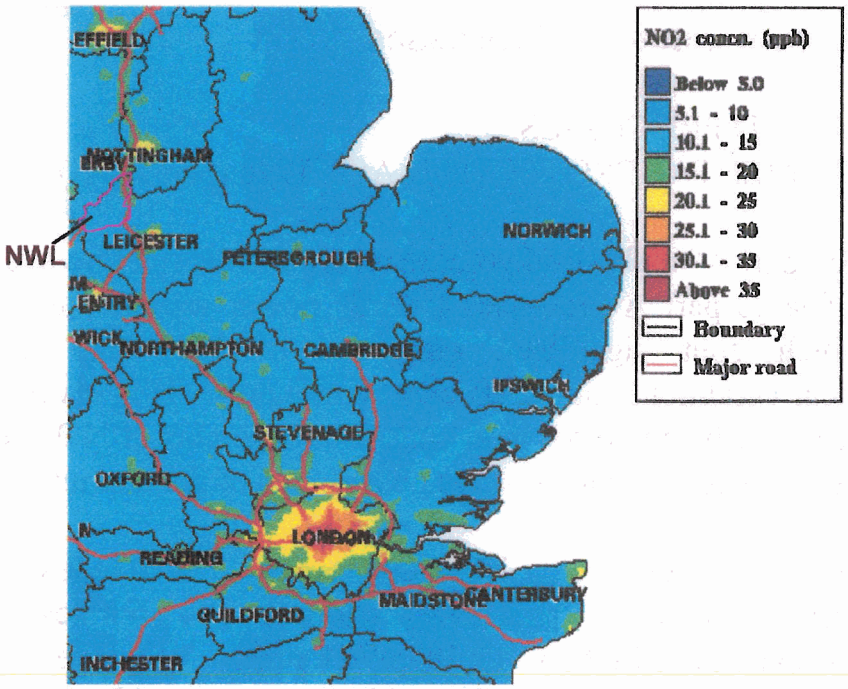
A total of 94 automatic monitoring stations operate at various locations around the country. In addition, the National Environmental Technology Centre co-ordinates the collation of data from passive diffusion tube samplers collected from approximately 300 different local authorities across the country. Trends indicated from the automatic stations vary depending on local influences. Of the diffusion tube surveys there appeared to be a 34% increase in the period 1986-1991 (corresponding with a 30% increase in road traffic). NETCEN are cautious about drawing national trends from more recent data. However, 1995 results indicated that 326 of the 1220 sites monitored were in exceedance of the then WHO annual average guideline of 20.9ppb.

Road Traffic NOx emissions are predicted to drop by 46% by 2005 due to a variety of EU Directives. However, the local and national trends are still very difficult to predict.

7.3 Exposure and Background Levels

The Pollutant Specific Guidance (LAQM TG [98]) states that the authority's focus for review and assessment should be for outdoor locations where it will potentially be likely that people will be exposed over one hour. Therefore, we will focus on areas such as pavements particularly in the vicinity of shops.
For purposes of this stage 1 review and assessment the guidance suggests that if background concentrations or monitoring results of over 30 ppb are identified then further review and assessment is required.

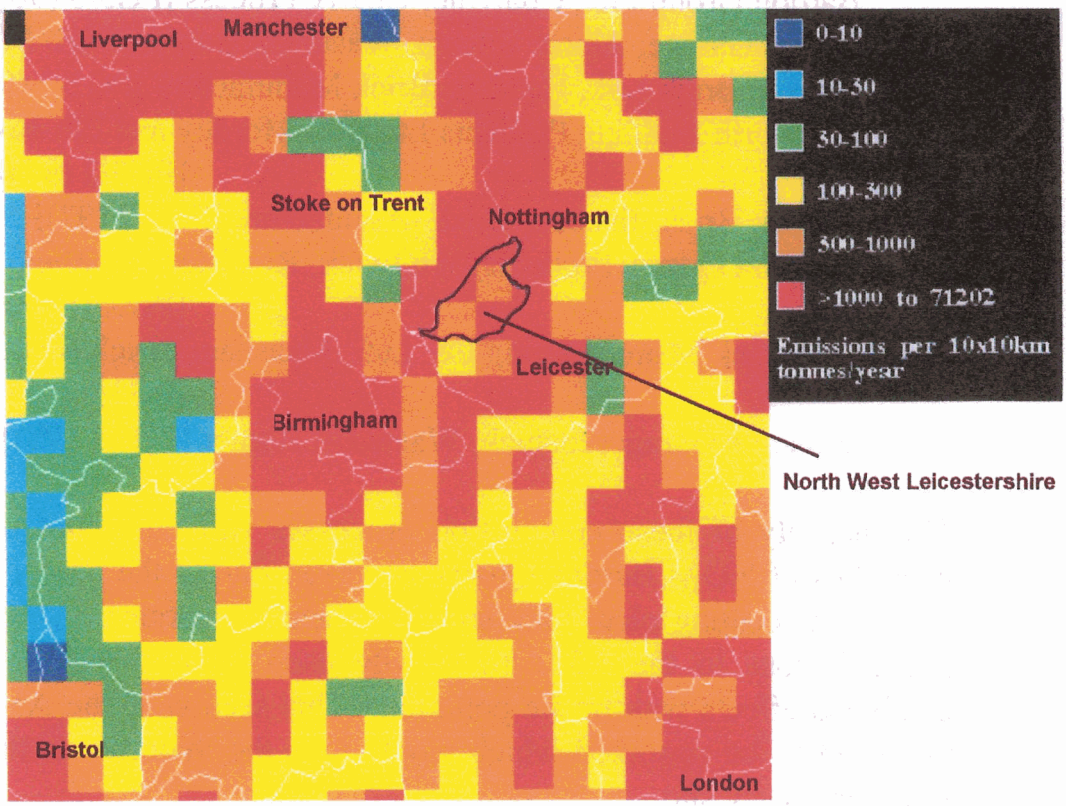
Published background levels for the district are between 10 and 15 ppb as an annual average (see map page 33). This is similar to our own monitoring results which shows annual average background levels of 17 ppb



7.4 Emissions

7.4.1 General Emissions

Published emissions maps for the district are based on a 10 x 10 km grid. The district of North West Leicestershire is covered by 6 grid squares with those in the north-east and south-west of the district having emissions of between 300 and 1000 tonnes per 100km^2 per year and those in the north-west and south-east having emissions of over 1000 tonnes per 100km^2 per year (see map below).



7.4.2 Emissions from Industrial Processes

A, AUTHORISED PROCESSES
ENVIRONMENTAL PROTECTION ACT 1990 (part 1 [A])

There are no "part A" authorised process within the district however, there are a number of large part A processes (mainly power stations surrounding the district) which emit significant quantities of NO_2 that under some meteorological conditions may drift and contribute to NO_2 levels within the district. These are listed below with emissions in tonnes of NO_2 per year and approximate distance to the nearest residential area of the district.

Willington Power Station	1,191,000 tonnes	6 miles Breedon
Drakelow Power Station	1,293,160 tonnes	6 miles Moira
Ratcliffe-on-Soar Power Station	17,182,090 tonnes	1 mile Kegworth
Rugeley Power Station	16,732,000 tonnes	15 mls Donisthorpe
Cortaulds Chemicals, Spondon	1,900,000 tonnes	5 mile C/Donington

B, AUTHORISED PROCESSES
ENVIRONMENTAL PROTECTION ACT 1990 (part 1 [B])

There are 8 "part B" authorised processes within the district that will emit quantities of NO_2.

Bardon Group Plc., Coalville, Quarry Process [PG3/8 (96)]
Fearns Garage, Albert Village, Waste Oil Burner [PG1/1 (95)]
Hanson Brick Ltd., Heather, Brick Manufacture [PG3/2 (97)]
Hepworth Building Products Ltd. Blackfordby and Ellistown [PG3/2 (97)]
Ibstock Brick, Ibstock, Brick Manufacture [PG3/2 (97)]
Midland Quarry Products, Whitwick, Roadstone Coating [PG3/15 (96)]
Red Bank Manufacturing Co. Ltd., Measham, Brick Manufacture [PG3/2 (97)]
Wilson's Garage, Ibstock, Waste Oil Burner [PG1/1 (95)]

The majority of these combustion processes will only emit relatively small quantities of NO_2. Bardon Quarry however, due to the use of reclaimed oils for it's tar coating plant may emit significant quantities of NO_2. This site is situated close to the A511 (a heavily used road) therefore there may be combined effects with traffic pollution. This section of the A511 however, is proposed to be re-routed which would take the majority of the traffic away from the quarry site.

C, EAST MIDALNDS AIRPORT

Predictions for NO_x concentrations (of which considerable proportions will be NO_2 or will be converted to NO_2) resulting from emissions from the airport as a whole based on predicted air traffic including the new DHL facility are as follows:-

i. Within **1km** of the runway (including some parts of Castle Donington such as Stonehill [where the NO_2 monitoring tube is located]) predicted contribution to concentrations for 2006 are **> 5.25 ppb**.

ii. Within **2 km** of the runway (including parts of Castle Donington , Lockington, Hemington, Isley Walton, Diseworth, western parts of Kegworth.) Predicted contribution to concentrations for 2006 are **2.5 – 5.25 ppb**.

iii. Within **4 km** of the runway (including the remainder of Kegworth, Breedon, Tonge, Long Whatton, Wilson, and also Sutton Bonington, Kingston-on-Soar, and Ratcliffe-on-Trent, the latter 3 villages being within Rushcliffe district.)
Predicted contribution to concentrations for 2006 are **1.0 – 2.5 ppb**

The part of the district with predicted elevated NO_2 concentrations as a result of activities at East Midlands Airport [ie. The northern parishes] also includes overlap with other significant sources of NO_2.
These include

Major roads;
M1,
A50 (Stoke – Derby by-pass)
A6,
A453
A42 (T).

Emissions from Ratcliffe-on-Soar power station

7.4.3 Road Traffic Emissions

Simple modelling results using the traffic flow data and DMRB for predicted concentrations for 1998 and 2005 are listed in the tables below.

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	937	2798	84	260
A42 Stretton (97)	979	2798	84	221
A42 Breedon	425	1780	54	139
A42 Long Whatton	616	2273	63	178
A444 Appleby Parva	40	553	40	487
A447 Ibstock	31	145	31	145
A453 Isley Walton	37	294	37	294
A511 Ashby	45	243	44	215
A511 Bardon	65	526	61	463
A512 Coleorton	36	229	35	202
A6 Kegworth (village)	44	229	44	229
A6 Kegworth (Jtn 24)	47	249	47	249
B591 Bawdon Lodge	31	173	31	173
B5324 Long Whatton	24	205	24	205
M1 Copt Oak (97)	1612	3936	127	323
M1 Copt Oak (98)	1351	3936	108	323
M1 Long Whatton (97)	1192	3052	97	243
M1 Long Whatton (98)	2132	3052	166	243

Table 6 Predicted Concentrations of Nitrogen Dioxide (ppb) for 1998 using DMRB.

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	426	1390	56	88
A42 Stretton (97)	446	1390	58	88
A42 Breedon	153	508	58	58
A42 Long Whatton	251	756	58	71
A444 Appleby Parva	36	180	36	180
A447 Ibstock	19	45	19	45
A453 Isley Walton	30	79	30	79
A511 Ashby	39	64	58	60
A511 Bardon	48	168	58	149
A512 Coleorton	27	61	27	57
A6 Kegworth (village)	38	61	38	61
A6 Kegworth (Jtn 24)	40	66	40	66
B591 Bawdon Lodge	19	49	19	49
B5324 Long Whatton	15	55	15	55
M1 Copt Oak (97)	582	1186	65	97
M1 Copt Oak (98)	467	1186	59	97
M1 Long Whatton (97)	352	753	53	70
M1 Long Whatton (98)	651	753	70	70

Table 7 Predicted Concentrations of Nitrogen Dioxide (ppb) for 2005 using DMRB

7.5 Monitoring Results

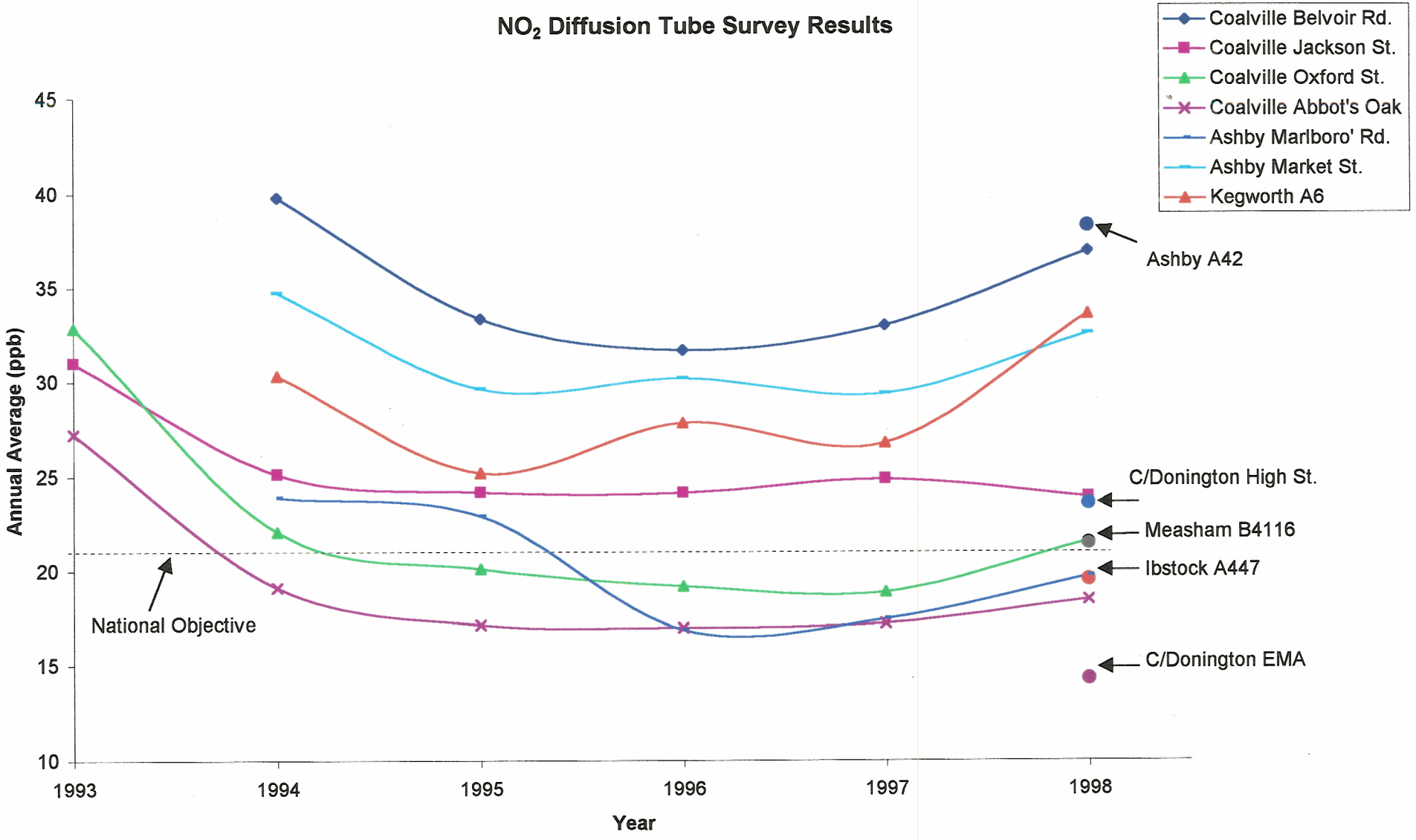
The results of the North West Leicestershire NO_2 diffusion tube survey are summarised on the chart on the following page. The full details can be found in appendix 1. Throughout the year the concentrations show a general trend of being lower in the spring and summer months. This is probably due to meteorological conditions giving greater mixing and dispersion. Since 1993 the annual average values for each site were decreasing until 1996 when they appear to have increased both in 1997 and 1998. Six of the sites (including 2 of the new sites) consistently have average concentrations above the 21ppb objective, these are located at :-

Coalville Belvoir Rd.,
Coalville Jackson St.
Ashby Market St.
Ashby A42
Kegworth A6
Castle Donington High St.

Of the above sites all except Castle Donington and Coalville Jackson St. have average concentrations above the 30ppb stage 1 guidance value.

Of note is that the new Castle Donington East Midlands Airport site shows no apparent elevation of NO_2 levels above normal background levels.

The Leicester Centre automatic monitoring station has lower results than for our Coalville Centre. This is likely to be due to a larger margin of error on the diffusion tube results. The annual averages for Leicester centre are 23 ppb, 23ppb and 22ppb for 1994, 1995, 1996 respectively.


NO_2 Diffusion Tube Survey Results
Coalville Belvoir Rd.
Coalville Jackson St.
Coalville Oxford St.
Coalville Abbot's Oak
Ashby Marlboro' Rd.
Ashby Market St.
Kegworth A6
Ashby A42
C/Donington High St.
Measham B4116
Ibstock A447
C/Donington EMA
National Objective
Annual Average (ppb)
45
40
35
30
25
20
15
10
1993
1994
1995
1996
1997
1998
Year

7.6 Discussion and Conclusions

In general the traffic predictions show that the only roads that are likely to exceed the 150 ppb hourly limit are the M1 and the A42 both of which do not have footpaths where people are likely to be exposed to these levels for the duration of an hour. However the very high predictions for these roads means that residential areas within 50m of the road, such as parts of Ashby (A42) and Long Whatton (M1) may be exposed to concentrations over the objective especially if there is congestion. Also the predictions for 1998 suggest that many of the other roads including those lined with shops and houses could have concentrations above the objective if there is congestion. Some roads in particular the A6 in Kegworth and the present A511 through Ashby are quite likely to be congested for the duration of an hour.
The 2005 predictions are lower than those for 1998 and predicted exceedances for 2005 are only on the roads that do not have footpaths or roads such as the A511 at Bardon and through Ashby which should have a by-pass constructed by 2005.

The predictions correspond to the monitoring data which shows that roads which are particularly congested or have high traffic flows also have concentrations above the air quality objectives.

Emissions from individual industrial sources such as the East Midlands Airport and the Ratcliffe-on-Soar power station are not likely to cause concentrations of NO_2 above the objectives in areas where people will be exposed. However, in conjunction with other sources of NO_2 such as road traffic and together with the relatively high background concentrations the influence of these industrial sources may lead to breaches in the air quality objectives.

Concentrations of over 30 ppb are recorded by some of the diffusion tubes including roadsides such as Belvoir Rd. Coalville where shops are located and pedestrians are likely to be exposed. This, together with possible increases due to industrial sources means that further assessment of NO_2 to stage 2 will be necessary.

The stage 2 review will focus on the northern parishes in particular where road traffic emissions from the M1, A6 and A42 overlap on emissions from Ratcliffe-on-Soar power station and the East Midlands Airport. The stage 2 review will also consider the impact of proposed road developments and national trends on the other highways in the district which presently have concentrations above the objective.

8. Review and Assessment of Sulphur Dioxide

8.1 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 (67%) 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 transport 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 local effects the acidic nature of dissolved SO_2 causes irritation to lung tissue and may provoke attacks of asthma. The onset of clinical effects upon exposure can be very rapid.

In considering the desirable Air Quality Standards for SO_2 EPAQS took consideration of the rapid onset of symptoms and considered that exposure should be considered over **15 minute averaging periods**. A concentration of below **100 ppb** was considered unlikely to have significant health effects in humans. This has been calculated to be comparable to an annual 98th percentile of daily values of 19 ppb or a maximum daily average of 28 ppb.

The EU air quality daughter directive also specifies a 15 minute averaging period with a limit of 100 ppb.

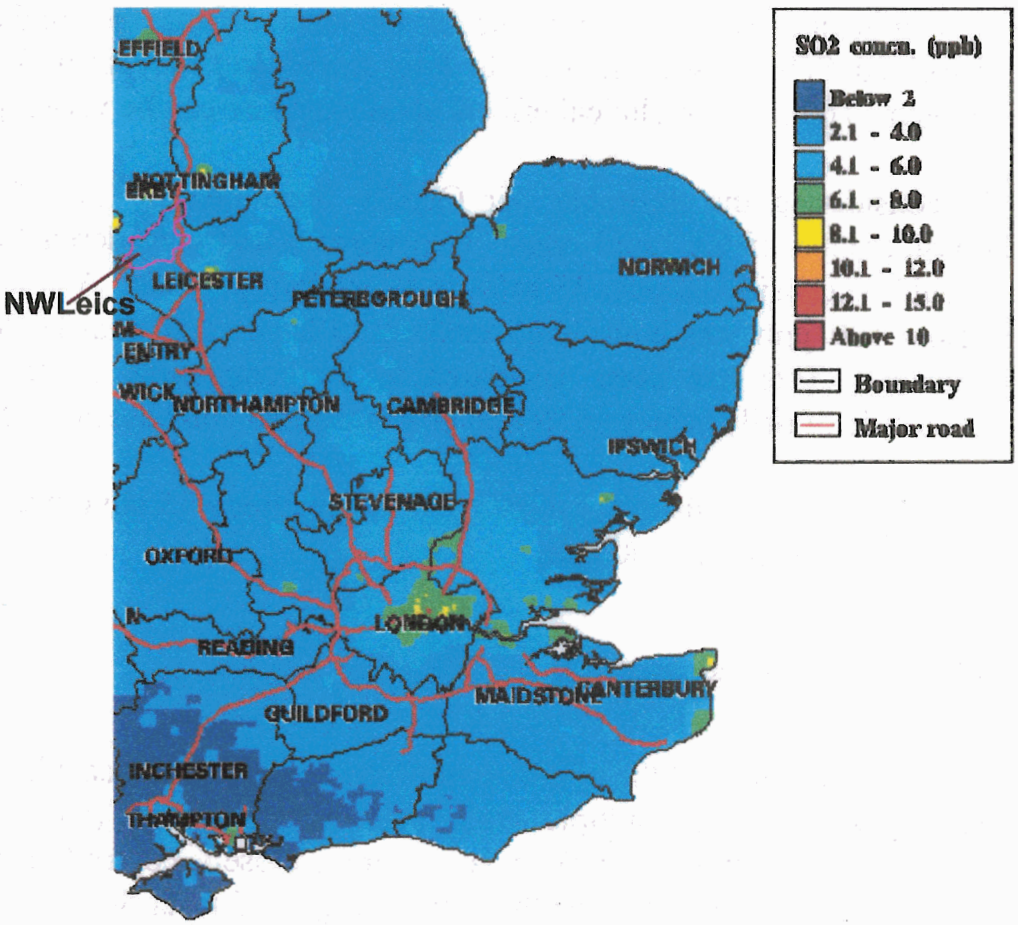
8.2 National Trends

The move throughout the middle part of the century to relocate heat and power raising sources from multiple small, solid fuel fired units (e.g. domestic coal fires and solid fuel boilers) to large, rural, closely controlled sources (e.g. power stations) has dramatically decreased ground level SO_2 concentrations in the UK. Ever since 1970 there has been a 63% decrease in total SO_2 emissions. The risk of exceedences of the National Air Quality Standard for SO_2 is therefore greatly dependent upon the influence of individual local combustion sources and the type of fuel used.

8.3 Exposure and Background Levels

The Pollutant specific guidance (LAQM TG4 [98]) states that the authority's focus for review and assessment should be for outdoor non-occupational areas where people may be exposed to concentrations of sulphur dioxide for the 15 minute averaging period. As this is a small time period we interpret this as being practically anywhere outside in the district including footpaths in rural areas. The guidance suggests to particularly identify solid fuel or fuel oil combustion systems with greater than 5 megawatts of power (MW). Also areas where combined small scale combustion (domestic and short stack) emissions are greater than 25kg per hour or 40 tonnes per year (approximately 300 houses) within a 1km^2 area.

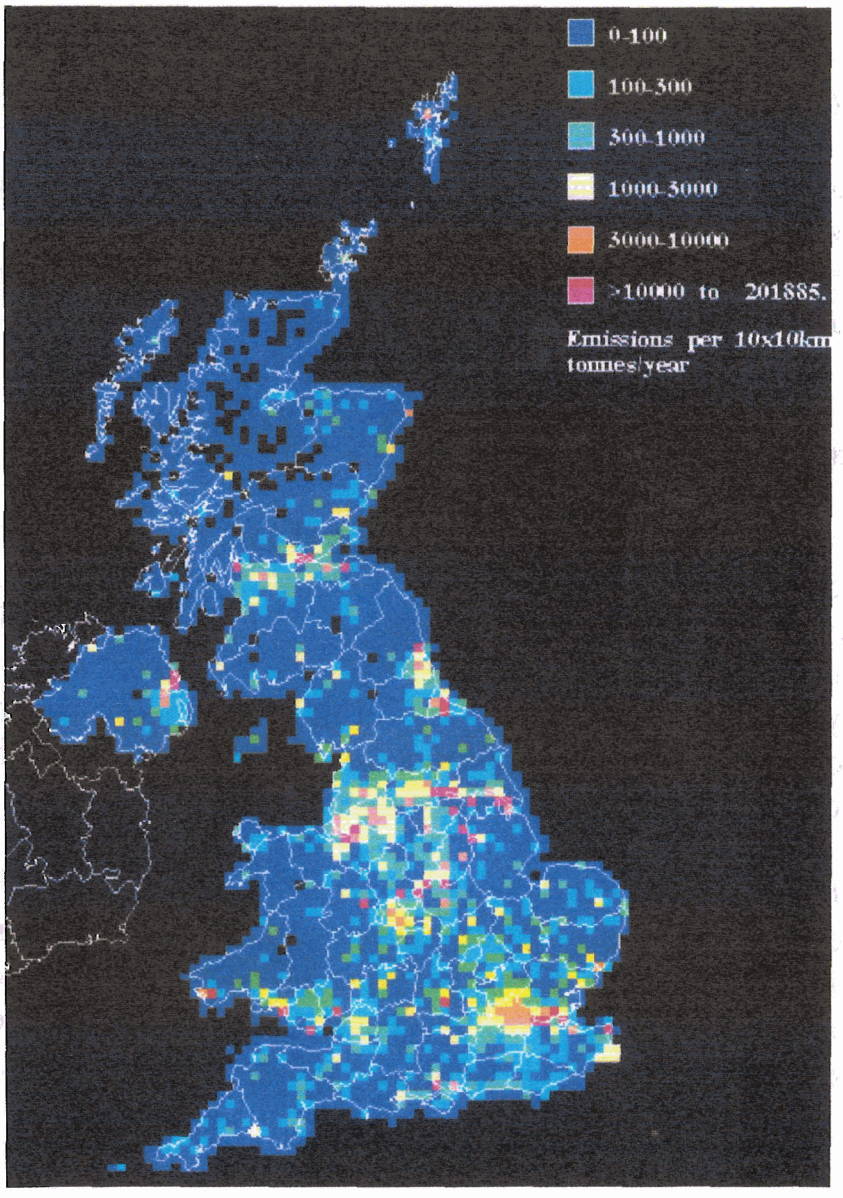
Published background concentrations for the district (see map below) show concentrations between 2.1 and 6.0 ppb. This compares to our own monitoring results which show an annual average of around 8.0 ppb in Coalville.



8.4 Emissions

8.4.1 General Emissions Including Road Traffic

Published emissions of SO_2 (see map below) show the district of North West Leicestershire divided into 6 100 km^2 grid squares. These show a very large range of emissions. The lowest being in the SW sector of the district at between 0 and 100 tonnes per year per grid square. The highest are in squares which contain the power stations at between 10,000 and 20,000 tonnes per year per grid square. Road traffic emissions will arise from diesel powered engines however, they generally only account for 2% of all emissions and the use of city diesel especially by the councils own fleet, and continued improvements to vehicle emissions means emissions from vehicles can be considered negligible.



8.4.2 Emissions from Coal Fired Power Stations

Although there are no power stations in the district Ratcliffe-on-Soar power station is 500 meters from the border of the district and Drakelow and Willington power stations are within 6 miles of the district. Ratcliffe-on-Soar has recently been fitted with a flue gas de-sulphurisation plant (FGD) however emissions of SO_2 are still significant. The contribution of emissions from these power stations to concentrations within the district will depend on wind direction and atmospheric conditions.

Annual emissions of SO_2 in tonnes per year and distance from the district are shown below:-

Ratcliffe-on-Soar	500 meters	11,470,000 tonnes/yr
Willington	6 miles	4,875,000 tonnes/yr
Drakelow	6 miles	50,117,650 tonnes/yr
Rugeley	15 miles	68,400,000 tonnes/yr

8.4.3 Emissions from Other Industrial Processes

There are no known industrial processes powered by coal or oil with a capacity of over 5 megawatts.
There is the potential for emissions of SO_2 arising from opencast mining of coal.

8.4.4 Emissions from Domestic Coal Burning

Due to the heritage of coal mining in the district there are a large number of homes still heated by coal. There are no "designated" smoke control areas within the district and an estimated 60% of the coal burnt is bitumenous rather than smokeless which emit more SO_2. Estimates of the amount of coal used by domestic properties are difficult as distribution is by a number of different coal merchants who each sell to customers over a range of different locations both within and away from the district.

Of the council owned domestic properties 30% (a total of 1583 homes) use solid fuel. The numbers of customers receiving concessionary coal (generally ex-coalminers) are known and when plotted onto a km grid show that some parts of the district have high densities of coal users. For example the south west sector of Coalville has 114 domestic coal users per km^2.

8.5 Monitoring Results

The results of sulphur dioxide monitoring using the 8 port semi-automatic sampler located at the council offices in Coalville gives daily averages of SO_2. The annual average results show a general decrease from approximately 15 ppb from 1990 to 1993 to around 8ppb from 1994 to 1998. The full details of the results can be found in appendix 2. These results suggest that the air quality objective is not likely to be exceeded at this location as the maximum daily mean is below 28 ppb.

The automatic monitoring station at Leicester Centre measures 15 minute sampling periods and generally records relatively low levels of SO_2 at around 10 – 20 ppb. Occasionally there are events such as on 17th Nov 1998 when SO_2 concentrations peak. On this day the maximum 15 minute concentration was 137 ppb (37 ppb above the National Air Quality Standard). Investigations correlating these short term peaks with meteorological conditions have attributed these peaks to emissions from the power stations to the north-west of the city of Leicester. Of note is that the district of North West Leicestershire lies between the power stations and the city of Leicester. Therefore it could be suggested that if the National Air Quality Standard is being exceeded in Leicester as the result of emissions from the power stations to the north west, then it will be exceeded (possibly even more so) within our district.

8.6 Discussion and Conclusions

Although the results of the semi-automatic SO_2 monitor suggest that concentrations in Coalville are unlikely to be above the national air quality objective this equipment measures the average daily concentrations. Data from the automatic monitoring station in Leicester (which measures averages of 15 minute periods) suggests that emissions from the surrounding power stations may lead to concentrations above the objective of 100 ppb for some 15 minute averaging periods depending upon atmospheric conditions. The information on coal usage also suggests that there may be parts of the district with raised concentrations of SO_2 due to domestic coal burning.

Due to these conclusions it will be necessary to continue the review and assessment of SO_2 to stage 2. This next review will focus on the impact of emissions from power stations using results of modelling performed by Eastern Generation at the Drakelow Power Station. Further details for domestic coal usage will also be assessed possibly with the aid of further monitoring by diffusion tubes.

9 Review and Assessment of Particulates

9.1 Introduction

Unlike all other pollutants discussed in this report, particulate matter in the atmosphere is composed of a wide range of materials from a wide range of sources. The particulates of interest for the purposes of review and assessment are those smaller than 10μm (micrometers) which equates to a thousandth of a millimetre. This pollutant is therefore defined by its physical characteristics rather than its chemical composition. These particulates are collectively known as PM_{10}.

There are a multitude of potential sources of particulates, both man-made and natural. In general, man-made emissions tend to be of a smaller size range. Man-made sources include carbon based particulates from incomplete combustion, ash, recondensed metallic vapour, dust from mining, quarrying and construction, motor vehicle brake and tyre wear and secondary particiulates formed from condensing reactions of gaseous airborne pollutants (typically ammonium sulphate and. nitrate). Natural sources include wind blown dust and soil, sea-salt and biological particulates such as fungus spores and pollen.

The largest man-made source in the UK is road transport. However, the contribution of all sources to pollutant levels will vary depending on the characteristics and activities in the surrounding area.

Traditionally, particulate pollution was thought to be a localised problem around its source. Recent evidence does, however, suggest that whole regions can experience elevated particulate levels.

A lot of research has recently focused on the health effects of particulates. It is now considered that even low levels can be associated with respiratory and cardio-vascular illness and asthma.

Researchers have not identified a 'no effects' level of exposure to particulates. EPAQS therefore sought to identify levels at which the effects on the population would be relatively small. They reviewed the figure of **50μg/m^3 as a running 24 hour mean** as the standard with an overall recommendation that PM_{10} levels be reduced.

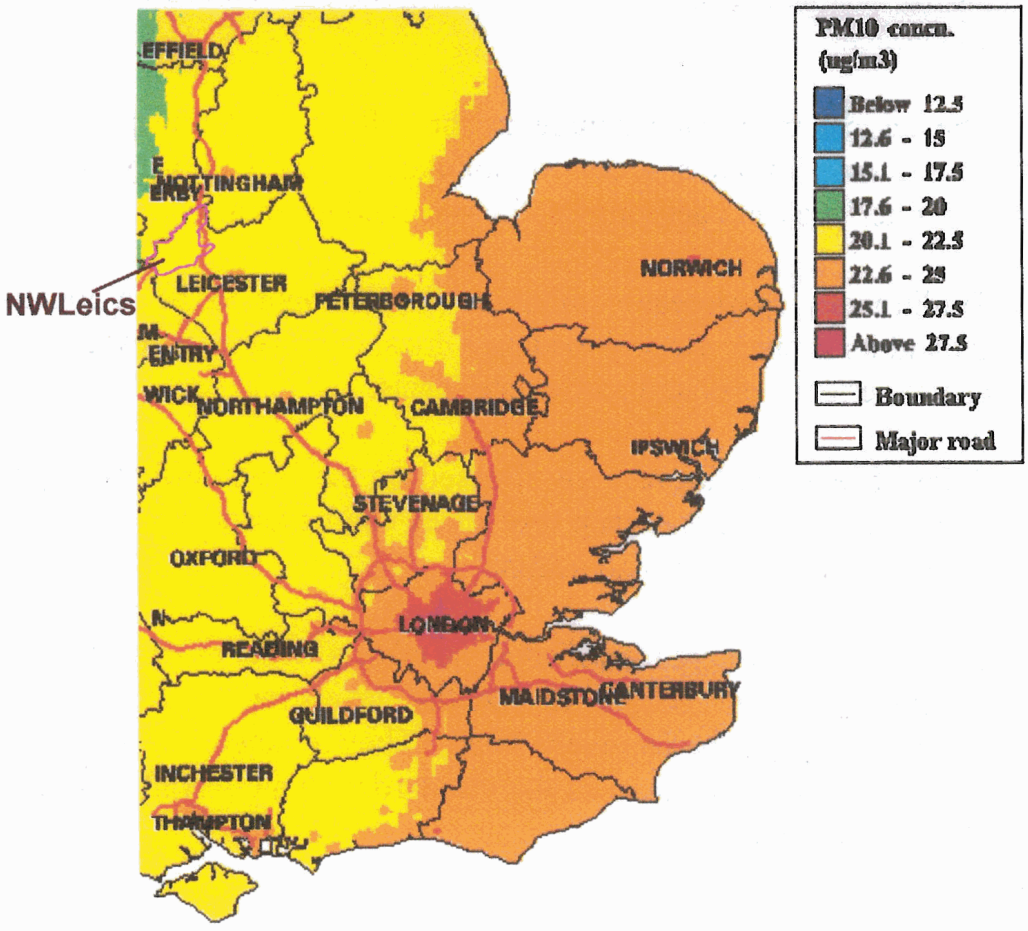
9.2 National Trends

Detailed monitoring of PM_{10} has only been carried out for the last few years but that which has been carried out indicates widespread breaches of the objective across the UK. Numerous European Directives aimed at reducing emissions from vehicles and large industrial plant are expected to reduce emissions. However, a continued increase in the national vehicle fleet size is likely to offset this.

9.3 Exposure and Background Levels

The pollutant specific guidance (TG4 [98]) states that the focus for the Authority's review should be non-occupational outdoor locations where a person may be reasonably expected to be exposed over a 24 hr period such as housing, schools or hospitals.

Published maps (see below) show estimated annual average background levels in the district of between 20.1 and 22.5µgm^{-3} except for immediately adjacent to the M1 which is estimated to be between 25.1 and 27.5 µg/m^3.



9.4 Emissions

9.4.1 Industrial Processes

Nearly all of the processes authorised under the Environmental Protection Act 1990 (part 1 [B]) emit some quantities of dust including PM_{10} (see appendix 3). These emissions fall into 2 general categories.

a. Emissions from point sources, (local exhaust vents) eg. from bag filters, in the main these have emission limits set as part of the authorisation.
b. Fugative emissions such as from the quarries and open-cast coal mines. These are usually controlled by visual inspection or dust sampling.

There are also emissions from the surrounding power stations:

a. Ratcliffe-on-Soar power station 83,000 tonnes PM_{10} per year.
b. Drakelow power station 543,088 tonnes PM_{10} per year.
c. Willington Power Station 91,450 tonnes PM_{10} per year.

9.4.2 Road Traffic Emissions

Prediction of emissions from road traffic has a higher associated degree of error due to the complex mix of possible sources. However, the following tables show predictions for PM_{10} concentrations ($\mu g/m^3$) as the 95th percentile of the daily mean using DMRB.

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	232	382	80	156
A42 Stretton (97)	236	382	81	146
A42 Breedon	147	289	49	103
A42 Long Whatton	186	340	62	125
A444 Appleby Parva	26	198	25	188
A447 Ibstock	7	52	7	52
A453 Isley Walton	16	122	16	122
A511 Ashby	32	102	30	97
A511 Bardon	66	191	62	182
A512 Coleorton	12	96	11	91
A6 Kegworth (village)	29	96	29	96
A6 Kegworth (Jtn 24)	33	105	33	105
B591 Bawdon Lodge	7	69	7	69
B5324 Long Whatton	6	85	6	85
M1 Copt Oak (97)	254	387	88	148
M1 Copt Oak (98)	236	387	82	148
M1 Long Whatton (97)	203	323	69	118
M1 Long Whatton (98)	259	323	90	118

Table 8 Predicted Concentrations of PM_{10} ($\mu g/m^3$) for 1998 using DMRB

Location	Kerbside Normal	Kerbside Congested	Residential Normal	Residential Congested
A42/M42 Appleby	181	308	64	98
A42 Stretton (97)	184	308	66	98
A42 Breedon	116	206	66	70
A42 Long Whatton	145	244	66	85
A444 Appleby Parva	20	136	20	136
A447 Ibstock	6	40	6	40
A453 Isley Walton	12	85	12	85
A511 Ashby	26	72	66	68
A511 Bardon	50	131	66	124
A512 Coleorton	10	68	10	64
A6 Kegworth (village)	24	68	24	68
A6 Kegworth (Jtn 24)	26	74	26	74
B591 Bawdon Lodge	6	50	6	50
B5324 Long Whatton	5	61	5	61
M1 Copt Oak (97)	203	287	73	102
M1 Copt Oak (98)	186	287	66	102
M1 Long Whatton (97)	164	236	58	82
M1 Long Whatton (98)	211	236	76	82

Table 9. Predicted Concentrations of PM_{10} ($\mu g/m^3$) for 2005 using DMRB.

9.5 Monitoring Results

Dark smoke is monitored at the council offices on a daily basis with an annual average of approximately 10 $\mu g/m^3$. Dust and particulates are also monitored at various industrial locations regularly however, none of these measurements can be directly compared to levels of PM_{10} as the monitoring equipment does not specify the size fraction of the particulates.

Results from surrounding automatic monitoring stations for 1996 show an annual average of 23 $\mu g/m^3$ for Birmingham East and 22 $\mu g/m^3$ for Leicester Centre. The 98th percentile of hourly averages is 71 $\mu g/m^3$ for Birmingham East and 66 $\mu g/m^3$ for Leicester Centre. This suggests that most peak results are about 3 times the average.

9.6 Discussion and Conclusions

The predicted concentrations from road traffic suggest that the National Air Quality objective for PM_{10} will not be exceeded in 2005 (or is in 1998) in residential areas when traffic is flowing normally. However, the levels are close to the objective and combined with background levels and emissions from industrial sources it may be possible that the objective will be exceeded. Also, levels at the kerbside or during congestion are likely to cause peaks of about 3 times the average as seen at the automatic monitoring stations. Thus there is a need to continue the review and assessment of particulates to stage 2. Focus of this review will be on areas where there is overlap between industrial sources and road traffic emissions. Further assessment will be by use of particle size specific monitoring equipment.

10 Conclusions of this Report

10.1 Summary of Pollutant Specific Conclusions

Benzene

Predictions for benzene levels are higher for 1998 than for 2005. Although it is predicted that the air quality objective may be exceeded on the M1 and M42/A42 during heavy congestion, the concentrations fall well below the objective for the nearest residential locations. Emissions from industrial sources including the East Midlands Airport are negligible. It will not be necessary to continue the review and assessment to stage 2.

1,3 – Butadiene

Emissions from the nearest sources in the district of East Staffordshire are unlikely to affect this district therefore further assessment to stage 2 will not be necessary.

Lead

Due to increasing use of unleaded petrol it is unlikely that emissions from road vehicles will cause exceedance of the air quality objective by 2005. There is likely to be significant emissions from the secondary lead smelter in Woodville in the district of South Derbyshire that may impact upon the residents of Albert Village some 250 meters away. Further assessment may be necessary following stage 2 of the air quality review by South Derbyshire District Council.

Carbon Monoxide

Road traffic emissions are not likely to cause exceedance of the objective by 2005 in areas where people may be exposed for the period of 8 hours. Emissions from individual industrial sources are also unlikely to cause exceedance of the objective and do not significantly overlap with major roads and residential areas. Further assessment to stage 2 will not be necessary.

Nitrogen Dioxide

Emissions from road traffic may cause exceedance of the air quality objective during congestion. This includes roads that are lined with shops and houses where people may be exposed to concentrations for the period of 1 hour. Monitoring results also suggest that the objectives are being exceeded at 6 of the 12 monitoring locations in the district. Emissions from the East Midlands Airport and Ratcliffe-on-Soar power station will also raise nitrogen dioxide concentrations. Further assessment to stage 2 will be necessary.

Sulphur Dioxide

Information on coal usage in the district suggests that considerable emissions may arise from domestic coal burning. Results and research from the automatic monitoring station in Leicester Centre show that emissions from the power stations to the north-west of the city of Leicester cause exceedances of the national air quality objective in the city of Leicester. The district of North West Leicestershire lies between these power stations and the city of Leicester. Further review and assessment to stage 2 will be required.

Particulates PM_{10}

Emissions from industrial sources such as the quarries and open cast coal mines together with relatively high background levels and emissions from road traffic are likely to cause exceedances of the objective in some locations. Further assessment to stage 2 will be required.

10.2 Further Work (stage 2 proposals)

Lead

Liaison with South Derbyshire district council regarding the lead smelter at Woodville

Nitrogen Dioxide

Focus on the northern parishes where there are overlaps between road traffic emissions of the M1, A6 and A42 and emissions from Ratcliffe-on-Soar power station and the East Midlands Airport. Also consideration of the impact of proposed road developments on other roads in the district which presently have concentrations above the objective.

Sulphur Dioxide

Review of modelling performed by Eastern Merchant for sulphur dioxide emissions from the Drakelow power station. Further assessment of coal usage possibly with the aid of increased monitoring by use of diffusion tubes.

Particulates PM_{10}

Assessment focusing on areas of overlap between industrial sources and road traffic emissions by use of particle size specific monitoring equipment.

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Appendix 1

Monthly Averages of NO_2 Concentrations (ppm) 1992 - 1998

	Coalville Belvoir	Coalville Jackson	Coalville Oxford	Coalville Abbot's	Ibstock	Measham	Ashby A42	Ashby Marlb.	Ashby Market	Castle Doning.	C/Don E.M.A.	Kegworth A6
Dec-92	22.1	31.7	29.2	25.2								
Jan-93	19.3	37.8	20.9	20.9								
Feb-93	28.2	20.8	23	21.6								
Mar-93	24	17.2	18.3	22.1								
Apr-93			16.9	17.3								
May-93		19.5	20.3									
Jun-93	37.8		16.8									
Jul-93	27.4	15.7	13.6	11								
Aug-93	33.6	18.3	18.7	11.8								
Sep-93	36.2	18.9	22.6									
Oct-93	35.6	19.9	25.1	23.6								
Nov-93	40.9	26.9	29.7	31								
Dec-93	31.1	12.1	23.1	22.2								
Jan-94	37.7	26.6	24.5	22								
Feb-94	37.7	28.8	29.3	25.9								
Mar-94	33.6	21.2	20.6	16								
Apr-94	47.8	24.6	21.4	18.5								
May-94	42.2	23.6	14	13.8								
Jun-94	37.7	19.9	14.6	9.8								
Jul-94	48.6	25.5	17.4	15.3				21.8	37.9			38.4
Aug-94	32.8	20.2	16.5	15.2				16.6	29			29.9
Sep-94	38.2	24.7	18	15.7					35.4			30.9
Oct-94	37.6	27.5	26.3	23.7					33.8			32.2
Nov-94	40.1	30.2	31.4	26.6				30.2	37.1			36.6
Dec-94	43.6	28.7	30.8	27				27	35.1			33.6
Jan-95	37.9	23.5	26.7	23				25.2	30.1			20.8

	Coalville Belvoir	Coalville Jackson	Coalville Oxford	Coalville Abbot's	Ibstock	Measham	Ashby A42	Ashby Marl.	Ashby Market	Caslte Doning.	C/Don E.M.A	Kegworth
Feb-95	38	29.2	23.6	20.8				28.3	35			24.7
Mar-95	34.7	28.8	23.3	19.6				29.9	34.5			22.9
Apr-95	42.3	28.8	15.8	12.6				21.7	24.2			24.1
May-95	28.8	19.5	16	13.6					27.4			25
Jun-95	19.3	13.4		10					23.2			19.5
Jul-95	30.9	16.9	11.3	9.8				11.7	26.1			29.6
Aug-95	26.7	17.5	11	10.3					31			26.6
Sep-95	33.6	29.2	20.5	15.2				20				30.8
Oct-95	38	23.7	21.4	20.1				21.6				32.8
Nov-95	36.8	31.3	27.7	24.7				24.7	32.7			35.2
Dec-95	33.4	28.4	24.1	26.1				23	32			29.2
Jan-96	29.3	24.1	23.7	23.2				20.2	30.2			28.3
Feb-96	36.1	30.1	24.5	23.4				23.7				29.7
Mar-96	20.4	15.8	15.1	15.9				13.2	17.5			19.3
Apr-96	41.2	32.8	21	18				20.5	34.3			28.8
May-96	36.2	22.8	16.2	14.4				14.3	36.1			
Jun-96	15.9	26.2	17.6	14.3				15.2	36.6			31.3
Jul-96	27	21	15.3	12.6				13.2	30.5			28.5
Aug-96	41.7	30.3	21	16.5				18.5				32.6
Sep-96	23.2	15.2	13.8	13.3				11.1	29.2			22.5
Oct-96	36.6	22.6	21.1	14.9				15.8	24.2			
Nov-96	39.5	23.8	24.3	20.5				18.5	28.4			28.2
Dec-96	33.2	25.1	16.8	17.5				18.2	34.9			29
Jan-97	45.7	31.3	30.2	30				29.3	37.3			36.2
Feb-97	22.6	16.8	13.5	13.5				12.8	27.5			20
Mar-97	35.7	18.9	17.5	20.3				16.7	31.3			23.6
Apr-97	29.6	21	15.9	13.2				11.6	26.8			28.5
May-97	35.2	32.9	26	11.8				13.3	23.9			19.7
Jun-97	35.3	23.9	17.2	11.5				15.8	30.9			28.4

	Coalville Belvoir	Coalville Jackson	Coalville Oxford St	Coalville Abbot's	Ibstock	Measham	Ashby A42	Ashby Marl.	Ashby Market	Castle Doning.	C/Don E.M.A.	Kegworth
Jul-97	32.4		14.6	19.6				13.8	32.6			
Aug-97	26.2		14.8	10.1				11.1	22.7			20.1
Sep-97	23	16.4	13.5	10.9				17.1				
Oct-97	34.4	30	24.9	18.9					30.7			
Nov-97	43	28.3		22.9				29.1	31			31
Dec-97		29	19.5	23.9				21.3	28.5			19.2
Jan-98	33.2	21.9	21.1	20.9					34.9			29.3
Feb-98			34	21								34.6
Mar-98	43.5	26.5		25.4								
Apr-98	41	32	23	24	25		40		33	27	15	32
May-98	39	23	19	15	20	25	53	21	39	32	15	30
Jun-98		20		16	19	22	36	15	28	17	10	24
Jul-98		20		13	10	21	33	10	26	19	8	25
Aug-98		23	18	13	23	26	39	33	33		13	36
Sep-98	26	26	18		19	24	39		34	17		31
Oct-98	39	23	18	18	21		28			17	25	31

Appendix 2

Monthly Averages of Smoke and Sulphur Dioxide Levels in Coalville. (1990 – 1998)

Sulphur dioxide		
Date	Smoke ($\mu g/m^3$)	SO2 ($\mu g/m^3$)
Jan-90	18	42
Feb-90	11	42
Mar-90	12	30
Apr-90	12	44
May-90	7	38
Jun-90	7	34
Jul-90	7	36
Aug-90	8	39
Sep-90	10	43
Oct-90	11	31
Nov-90	23	53
Dec-90	25	53
Jan-91	22	60
Feb-91	34	69
Mar-91	12	42
Apr-91	12	44
May-91	8	58
Jun-91	7	42
Jul-91	7	32
Aug-91	8	28
Sep-91	13	40
Oct-91	18	49
Nov-91	20	48
Dec-91	35	56
Jan-92	40	66
Feb-92	20	46
Mar-92	13	43
Apr-92	10	35
May-92	6	30
Jun-92	6	47
Jul-92	6	40
Aug-92	7	24
Sep-92	11	32
Oct-92	15	49
Nov-92	17	31
Dec-92	27	43
Jan-93	17	28
Feb-93	20	39
Mar-93	15	34
Apr-93	12	37
May-93	8	30
Jun-93	8	31
Jul-93	6	34
Aug-93	9	26

Sep-93	8	30
Oct-93	13	34
Nov-93	28	37
Dec-93	15	26
Jan-94	16	25
Feb-94	23	32
Mar-94	8	21
Apr-94	6	25
May-94	7	25
Jun-94	6	25
Jul-94	6	22
Aug-94	6	22
Sep-94	9	21
Oct-94	19	31
Nov-94	19	23
Dec-94	15	26
Jan-95	15	23
Feb-95	13	18
Mar-95	12	29
Apr-95	10	31
May-95	9	29
Jun-95	6	30
Jul-95	6	22
Aug-95	5	26
Sep-95	10	24
Oct-95	11	18
Nov-95	21	23
Dec-95	20	29
Jan-96	16	19
Feb-96	16	27
Mar-96	22	26
Apr-96	11	20
May-96	6	19
Jun-96	6	24
Jul-96	5	18
Aug-96	7	20
Sep-96	7	19
Oct-96	10	19
Nov-96	18	23
Dec-96	18	16
Jan-97	22	17
Feb-97	8	12
Mar-97	10	20
Apr-97	9	25
May-97	9	25
Jun-97	4	26
Jul-97	7	20
Aug-97	7	20
Sep-97	6	23
Oct-97	13	28

Nov-97	15	26
Dec-97	15	30
Jan-98	16	29
Feb-98	11	25
Mar-98	10	23
Apr-98	8	25
May-98	8	22
Jun-98	10	14
Jul-98	8	12
Aug-98	5	16
Sep-98	no result	no result
Oct-98	13	26
Nov-98	no result	no result
Dec-98		