Air Quality Review and Assessment

Updating and Screening Assessment

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Executive Summary

In January 2001 North West Leicestershire District Council completed the first stage review and assessment of air quality for the district. The purpose of the assessment was to determine whether the Air Quality Objectives set by the Government for the seven pollutants, considered as being of most concern to public health would be achieved. The seven pollutants are; carbon monoxide (CO), benzene, 1,3-Butadiene, lead, sulphur dioxide (SO_2), particulate matter (PM_{10}) and nitrogen dioxide (NO_2).

As a result North West Leicestershire District Council declared two Air Quality Management Area's (AQMA's) due to exceedences in NO_2 concentrations.

This Updating and Screening Assessment reviews the changes which may have occurred within the district which may affect air quality, and any improvements that have been made in the methods of predicting air quality. If areas are identified as not meeting the Air Quality Objectives and there is relevant exposure, then it will be necessary to proceed to a Detailed Assessment for that particular pollutant in the area identified.

The report concludes that within North West Leicestershire, the Air Quality Objectives for CO, Benzene, 1,3-Butadiene, Lead, SO_2 and PM_{10} are currently being achieved.

The report indicates that the annual mean objective for NO_2 will not be achieved within the two AQMA's and at three other locations within the district. The report therefore concludes that Detailed Assessments must be conducted at three locations in the district. These locations are High Street Castle Donington, Bardon Road Coalville and Broomleys junction (A511/Broomleys Road) Coalville.

Contents

1. Introduction

1.1 Description of the District

Figure 1.1 Map of North West Leicestershire District

North West Leicestershire lies in the East Midlands Region and is both the name and geographical location. The district is situated in the heart of the National Forest and lies between Leicester, Burton-on-Trent, Derby and Nottingham, covering 105 square miles. The district is mostly rural with a large extent of industry historically from coal mining, but more recently with Nottingham East Midlands Airport and large quarries. The population of 88,800 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.

1.2 Background to Local Air Quality Management

In 1995 the Government published the Environment Act which introduced initiatives for the protection of air quality in the UK. It uses health-based standards to control the levels of seven designated pollutants. It requires local authorities to conduct reviews and assessments and to identify the locations within their areas where the standards for pollution levels are 'not likely' to be met. If as a result of the review process, it appears that the air quality objectives are not, or are unlikely to be achieved in any area within the boundary of the local authority – then the local authority shall by order designate it as an 'Air Quality Management Area' (AQMA). Once such an area has been designated a more detailed assessment of the air quality shall be conducted.

In January 2001 North West Leicestershire District Council completed the first stage review and assessment of air quality for the district. The purpose of the assessment was to determine whether the Air Quality Objectives set by the Government for the seven pollutants, considered as being of most concern to public health would be achieved. The seven pollutants are; carbon monoxide (CO), benzene, 1,3-Butadiene, lead, sulphur dioxide (SO_2), particulate matter (PM_{10}) and nitrogen dioxide (NO_2).

As a result North West Leicestershire District Council declared two Air Quality Management Area's (AQMA's) due to exceedences in NO_2 concentrations.

Following the Updating and Screening Assessment conducted in June 2003 (NWLDC, 2003), one location, in the vicinity of Tilson House, Coalville was identified as an area where the PM_{10} objective may not be met due to the proximity of mineral processes. The Detailed Assessment produced in April 2005 (NWLDC, 2005a) concluded that the $50\mu gm^{-3}$ 24-hour mean was not exceeded more than 35 times, therefore an Air Quality Management Area was not declared.

This report details all new monitoring data obtained since the publication of the last Updating and Screening Assessment conducted in 2003 (NWLDC, 2003).

2. Aims and Objectives

The objectives of this Updating and Screening Assessment are to:

- Report the results of any monitoring that has taken place since the Progress Report conducted in 2005 (NWLDC, 2005b).

- Review any changes that have taken place which may have had an adverse effect on air quality in the North West Leicestershire District.

- Update members of the public on air quality in North West Leicestershire District and provide a yearly continuity of reports that satisfies the statutory requirements.

3. Review and Assessment of Carbon Monoxide

3.1 Introduction

Carbon Monoxide (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 United Kingdom.

Carbon Monoxide is largely produced due to the incomplete combustion of fuels containing carbon. It is therefore 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 therefore only 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.

3.2 Air Quality Objective for Carbon Monoxide

The following table specifies the Air Quality Objective for CO as set out in the Air Quality Regulations (2000).

Table 3.1 Air Quality Objective for Carbon Monoxide

Pollutant	Objective		Due to be Achieved by
	Concentration	Measured As	
Carbon Monoxide	10.0mgm^{-3}	Maximum, daily running 8 hour mean	31st Dec 2004

3.3 Conclusions of the Previous Review and Assessment

The Updating and Screening Assessment report produced in 2003 (NWLDC, 2003) concluded that there were no locations in the district where CO was likely to exceed the relevant Air Quality Objectives. This is based on national guidance in relation to emissions from road traffic and the effects on people in the vicinity.

3.4 Monitoring Data

North West Leicestershire District Council does not currently monitor for CO. The nearest automatic monitoring station (AUN) is operated by Leicester City Council at an urban centre location. The maximum daily running annual means for that station are detailed in Table 3.2.

Table 3.2 Maximum Daily Running 8-Hour Mean Carbon Monoxide Concentrations

Year	Maximum Daily Running 8-Hour Mean Concentration (mgm^{-3})
1999	2.8
2000	1.4
2001	1.2
2002	1.0
2003	1.2
2004	0.8
2005	0.6

The maximum daily running 8-hour mean concentrations measured at the Leicester site are well below the $10mgm^{-3}$ Air Quality Objective concentration for CO. North West Leicestershire is predominantly rural and thus would expect lower concentrations than those measured in Leicester City Centre. As such the concentration of CO in North West Leicestershire is unlikely to exceed $10mgm^{-3}$.

3.5 Very Busy Roads or Junctions in Built-up Areas

As reported above there are no locations within North West Leicestershire which are likely to exceed $1mgm^{-3}$, therefore it is not necessary to proceed any further with the assessment for road traffic.

3.6 Conclusions for Carbon Monoxide

It can be concluded that the objective of $10mgm^{-3}$ as a maximum daily running 8-hour mean is being achieved in North West Leicestershire therefore it is not necessary to proceed to a Detailed Assessment for CO.

4. Review and Assessment of Benzene

4.1 Introduction

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 un-burnt 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 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.

Except for a small number of sites close to the busiest roads, none of which exist in North West Leicestershire, it is expected that the benzene objective for 2003 and 2010 will be met nationally.

4.2 Air Quality Objectives for Benzene

The following table specifies the Air Quality Objectives for benzene as set out in the Air Quality Regulations (2000).

Table 4.1 Air Quality Objectives for Benzene

Pollutant	Objective		Date to be Achieved by
	Concentration	Measured As	
Benzene	16.25µgm^{-3}	Running Annual Mean	31st Dec 2003
Benzene	5µgm^{-3}	Annual Mean	31st Dec 2010

4.3 Conclusions of the Previous Review and Assessment

The Updating and Screening Assessment in 2003 (NWLDC, 2003) concluded that the relevant Air Quality Objectives would be met locally. Benzene is emitted primarily from petrol-engine vehicles, petrol refining, and petrol station forecourts and from specific industrial uses. There have been no developments locally since June 2003 which are likely to have any significant impact on the previous conclusion.

4.4 Monitoring Data

4.4.1 Outside an AQMA

Benzene is currently monitored at the Aeropark in Castle Donington to record concentrations from Nottingham East Midlands Airport. Monitoring is undertaken using passive diffusion tubes, the results of which are presented in Table 4.2.

Table 4.2 Annual and Running Annual Mean Concentrations of Benzene (μgm^{-3})

Annual Mean		**Running Annual Mean**	
Year	**Concentration (μgm^{-3})**	**Period**	**Concentration (μgm^{-3})**
2004	0.7	Aug 04 – Aug 05	0.7
2005	1.0	Sep 04 – Sep 05	0.7
		Oct 04 – Oct 05	0.7
		Nov 04 – Nov 05	1.0
		Dec 04 – Dec 05	1.0

The results from the diffusion tube survey indicate that the levels monitored at the Aeropark, Castle Donington are well below the Air Quality Objective's for Benzene.

4.4.2 Within an AQMA

Benzene is not currently monitored within either Air Quality Management Areas.

4.5 Road Traffic

4.5.1 Very Busy Roads or Junctions in Built-up Areas

There are no locations throughout the district where the predicted background level for benzene in 2010 will be above 2μgm^{-3}. Therefore it is not necessary to proceed any further with the assessment for road traffic.

4.6 Industrial Sources

4.6.1 New Industrial Sources

There have been no new industrial sources of benzene in North West Leicestershire or in any neighbouring authorities.

4.6.2 Industrial Sources with Substantially Increased Emissions, or New Relevant Exposure

It has been concluded that there are no processes within the boundaries of North West Leicestershire with substantially increased emissions of benzene or with new relevant exposure.

4.7 Other Sources

4.7.1 Petrol Stations

There is a potential for benzene to be emitted from petrol stations during loading and distribution of petrol. Studies have concluded that the presence of a petrol station is unlikely to have a significant influence on the concentrations of benzene close to residential properties where:

- The throughput of petrol is less than 2 million litres per annum.
- The distribution pumps are more than 10m from residential properties.

There are 13 petrol stations in the district with a throughput of petrol greater than 2 million litres per annum. These petrol stations utilise vapour recovery systems, which recover vapours that are displaced when filling underground tanks, known as Stage 1 emissions. The distribution pumps at all of these petrol stations are more than 10m from residential properties.

4.7.2 Major Fuel Storage Depots (Petrol Only)

There are no major fuel storage depots handling petrol with the boundaries of the district. The nearest major petrol storage and distribution facility is located in Kingsbury in North Warwickshire District Council, which is 8 miles from North West Leicestershire.

4.8 Conclusions for Benzene

The benzene concentrations within North West Leicestershire are unlikely to exceed the Air Quality Objectives set for 2003 and 2010. It can therefore be concluded that it will not be necessary to proceed to a Detailed Assessment for benzene.

5. Review and Assessment of 1,3-Butadiene

5.1 Introduction

In the UK the main source of 1,3-Butadiene is road vehicles, with petrol engines emitting 67% of the total annual concentration and diesel a further 11%. The compound is not present itself in fuel, but is formed as a product of the combustion of the olefins 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. The Expert Panel on Air Quality Standards (EPAQS) set a level of 2.25µgm^{-3} as a running mean representing an exceedingly small risk to health.

5.2 Air Quality Objective for 1,3-Butadiene

The following table specifies the Air Quality Objective for 1,3-Butadiene as set out in the Air Quality Regulations (2000).

Table 5.1 Air Quality Objective for 1,3-Butadiene

Pollutant	Objective		Date to be Achieved by
	Concentration	Measured As	
1,3-Butadiene	2.25µgm^{-3}	Running Annual Mean	31st Dec 2003

5.3 Conclusions of the Previous Review and Assessment

The national perspective on 1,3-Butadiene is that Air Quality Objectives will be met by the due date in all areas except for authorities with major industrial processes where the chemical is handled in bulk. There are no processes within North West Leicestershire that handle, store or emit 1,3-Butadiene at present. The Updating and Screening

Assessment conducted in 2003 (NWLDC, 2003) concluded that there was no requirement for further assessment.

5.4 Monitoring Data

North West Leicestershire District Council does not monitor for 1,3-Butadiene.

5.5 Industrial Sources

5.5.1 New Industrial Sources

There are no new industrial processes with the boundaries of the district which are likely to release significant quantities of 1,3-Butadiene.

5.5.2 Existing Industrial Sources with Significantly Increased Emissions

There are no Permitted Installations that emit 1,3-Butadiene within North West Leicestershire or in neighbouring authorities.

5.6 Conclusions for 1,3-Butadiene

North West Leicestershire is unlikely to exceed the Air Quality Objective for 1,3-Butadiene. It can therefore be concluded that it will not be necessary to proceed to a Detailed Assessment for 1,3-Butadiene.

6. Review and Assessment of Lead

6.1 Introduction

Most lead in the atmosphere is in the form of very fine particles of less than 1µm although some sources of lead generate larger particles 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.

Since the banning of leaded fuel from sale in 2000, 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.

Lead is bio-accumulative, namely it concentrates within the 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.

6.2 Air Quality Objectives for Lead

The following table specifies the Air Quality Objectives for lead as set out in the Air Quality Regulations (2000).

Table 6.1 Air Quality Objective for Lead

Pollutant	Objective		Date to be Achieved by
	Concentration	Measured As	
Lead	$0.5\mu gm^{-3}$	Annual Mean	31/12/2004
Lead	$0.25\mu gm^{-3}$	Annual Mean	31/12/2008

6.3 Conclusions of Previous Review and Assessment

Emissions of lead to atmosphere are now restricted in the UK to specific industrial sources including battery manufacture, pigments for paints and glazes, alloys, radiation shielding, tank lining and piping.

Current levels of lead in the air at national monitoring sites indicate compliance with the Air Quality Objectives. The Updating and Screening Assessment conducted in 2003 (NWLDC, 2003) concluded that there was no requirement for further assessment.

6.4 Monitoring Data

North West Leicestershire District Council does not monitor for lead and there is no national network sites located in close proximity to the district.

6.5 Industrial Sources

6.5.1 New Industrial Sources and Sources with Substantially Increased Emissions

There are no industrial processes within the district or in neighbouring authorities which emit lead.

6.6 Conclusion for Lead

North West Leicestershire District Council is unlikely to exceed the Air Quality Objectives for lead. It can therefore be concluded that it will not be necessary to proceed to a Detailed Assessment for lead.

7. Review and Assessment of Sulphur Dioxide

7.1 Introduction

The principal source of sulphur dioxide (SO_2) is 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. If exposed to sufficiently high concentrations of the gas the onset of clinical effects can be very rapid. Hence, three air quality standards have been set at which SO_2 are unlikely to have any significant health effects.

7.2 Air Quality Objectives for Sulphur Dioxide

The following table specifies the Air Quality Objectives for SO_2 as set out in the Air Quality Regulations (2000).

Table 7.1 Air Quality Objectives for SO_2

Pollutant	Air Quality Objective		Date to be Achieved By
	Concentration	Measured As	
SO_2	350µgm^{-3} Not to be exceeded more than 24 times per year	1 Hour Mean	31st Dec 2004
SO_2	125µgm^{-3} Not to be exceeded more than 3 times per year	24 Hour Mean	31st Dec 2004
SO_2	266µgm^{-3} Not to be exceeded more than 35 times per year	15 Minute Mean	31st Dec 2005

7.3 Conclusions of Previous Review and Assessment

The Updating and Screening Assessment conducted in 2003 (NWLDC, 2003) concluded that North West Leicestershire was unlikely to exceed the Air Quality Objectives for SO_2 therefore there was no need to progress to a Detailed Assessment.

7.4 Monitoring Data

Sulphur dioxide is currently not monitored within North West Leicestershire.

7.5 Industrial Sources

7.5.1 New Industrial Sources

There are no new industrial processes within North West Leicestershire which are a source of SO_2.

7.5.2 Industrial Sources with Substantially Increased Emissions

There are no industrial sources within North West Leicestershire with substantially increased emissions of SO_2.

7.6 Domestic Sources

7.6.2 Areas of Domestic Coal Burning

Using professional judgement it has been concluded that it is unlikely that there are any locations within the district where there may be more than 100 houses in an area of 500x500m, which burn solid fuel as their primary source of heating.

7.7 Boilers

7.7.1 Small Boilers >5MW$_{(thermal)}$

No boiler plant greater than 5MW$_{(thermal)}$ have been identified with the boundaries of North West Leicestershire.

7.8 Conclusion for Sulphur Dioxide

North West Leicestershire is unlikely to exceed the Air Quality Objectives for SO_2 therefore there is no need to progress to a Detailed Assessment.

8. Review and Assessment of PM_{10}

8.1 Introduction

Particulate matter differs from other pollutants in that it is not derived from a single substance. Particulate matter in the atmosphere is composed of a wide range of materials of various origins.

Particulate matter with an aerodynamic diameter of 10 microns or less is referred to as PM_{10}. There are a wide range of emission sources of PM_{10} concentrations in the UK, which can be divided into three main categories. Primary particulate emissions derived directly from combustion sources, including road traffic, power generation and industrial processes. Secondary particles formed by chemical reactions in the atmosphere, and comprise principally of sulphates and nitrates. Coarse particles comprising a wide range of sources, including re-suspended dusts from road traffic, construction works, mineral extraction processes, wind blown dusts and soils, sea salt and biological particles.

8.2 Air Quality Objectives for PM_{10}

The following table specifies the Air Quality Objectives for PM_{10} as set out in the Air Quality Regulations (2000).

Table 8.1 Air Quality Objectives for PM_{10}

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured As	
PM_{10}	$40\mu gm^{-3}$	Annual Mean	31st Dec 2004
PM_{10}	$50\mu gm^{-3}$ Not to be exceeded more than 35 times per year	24-Hour Mean	31st Dec 2004

8.3 Conclusions of Previous Review and Assessment

The Updating and Screening Assessment conducted in 2003 (NWLDC, 2003) concluded that a Detailed Assessment was required for PM_{10} in the vicinity of Bardon Quarry, Coalville. The Detailed Assessment for PM_{10} was conducted in 2004 (NWLDC, 2005a) at Tilson House, approximately 200m from the boundary of Bardon Quarry. This site is located approximately 200m from the boundary of Bardon Quarry. The number of exceedences recorded in 2004 in the vicinity of Bradgate Drive on the Greenhill Estate, Coalville was below the permitted 35 per year, therefore an Air Quality Management Area was not declared.

8.4 Monitoring Data

8.4.1 Outside an AQMA

Particulate matter is monitored using an Osiris PM_{10} analyser which is operated by Aggregate Industries, and is located at Tilson House, a residential care home on the Greenhill Estate, Coalville. The annual mean PM_{10} concentrations and the number of exceedences of the 24-hour 50µgm^{-3} objective are presented in Table 8.2.

Table 8.2 Annual Mean PM_{10} Concentrations (µgm^{-3}) measured at Tilson House Coalville

Year	Annual Mean (µgm^{-3})	Number of Exceedences
2002	37.54	33
2003	26.52	31
2004	25.67	21
2005	20.74	13

The annual mean PM_{10} concentrations (µgm^{-3}) recorded at Tilson House have decreased every year since 2003 and are below the Air Quality Objective of 40µgm^{-3}. The Air Quality Objective also sets a limit of 35 exceedences per year of the 24-hour mean concentration of 50µgm^{-3}. The number of exceedences of the 24-hour objective recorded at Tilson House has fallen every year since 2002 and is below the objective limit.

8.4.2 Within an AQMA

Particulate matter (PM_{10}) is not monitored within either of the two AQMA's declared in North West Leicestershire.

8.5 Road Traffic

8.5.1 Junctions

Using traffic count data supplied by Leicestershire County Council, 'busy' junctions with more than 10000 vehicles per day where identified. One site, the A511/Broomleys Road junction (referred to as Broomleys junction) in Coalville was identified as having relevant exposure within 10m. The DMRB Screening Method – Version 1.01 (April 2003) was used to predict the annual mean, and the number of exceedences of the 50µgm^{-3} 24-hour objective (Table 8.3).

Table 8.3 Predicted PM_{10} Concentrations (µgm^{-3}) and Number of Exceedences for 2005 using DMRB at Busy Junctions

Site	Annual Mean (µgm^{-3})	Number of Days >50µgm^{-3}
Broomleys (A511/Broomleys Road) – Coalville	23.8	10

The PM_{10} annual mean concentration (µgm^{-3}) of 23.8, predicted by the DMRB Screening Method for Broomleys junction, Coalville is below the Air Quality Objective. The predicted number of exceedences of 50µgm^{-3} was also below the objective limit of 35.

8.5.2 Roads with High Flow of Buses and/or HGV's

There are no roads in North West Leicestershire with unusually high proportions of buses or HGV's as defined within LAQM.TG (03) – Update, (DEFRA 2006).

8.5.3 New Roads Constructed or Proposed

No new roads have been proposed or constructed within the district since the last round of Review and Assessment.

8.5.4 Roads with Significantly Changed Traffic Flows or New Relevant Exposure

There are no roads within the district with significantly changed traffic flows as defined within LAQM.TG (03) – Update, (DEFRA 2006).

8.5.5 Roads Close to the Objective during the Second Round of Review and Assessment

There were no roads within North West Leicestershire which were close to the Air Quality Objective for $PM_{10.}$

8.6 Industrial Sources

8.6.1 New Industrial Sources

There are no new industrial processes within the district or in neighbouring authorities which make a significant contribution to annual mean PM_{10} concentrations.

8.6.2 Industrial Sources with Substantially Increased Emissions or New Relevant Exposure

There are no industrial sources with substantially increased PM_{10} emissions or with new relevant exposure.

8.7 Domestic Sources

8.7.1 Areas of Domestic Solid Fuel Burning

Using professional judgement it has been concluded that it is unlikely that there are any locations within the district where there may be more than 50 houses in an area 500m x 500m, which burn solid fuel as their primary source of heating.

8.8 Other Sources

8.8.1 Quarries

The main sites that may be potential sources of PM_{10} within the district have been identified. All of these sites are Permitted Installations in accordance with Pollution Prevention and Control (England and Wales) Regulations 2000. The emissions of PM_{10} are controlled through conditions contained in their Permits.

Table 8.4 Predicted Background Concentrations (μgm^{-3}) of PM_{10} and Distance (m) to Nearest Relevant Exposure

Site	Approx. Distance to Nearest Relevant Exposure (m)	Predicted Background μgm^{-3}	
		2004	2010
Bardon Quarry	100	21.8	20.1
Breedon Quarry	100	22.1	19.8
Cloud Hill Quarry	300	21.7	19.6

Aggregate Industries, who operate Bardon Quarry monitor PM_{10} using a real-time Osiris analyser situated at Tilson House, which is approximately 200m from the quarry boundary. The results of monitoring undertaken at Tilson House are presented in Table 8.2. The results from the monitoring conducted indicate that the predicted background concentrations for Bardon Quarry in Table 8.4 are slightly lower than those measured at Tilson House (Table 8.2). However, both the predicted and measured concentrations are below the annual mean Air Quality Objective for PM_{10}.

8.8.2 Aircraft

Nottingham East Midlands Airport (NEMA) is located in the north of the district. Whilst aircraft are not major sources of PM_{10} emissions, they may make a contribution close to the source. Emissions from aircraft once they are above 200m will make a negligible contribution to ground concentrations.

There are currently approximately 630 properties within 200m vertically of flight paths used at the airport and approximately 1900 properties within 500m of the airport boundary (Figure 12.3).

Information supplied by NEMA has been used to calculate the total equivalent passenger numbers in million passengers per annum (mppa). The results for 2004 and 2005 are shown in Table 8.5. As the total equivalent passenger numbers in million passengers per annum is below 10mppa there is no need to progress to a Detailed Assessment for PM_{10}.

Table 8.5 Annual Throughput of Passengers and Freight (mppa) in 2004 and 2005 at NEMA

Type of Cargo	**Throughput**	
	2004	**2005**
Passengers	4382000	4192000
Freight (tonnes)	279000	293000
Freight - Million passengers per annum (mppa)*	2.79*	2.93*
Total mppa	**7.17**	**7.12**

* The Technical Guidance states that the tonnes of freight should be converted to an equivalent number of passengers using 100000 = 1 million passengers per annum (mppa).

8.9 Conclusions for PM_{10}

Based on current information it can be concluded that it will not be necessary to proceed to a Detailed Assessment for PM_{10} at any locations within the district.

9. Review and Assessment of Nitrogen Dioxide

9.1 Introduction

Nitrogen dioxide (NO_2) 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 NO_2. Nitrogen dioxide and NO are collectively referred to as nitrogen oxides (NO_x). All combustion processes produce NO_x emissions, largely in the form of NO, which is converted to NO_2, mainly as a result of reaction with ozone in the atmosphere. It is NO_2 that is associated with adverse effects upon human health. The principle source of NO_x is road transport, which accounted for about 49% of total UK emissions in 2000. The contribution of road transport to NO_x emissions has declined significantly in recent years as a result of various national policy measures and further reductions are expected up until 2010 and beyond. Other significant sources of NO_x emissions include the electricity supply industry and other industrial and other industrial and commercial sectors, which accounted for about 24% and 23% respectively in 1999.

The principal health effects of NO_2 relate to impaired lung performance from changes in structure and function and suspected hyper reactivity to allergens (causes of allergic responses). 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.

9.2 Air Quality Objectives for Nitrogen Dioxide

The following table specifies the Air Quality Objectives for NO_2 as set out in the Air Quality Regulations (2000).

Table 9.1 Air Quality Objectives for NO_2

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured As	
NO_2	$40\mu gm^{-3}$	Annual Mean	31st Dec 2005
NO_2	$200\mu gm^{-3}$ Not to be exceeded more than 18 times	1-Hour Mean	31st Dec 2005

9.3 Conclusions of Previous Review and Assessment

The Progress Report published in 2005 (NWLDC, 2005b) concluded that more intensive monitoring should be conducted at locations were exceedences of the annual mean Air Quality Objective have been recorded.

9.4 Monitoring Data

Passive diffusion tubes are used throughout the district to monitor NO_2 (Figure 12.1). Details of the diffusion tube network in North West Leicestershire were published in the Progress Report (NWLDC, 2005) and should be referred to if further information is required.

Monitoring sites can be classified according to the type of environment in which they are located (DEFRA, 2003). The site descriptions are provided in Table 9.2, with the appropriate abbreviation being used to categorise the diffusion tube locations in Tables 9.3, 9.4 and 9.5.

Table 9.2 Monitoring Location Descriptions

Site Type	Description
(UC) Urban Centre	An urban location representative of typical population exposure in towns or city centres e.g. pedestrian precincts and shopping malls.
(UB) Urban Background	An urban location distanced from sources and therefore broadly representative of city-wide background condition e.g. urban residential areas.
(S) Suburban	A location type situated in a residential area on the outskirts of a town or city.
(R) Roadside	A site sampling between 1m of the kerbside of a busy road and the back of the pavement. Typically this will be within 5m of the road, but could be up to 15m.
(O) Other	Any special source-orientated or location category covering monitoring undertaken in relation to specific emission sources such as power stations, car-parks, airports or tunnels.

9.4.1 Outside an AQMA

North West Leicestershire currently monitors NO_2 concentrations at 22 locations in the district outside the two AQMA's. The 2005 annual mean concentrations obtained using passive diffusion tubes are presented in Table 9.3. The data has been bias adjusted with these corrected concentrations also being presented in Table 9.3. Details of the bias adjustment factor applied to the diffusion tube data and the QA/QC of the diffusion tube survey is contained within the previously published Progress Report (NWLDC, 2005).

The data highlighted in yellow in Table 9.3 represents concentrations that exceed the Air Quality Objective annual mean for NO_2 of 40µgm^{-3}. Values above 36µgm^{-3} have been highlighted in blue as these represent 40µgm^{-3} minus one standard deviation.

Table 9.3 2005 Annual Mean and Bias Adjusted Annual Mean NO_2 Concentrations (μgm^{-3})

No.	Type	Location	Annual Mean (μgm^{-3})	Bias Adj. Annual Mean (μgm^{-3})
1	R	Belvoir Rd, Coalville	34.49	37.96
2	UC	Jackson St, Coalville	29.11	32.04
3	UB	Oxford Rd Coalville	23.62	26.00
4	S	Abbots Oak Coalville	22.43	24.69
5	R	Bardon Rd Coalville	41.54	45.71
7	R	Measham	29.18	31.12
8	R	Boundary	22.79	25.08
11	R	Ashby de la Zouch A42	26.79	29.49
12	R	Castle Donington High St	36.83	40.54
13	O	Castle Donington NEMA	19.07	20.99
14	R	Castle Donington Station Rd	34.91	38.42
15	O	Castle Donington Diseworth	20.67	22.75
17	S	Kegworth NEMA	24.67	27.15
19	R	Long Whatton M1	25.95	28.56
20	R	Long Whatton West	32.19	35.43
21	R	Copt Oak	40.34	44.40
22	R	Charley	33.75	37.15
23	R	Broomleys 1 Coalville	42.16	46.40
24	R	Sinope	29.27	32.22
26	0	Aeropark	18.52	20.39
27	R	Bardon Rd West Coalville	42.95	47.27
29	R	Broomleys 2 Coalville	42.83	47.14

The bias adjusted annual mean NO_2 concentrations obtained in 2005 show nine locations which exceed $36\mu gm^{-3}$. Five of these locations are in Coalville; Belvoir Road, Bardon Road and Bardon Road West and Broomleys 1 and 2. Two locations in Castle Donington; High Street and Station Road recorded concentrations greater than $36\mu gm^{-3}$ in Castle Donington. The remaining sites were located at Copt Oak and Charley.

The results obtained from the diffusion tube survey indicate that more detailed monitoring should be undertaken at the nine locations discussed above.

The bias adjusted annual mean NO_2 concentrations recorded in 2003, 2004 and 2005 from the nine locations discussed above have been plotted in Figure 9.1.

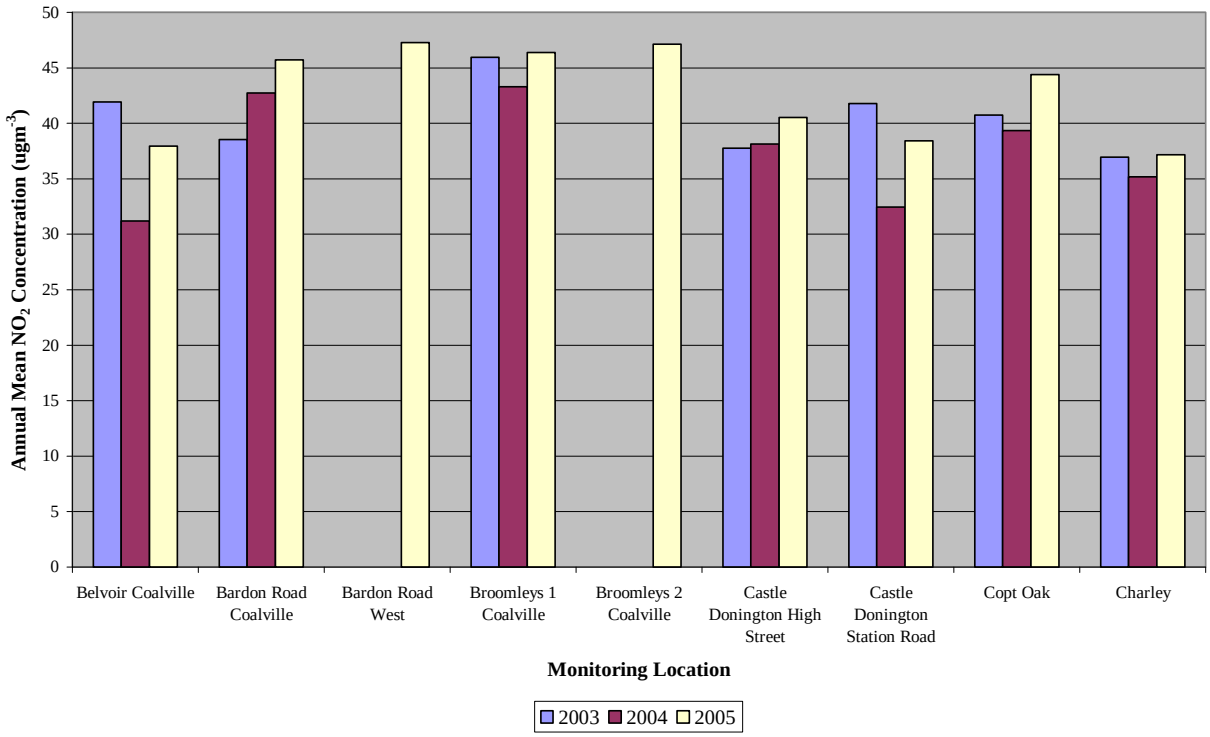

Figure 9.1 Trends in NO_2 Diffusion Tube Concentrations (μgm^{-3})

Two locations, Bardon Road West and Broomleys 2 both in Coalville were commissioned at the end of 2004 so only one year's data is available. Bardon Road in Coalville and High Street Castle Donington recorded increases in annual mean concentrations across the three year period. Five sites showed fluctuations in NO_2 concentrations over the three year period, each with the lowest concentrations being obtained in 2004 and the highest in 2005. These sites were Belvoir Road and Broomleys 1 in Coalville, Station Road in Castle Donington, Copt Oak and Charley. Of these five sites only one, Broomleys 1 in Coalville recorded levels which were consistently above the annual mean Air Quality Objective for NO_2.

From this analysis it can be concluded that the following sites require Detailed Assessments of NO_2 to be conducted for Bardon Road Coalville, Broomleys Junction in Coalville and High Street in Castle Donington.

Monitoring of NO_2 has been undertaken at Nottingham East Midlands Airport by the airport's Environmental Section using passive diffusion tubes and a real time analyser. The monitoring locations are shown in Figure 12.4. The annual mean concentrations (μgm^{-3}) recorded in 2004 and 2005 are presented in Table 9.4.

Table 9.4 Annual Mean NO_2 Concentrations (μgm^{-3}) Recorded at Sites within the Boundaries of Nottingham East Midlands Airport (NEMA)

Location	Type	2004 Annual Mean (μgm^{-3})	2005 Annual Mean (μgm^{-3})
Stand 15 (amended 16)	O	40.1	42.0
Crash Gate 27 ILS	O	30.6	32.5
Crash Gate 4	O	30.6	30.6
Central IRVR	O	32.5	30.6
Western Perimeter Fence	O	24.8	24.8
Aeropark	O	26.7	28.7
Ambassador Road	O	28.7	28.7
Aeropark (2)	O	-	22.9
Real Time Analyser	O	24.8	26.7

Only one location, Stand 15 exceeded the annual mean Air Quality Objective for NO_2. However as shown in Figure 12.5, Stand 15 is the closest location to idling aircraft and there are no sensitive receptors within 10m of the tube location.

9.4.2 Within an AQMA

Nitrogen dioxide is monitored using seven passive diffusion tubes within the two AQMA's declared by North West Leicestershire (Figures 12.1 and 12.2). The 2005 annual mean and bias adjusted annual mean concentrations (μgm^{-3}) are presented in Table 9.5. The first three locations detailed in Table 9.5 relate to the AQMA declared along the A6 in Kegworth (Figure 12.1), the remainder relate to the AQMA declared at Molehill House next to the M1 in Kegworth (Figure 12.2).

Table 9.5 2005 Annual Mean and Bias Adjusted Annual Mean NO_2 Concentrations (μgm^{-3}) within AQMA's

Tube No.	Type	Location	Annual Mean (μgm^{-3})	Bias Adj. Annual Mean (μgm^{-3})
6	R	Derby Rd Kegworth	34.04	37.47
9	R	Kegworth A6 2	38.45	42.32
16	R	Kegworth A6	40.37	44.38
10	R	M1 Molehill	54.19	59.64
18	R	Kegworth Molehill Analyser	54.57	60.06
28	R	Kegworth Molehill Analyser 2	52.72	58.03
23	R	Molehill House	35.92	39.53

The bias adjusted 2005 annual mean concentrations show that all seven locations exceeded 36μgm^{-3} with five exceeding the annual mean objective of 40μgm^{-3} (highlighted in yellow).

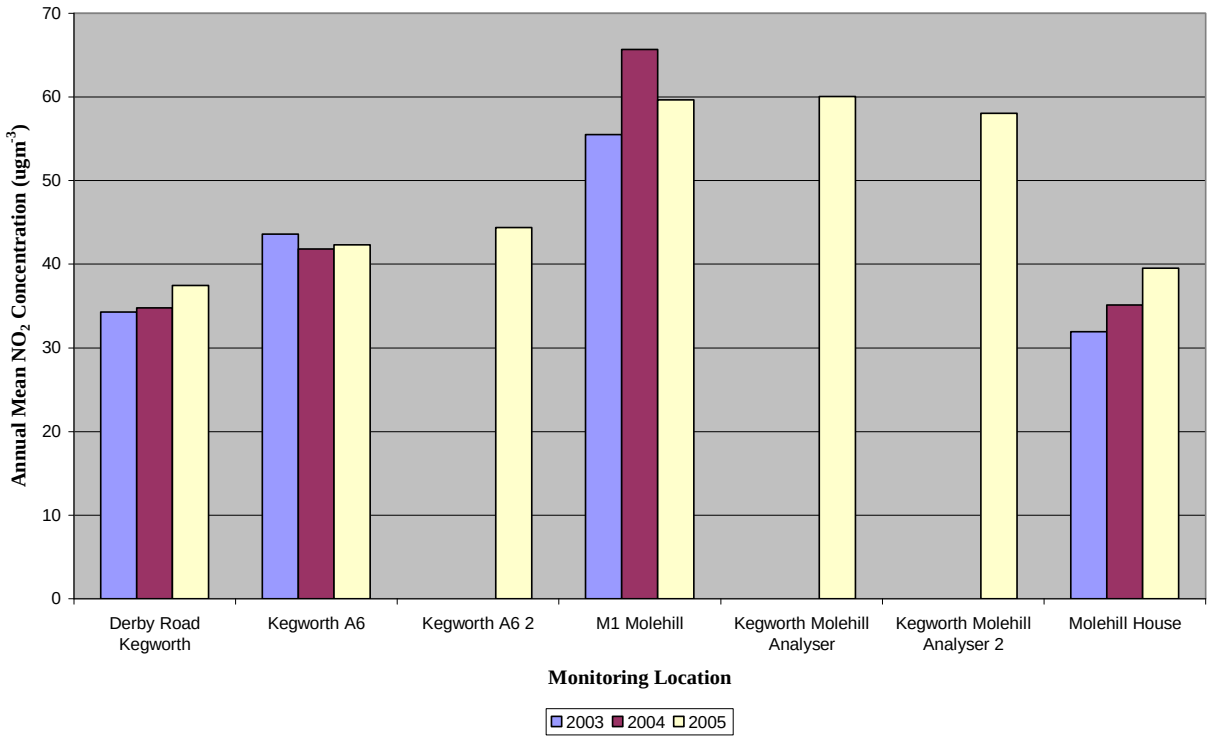

Figure 9.2 Trends in NO_2 Diffusion Tube Concentrations (μgm^{-3})

Bias adjusted annual mean NO_2 concentrations recorded at all seven location in 2003, 2004 and 2005 are presented in Figure 9.2. Three locations, Kegworth A6 2, Kegworth

Molehill Analyser and Kegworth Molehill Analyser 2 were commissioned at the end of 2004 so only one year's data is available.

The NO_2 concentrations recorded within the A6 AQMA (Derby Road Kegworth and Kegworth A6 diffusion tubes) have shown slight fluctuations in annual mean concentrations over the three year period. The Kegworth A6 site which is located next to the Parish Council Offices in Kegworth has shown little variation over the three year period with concentrations just above the annual mean Air Quality Objective of $40\mu gm^{-3}$.

The results from the diffusion tube located at Molehill House (on drainpipe) has show a steady increase in annual mean concentration over the three years, which in, 2005 was just below the $40\mu gm^{-3}$ objective but within one standard deviation. The M1 Molehill diffusion tube which is located closer to the motorway has consistently recorded concentrations above the annual mean objective although the level recorded in 2005 was lower than that recorded in 2004.

9.5 Road Traffic

9.5.1 Narrow Congested Streets

There are no narrow, congested streets in North West Leicestershire as defined in the Technical Guidance (LAQM.TG(03)- Update, DEFRA 2006).

9.5.2 Junctions

Using traffic count data supplied by Leicestershire County Council, 'busy' junctions with more than 10000 vehicles per day where identified. One site, the A511/Broomleys Road junction in Coalville was identified with relevant exposure within 10m. The DMRB Screening Method – Version 1.01 (April 2003) was used to predict the annual mean NO_2 concentration (Table 9.6).

Table 9.6 Predicted NO_2 Concentrations (μgm^{-3}) for 2005 using DMRB at Busy Junctions

Site	Annual Mean (μgm^{-3})
Broomleys Junction (A511/Broomleys Road) Coalville	21.0

The NO_2 annual mean (μgm^{-3}) of 21.0, predicted by the DMRB Screening Method for Broomleys junction, Coalville is below the Air Quality Objective. However, the measured 2005 annual mean concentrations recorded by the diffusion tubes located at Broomleys junction of 46.40 and 47.14 indicate that the objective of 40μgm^{-3} is not being achieved.

9.5.3 Busy Streets

Using traffic count data supplied by Leicestershire County Council, 'busy' roads with more than 10000 vehicles per day where identified. Three roads were identified with relevant exposure within 5m of the kerb. The DMRB Screening Method – Version 1.01 (April 2003) was used to predict the annual mean NO_2 concentration. The results are presented in Table 9.7.

Table 9.7 Predicted NO_2 Concentrations (μgm^{-3}) for 2005 using DMRB at Busy Junctions

Site	Annual Mean (μgm^{-3})
High Street Castle Donington	21.2
Bardon Road Coalville	28.9
A6 Kegworth	26.9

The NO_2 annual mean (μgm^{-3}), predicted by the DMRB Screening Method is below the Air Quality Objective at all three locations. However, the measured concentrations recorded at High Street in Castle Donington, Bardon Road in Coalville and the A6 in Kegworth were 40.54, 45.71 and 44.38 respectively. The concentrations recorded by the diffusion tubes indicate that the annual mean Air Quality Objective for NO_2 is not being achieved at any of these locations.

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9.5.4 Roads with High Flow of Buses and/or HGV's

There are no roads in North West Leicestershire with unusually high proportions of buses or HGV's as defined within LAQM.TG (03) – Update, (DEFRA 2006).

9.5.5 New Roads Constructed or Proposed

No new roads have been proposed or constructed within the district since the last round of Review and Assessment.

9.5.6 Roads with Significantly Changed Traffic Flows or New Relevant Exposure

There are no roads within the district with significantly changed traffic flows as defined within LAQM.TG (03) – Update, (DEFRA 2006).

9.5.7 Bus Stations

There are no bus stations located within North West Leicestershire.

9.6 Industrial Sources

9.6.1 New Industrial Sources

There are no new industrial processes within the district or in neighbouring authorities which make a significant contribution to NO_2 concentrations.

9.6.2 Industrial Sources with Substantially Increased Emissions or New Relevant Exposure

There are no industrial sources with substantially increased NO_2 emissions or with new relevant exposure.

9.7 Other Sources

9.7.1 Aircraft

Nottingham East Midlands Airport (NEMA) is located in the north of the district. Aircraft are significant sources of nitrogen oxides emissions, especially during takeoff. Emissions from aircraft once they are above 200m will make a negligible contribution to ground concentrations.

There are currently approximately 630 properties within 200m vertically of flight paths used at the airport and approximately 2300 properties within 1000m of the airport boundary (Figure 12.3).

Information supplied by NEMA has been used to calculate the total equivalent passenger numbers in million passengers per annum (mppa). The results for 2004 and 2005 are shown in Table 9.8.

Table 9.8 Annual Throughput of Passengers and Freight (mppa) in 2004 and 2005 at NEMA

Type of Cargo	**Throughput**	
	2004	**2005**
Passengers	4382000	4192000
Freight (tonnes)	279000	293000
Freight - Million passengers per annum (mppa)*	2.79*	2.93*
Total mppa	**7.17**	**7.12**

* The Technical Guidance states that the tonnes of freight should be converted to an equivalent number of passengers using 100000 = 1 million passengers per annum (mppa).

Although the total equivalent passenger numbers exceeds 5mppa, NO_2 monitoring conducted in the vicinity of Diseworth Lane Castle Donington (CD Diseworth diffusion tube, Table 9.3) which are the closest properties to the airport indicate the concentrations do not exceed the annual mean Air Quality Objective. It can be concluded that a Detailed Assessment for NO_2 in the vicinity of NEMA is not required.

9.8 Conclusions for Nitrogen Dioxide

The results of monitoring conducted in 2005 indicates that a number of locations in North West Leicestershire have exceeded the annual mean Air Quality Objective of 40µgm^{-3} for NO_2. Detailed Assessments will therefore be conducted at the following locations:

- Bardon Road – Coalville
- Broomleys Junction (A511/Broomleys Road) – Coalville
- High Street – Castle Donington

The results of monitoring conducted within the existing AQMA's indicate that the annual mean Air Quality Objective for NO_2 is still not being achieved in these areas. The Action Plan (NWLDC, 2006) developed for these two areas will continue to be implemented and progress reported annually.

The results of NO_2 monitoring in the vicinity of NEMA, indicates that a Detailed Assessment is not required even with the high throughput of passengers. Monitoring in the vicinity of the airport will continue and results will be reported annually.

10. Summary and Conclusions

Within North West Leicestershire the Air Quality Objectives for CO, Benzene, 1,3-Butadiene, Lead, SO_2 and PM_{10} are currently being achieved.

The annual mean Air Quality Objective for NO_2 is currently not being achieved at a number of locations within the district. The annual mean NO_2 concentrations within the two AQMA's in 2005 exceeded the objective of 40µgm^{-3}. The Air Quality Action Plan (NWLDC, 2006) devised to reduce the NO_2 concentrations within the AQMA's will continue to be implemented and progress reported annually.

It can be concluded from the findings published in this report that Detailed Assessments of NO_2 concentrations must be conducted at three locations within the district. Those locations being:

- Bardon Road – Coalville
- Broomleys Junction (A511/Broomleys Road) – Coalville
- High Street – Castle Donington

11. References

DEFRA (2003) LAQM.TG(03) Local Air Quality Management Technical Guidance. *Department of the Environment, Food and Rural Affairs*.

DEFRA (2006) LAQM.TG(03) – Update. Local Air Quality Management Technical Guidance. *Department of the Environment, Food and Rural Affairs.*

NWLDC (2003) Air Quality Review and Assessment - Updating and Screening Assessment. *North West Leicestershire District Council.*

NWLDC (2005a) Air Quality Review and Assessment – Detailed Assessment. *North West Leicestershire District Council.*

NWLDC (2005b) Air Quality Review and Assessment – Progress Report. *North West Leicestershire District Council.*

NWLDC (2006) Air Quality Review and Assessment – Air Quality Action Plan. *North West Leicestershire District Council.*

12. Appendix

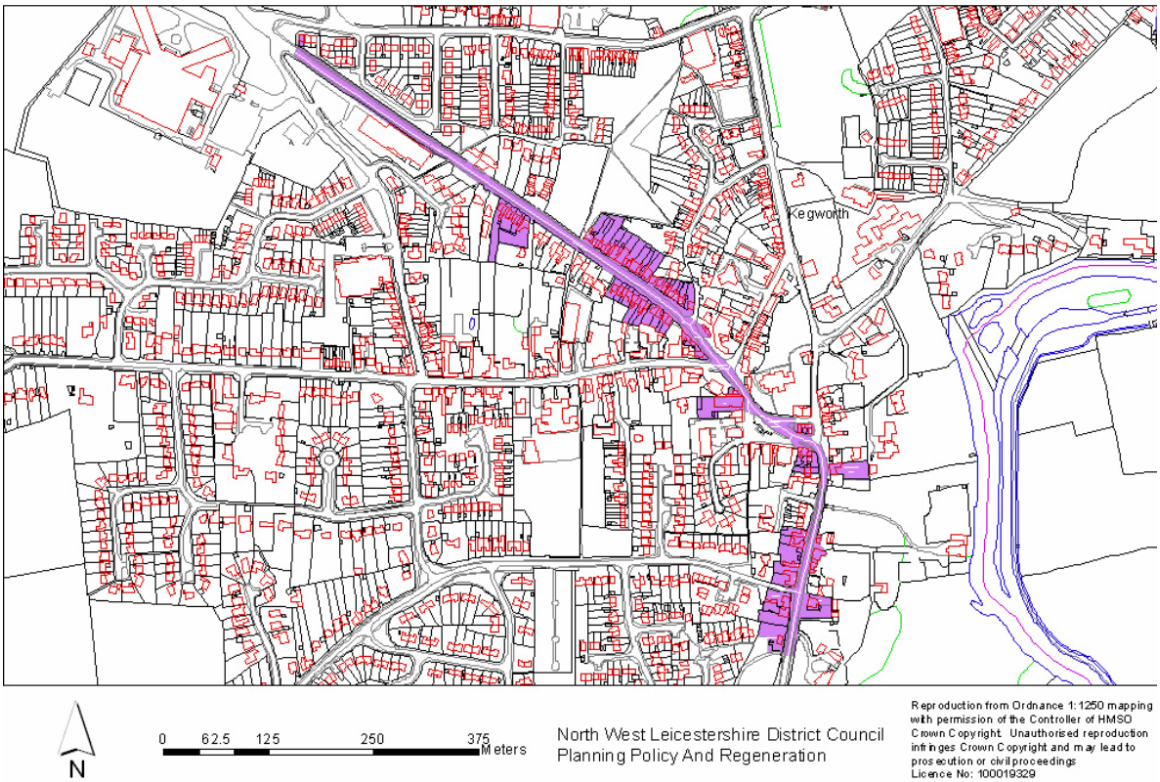

Figure 12.1 Boundaries of the A6 Kegworth AQMA

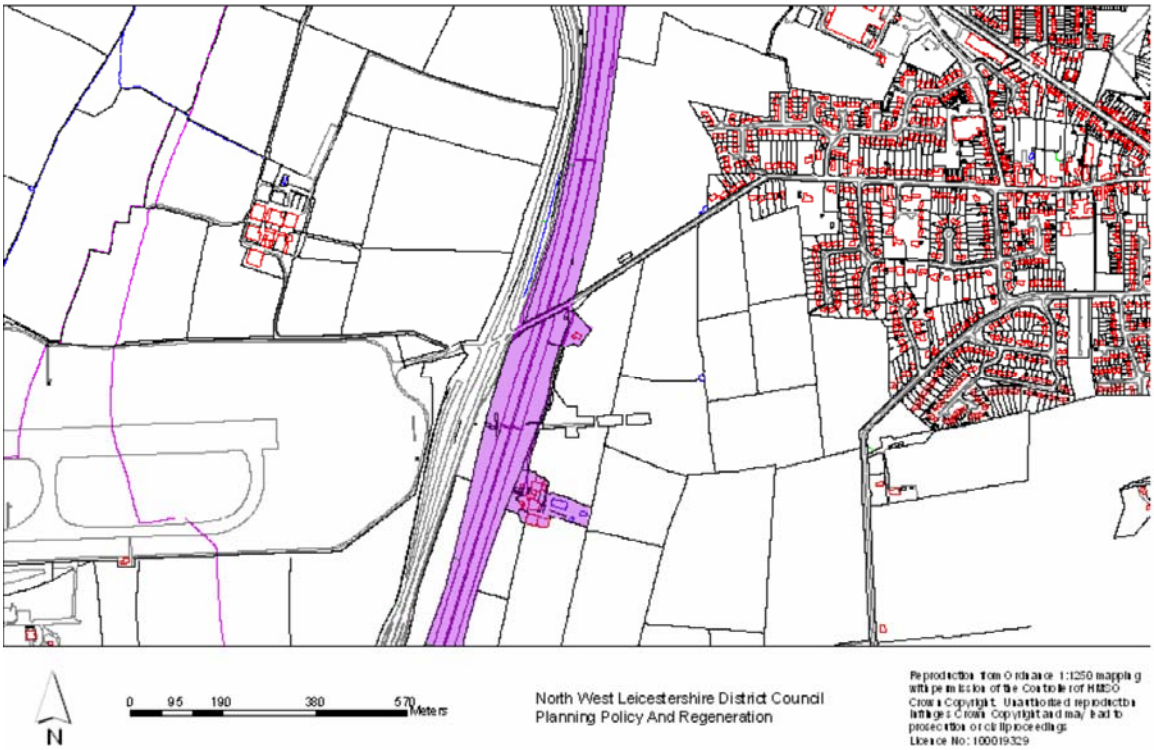

Figure 12.2 Boundaries of the M1 Molehill House AQMA

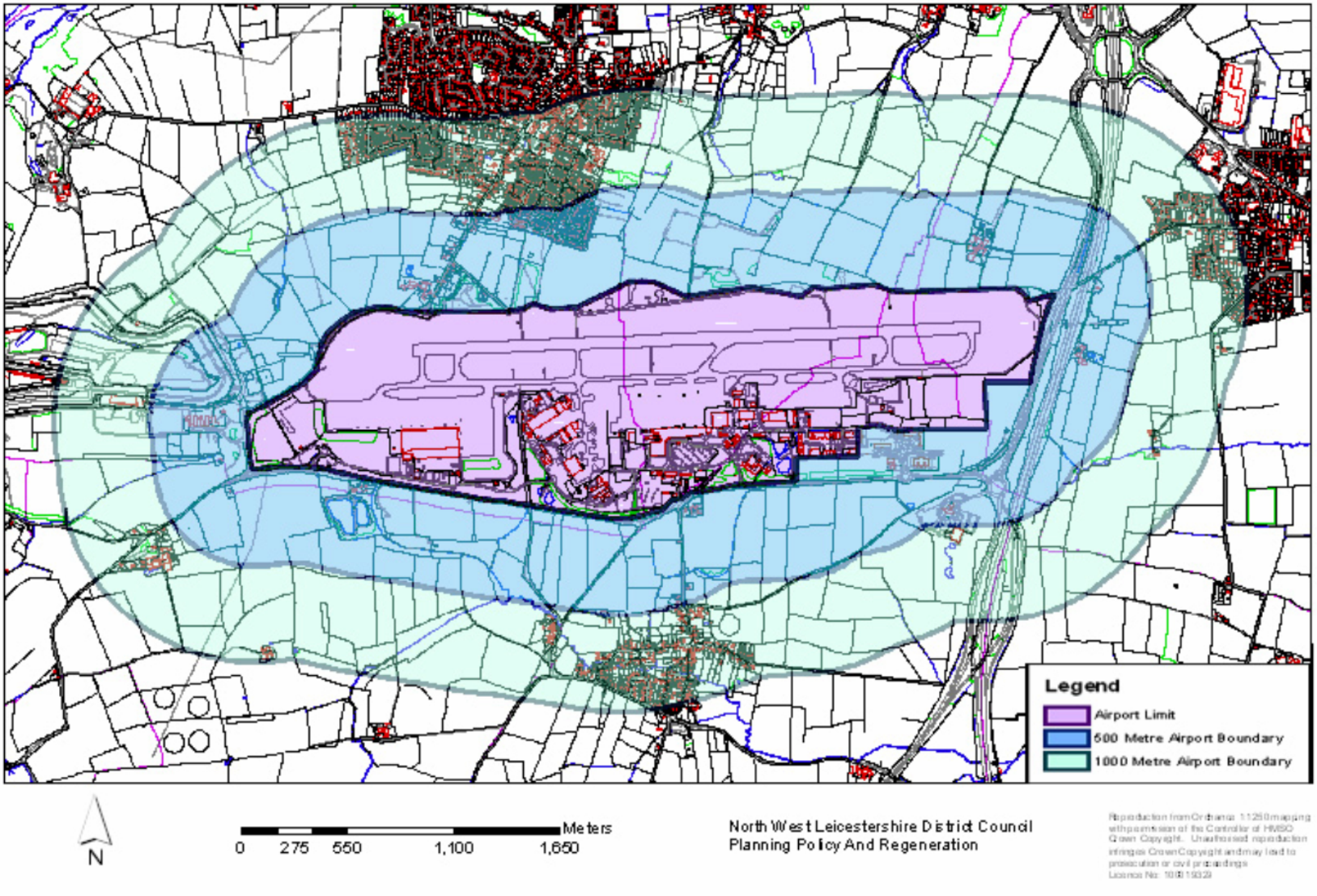

Figure 12.3 Properties within 500m and 1000m of the Boundary of Nottingham East Midlands Airport

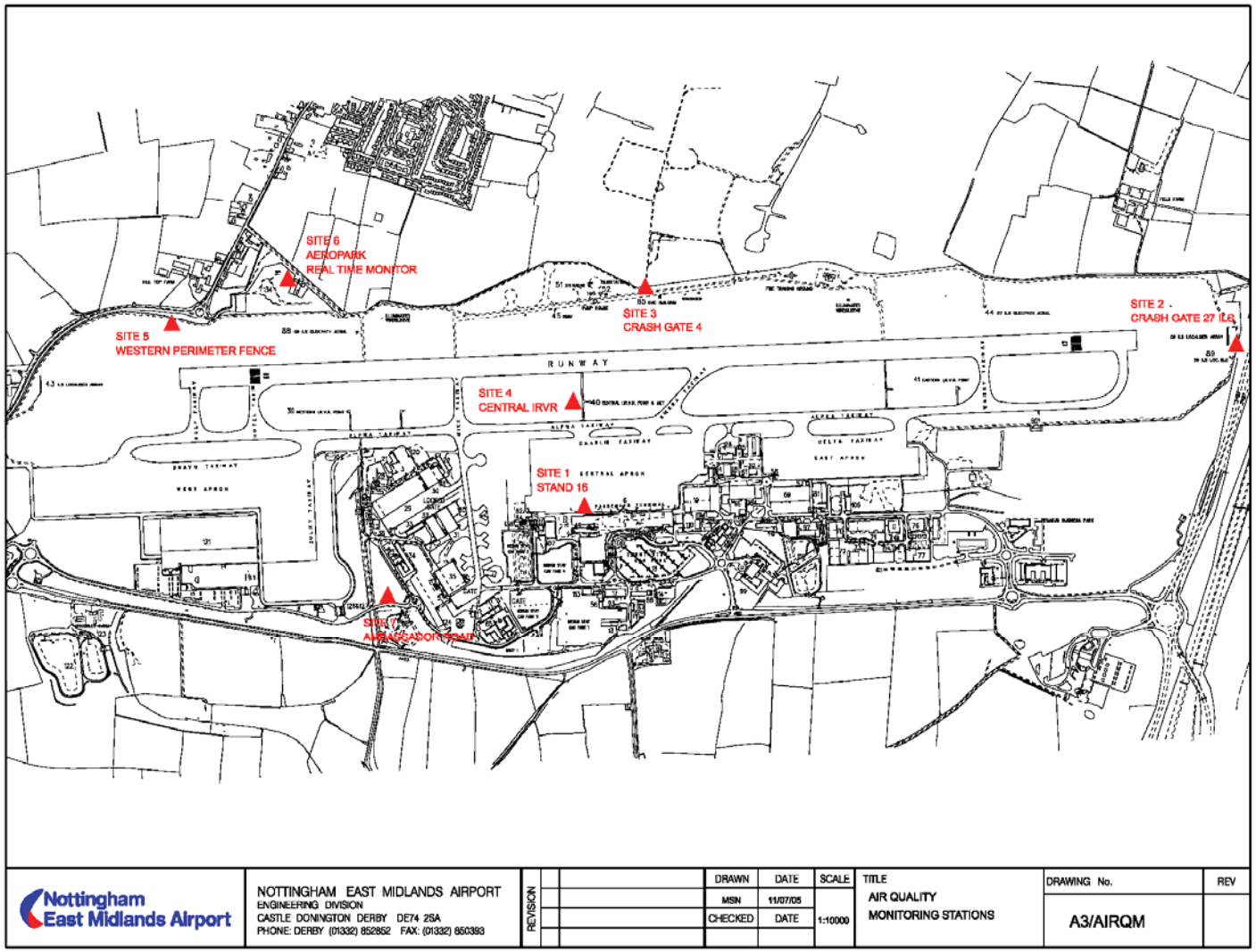

Figure 12.4 NO_2 Monitoring Locations at Nottingham East Midlands Airport (NEMA)