Worldwide Engineering, Environmental, Construction, and IT Services



AIR QUALITY FURTHER ASSESSMENT OF BARDON ROAD AQMA, COALVILLE

NORTH WEST LEICESTERSHIRE DISTRICT COUNCIL, COUNCIL OFFICES, COALVILLE

PREPARED FOR NORTH WEST LEICESTERSHIRE DISTRICT COUNCIL

FEBRUARY 2009 Ref. No. 933690 (2)



Synergy House, Unit 1 Calverton Business Park, Hoyle Road, Calverton, Nottingham, UK NG5 7PJ Telephone: +44 (0) 115 967 0505 Facsimile:+44 (0) 115 967 0606 www.cra.co.uk

AIR QUALITY FURTHER ASSESSMENT OF BARDON ROAD AQMA, COALVILLE

NORTH WEST LEICESTERSHIRE DISTRICT COUNCIL COUNCIL OFFICES, COALVILLE

PREPARED FOR NORTH WEST LEICESTERSHIRE DISTRICT COUNCIL

FEBRUARY 2009 REF. NO. 933690 (3) This report is printed on recycled paper.

EXECUTIVE SUMMARY

Conestoga-Rovers & Associates (Europe) Ltd (CRA) were commissioned by North West Leicestershire District Council to conduct an Air Quality Further Assessment of the Coalville Air Quality Management Area. This report represents the findings of the Further Assessment of the Coalville AQMA. The Further Assessment considers the original Detailed Assessment and assesses additional monitoring data to determine whether amendments to the geographical extent of the AQMA are required. A preliminary source apportionment study has been conducted and the improvement in air quality required to meet the Air Quality Objective calculated.

North West Leicestershire District Council monitors nitrogen dioxide (NO₂) concentrations at eight sites within the Coalville AQMA using passive diffusion tubes. Four of the monitoring sites are at roadside locations; Broom and Broomleys at Broom Leys Junction and Bardon and Bardon Road West on Bardon Road. The remaining four diffusion tubes are located on the façade of residential properties on Bardon Road as these locations represent relevant receptor locations as required by the Local Air Quality Management Technical Guidance, LAQM.TG(09), (DEFRA, 2009).

Exceedences of the 40µgm⁻³ annual mean Air Quality Objective were recorded at three of the four roadside monitoring locations; Broom, Broomleys and Bardon Road West in 2008. The annual mean concentration recorded at the fourth roadside monitoring location, Bardon was below the Air Quality Objective at 35.27µgm⁻³. Distance correction calculations were performed to determine the annual mean concentrations at the closest relevant receptor locations; residential properties, for each of the four roadside monitoring locations. The predicted NO₂ concentrations remain above the Air Quality Objective at three of the four monitoring locations; Broom, Broom Leys and Bardon Road West.

Nitrogen dioxide concentrations were monitored at the façade of four residential properties on Bardon Road in 2008. The annual mean NO_2 concentrations recorded at all four monitoring locations were significantly below the 40μ gm⁻³ Air Quality Objective.

The monitored and predicted annual mean NO_2 concentrations at Broom Leys Junction and Bardon Road West support the original AQMA declaration and demonstrate that no changes to the geographical extent of the AQMA at Broom Leys Junction or Bardon Road is required. However, as the annual mean concentrations measured at the façade of residential properties on Bardon Road, which represent relevant receptor locations, were significantly below the $40\mu gm^{-3}$ Air Quality Objective, monitoring should continue at these locations to ensure that an AQMA extending along Bardon Road is still required.

An assessment of the improvement in NO₂ concentrations which would be required within the Coalville AQMA, in order to achieve the 40µgm⁻³ annual mean Air Quality Objective was conducted. The results indicate that at Broomleys junction an improvement of between 3.84µgm⁻³ and 4.31µgm⁻³ in the NO₂ concentration is required, whilst at the Bardon Road West monitoring location an improvement of 8.96µgm⁻³ is required. In order to achieve these reductions the Local Authority will need to implement some far reaching air quality improvement measures.

A preliminary source apportionment assessment has been conducted for the Coalville AQMA to identify the predominant sources that contribute to air quality exceedences, with the aim of separating regional and local background air pollutant concentrations from local sources. The source apportionment assessment determined that over 69% of the NO₂ concentrations monitored within the Coalville AQMA arose from road traffic emissions. The results of the source apportionment assessment indicate that air quality improvement measures should be targeted at road traffic sources.

The findings of the Further Assessment support the original declaration of the AQMA comprising the four residential properties at Broom Leys Junction and the one hundred and seventy two residential properties on Bardon Road. Based on the findings of this Further Assessment the following recommendations are made to North West Leicestershire District Council:

- An Air Quality Action Plan be developed in partnership with Leicestershire County Council detailing a range of options for reducing NO₂ concentrations within the Coalville AQMA with particular attention paid to options which would have a significant impact on road traffic emissions. North West Leicestershire District Council must submit the Coalville AQMA Air Quality Action Plan within twelve months of submission of this Further Assessment to the Department of Environment, Food and Rural Affairs (DEFRA).
- The diffusion tubes located at the roadside at Broom Leys Junction should be relocated to the façade of the closest residential properties to ensure that the NO₂ concentrations are monitored at relevant receptor locations.
- The monitoring of NO₂ concentrations on the façade of residential properties on Bardon Road should continue to determine if any alterations in the geographical extent of the AQMA occurs in the future.

TABLE OF CONTENTS

<u>Page</u>

1.0	INTRODUCTION	1
1.1	DESCRIPTION OF THE DISTRICT	1
1.2	INTRODUCTION TO REVIEW AND ASSESSMENT	1
1.3	AIR QUALITY OBJECTIVES	2
1.4	KEY FINDINGS OF PREVIOUS REVIEW AND ASSESSMENT REPORTS	4
1.5	DEVELOPMENTS SINCE THE DECLARATION OF THE AQMA	5
1.5	5.1 LOCAL DEVELOPMENTS	5
1.5	5.2 NATIONAL DEVELOPMENTS	6
3.0	MONITORING	7
3.1	CURRENT MONITORING LOCATIONS	7
4.0	RESULTS	9
5.0	AIR QUALITY IMPROVEMENTS	12
6.0	SOURCE APPORTIONMENT	13
7.0	DISCUSSION AND RECOMMENDATIONS	15
8.0	REFERENCES	18

1.0 INTRODUCTION

1.1 DESCRIPTION OF THE DISTRICT

North West Leicestershire lies within the East Midlands, between Leicester, Burtonon-Trent, Derby and Nottingham and encompasses 105 square miles. The major urban areas of the district are the towns of Coalville and Ashby-de-la-Zouch, and the large villages of Castle Donington, Kegworth and Ibstock. The M1, M42/A42 between Birmingham and Nottingham and the A50/A511 from Leicester to Burtonon-Trent all run through the district and East Midlands Airport is located north of Castle Donington.

Figure 1: North West Leicestershire District Council Boundaries



1.2 INTRODUCTION TO REVIEW AND ASSESSMENT

The UK Government's Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DEFRA, 2007a) sets out a framework for air quality management, which includes a number of Air Quality Objectives. National and international measures are expected to achieve these objectives in most locations, but where areas of poor air quality remain, air quality management at a local scale has a particularly important role to play. Part IV of the Environment Act 1995 requires local authorities to periodically review and assess the current, and likely future air quality in their areas. The role of this process is to identify areas where it is unlikely that the Air Quality Objectives will be achieved by the due date. These locations must be designated as Air Quality Management Areas (AQMAs) and a subsequent Action Plan developed in order to reduce pollutant emissions in pursuit of the objectives.

Review and Assessment is a long-term, ongoing process, structured as a series of 'rounds'. Local authorities in England, Scotland and Wales have now largely completed two rounds of Review and Assessment, with the third round underway.

Local Air Quality Management Technical Guidance (LAQM.TG(09)) (DEFRA, 2009) sets out a phased approach to the second and third rounds of Review and Assessment. This prescribes an initial Updating and Screening Assessment, which all authorities must undertake. It is based on a checklist to identify any matters that have changed since the first round. In subsequent years all Local Authorities must undertake a Progress Report. New monitoring data is presented within the Progress Report along with details of any significant changes within the Local Authority area which may have an impact on air quality. If either an Updating and Screening Assessment or Progress Report identifies any areas where there is a risk that the objectives may be exceeded, which were not identified in the previous round, then the Local Authority should progress to a Detailed Assessment.

The purpose of the Detailed Assessment is to determine whether an exceedence of an Air Quality Objective is likely and the geographical extent of that exceedence. If the outcome of the Detailed Assessment is that one or more of the Air Quality Objectives is being, or is likely to be exceeded, then an AQMA must be declared. Subsequent to the declaration of an AQMA, a Further Assessment should be carried out to confirm that the AQMA declaration is justified and that the appropriate area has been declared; to ascertain the sources contributing to the exceedence; and to calculate the magnitude of reduction in emissions required to achieve the objective. This information can be used to inform an Air Quality Action Plan, which will identify measures to improve local air quality.

1.3 <u>AIR QUALITY OBJECTIVES</u>

The Government's Air Quality Strategy (DEFRA, 2007a) provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry,

transport and local government, can contribute to achieving the Air Quality Objectives. The objectives are prescribed within The Air Quality (England) Regulations 2000 (HMSO, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (HMSO, 2002). This latter publication sets more stringent objectives for benzene and carbon monoxide (CO). The 'standards' are set as concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date.

Table 1 summarises the objectives which are relevant to this report; those relating to nitrogen dioxide, (NO₂). Short-term exposure to high concentrations of NO₂ may cause inflammation of respiratory airways. Long-term exposure may affect lung function and enhance responses to allergens in sensitised individuals. The young, old and asthmatics will be particularly at risk.

The Air Quality Objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants). For annual mean objectives, relevant exposure is limited to residential properties, schools and hospitals. The 1-hour objective applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1 hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

Measurements across the United Kingdom (UK) have shown that the 1-hour NO₂ Air Quality Objective is unlikely to be exceeded unless the annual mean NO₂ concentration is greater than 60μ gm⁻³ (Laxen & Marner, 2003). Thus, exceedences of 60μ gm⁻³, as an annual mean NO₂ concentration, may be used as an indicator of potential exceedences of the 1-hour mean NO₂ objective.

The European Union has also set limit values for NO_2 . Achievement of these values is a national obligation rather than a local one. The limit values for NO_2 are the same levels as the UK objective, but are to be achieved by 2010.

Status	Time Period	Objective / Value	To be Achieved by ¹
Statutory UK	1-hour mean	200 µgm ⁻³ not to be exceeded more than 18 times a year	2005
Objective	Annual mean	40 μgm ⁻³	2005
EU Limit	1-hour mean	200 μgm ⁻³ not to be exceeded more than 18 times a year	2010
Value	Annual mean	40 μgm ⁻³	2010

Table 1: Air Quality Objectives for Nitrogen Dioxide

Note 1 The achievement dates for the UK objectives are the end of the specified year; achievement dates for the EU limit values are the start of the specified year.

1.4 KEY FINDINGS OF PREVIOUS REVIEW AND ASSESSMENT REPORTS

Two AQMAs were declared by North West Leicestershire District Council in 2003 due to exceedences of the annual mean NO₂ Air Quality Objective (40µgm⁻³) from road traffic emissions at residential properties within 10 metres of the A6 in Kegworth and Molehill House Farm, situated next to the M1 near Kegworth. The Updating and Screening Assessment conducted in 2006 (NWLDC, 2006) identified two areas within North West Leicestershire; High Street/Bondgate in Castle Donington and Bardon Road to Broom Leys Junction in Coalville as areas in which the NO₂ concentrations exceeded the annual mean Air Quality Objective due to road traffic emissions.

The Detailed Assessment conducted for Broom Leys Junction and Bardon Road, Coalville identified exceedences of the annual mean Objective for NO₂ concentrations between 2005 and 2007. Atmospheric dispersion modelling was also conducted and the results demonstrated that exceedences of the 40µgm⁻³ Air Quality Objective were likely at properties on the northern side of Bardon Road and at Broom Leys Junction. The modelling identified that properties on the southern side of Bardon Road were unlikely to suffer exceedences, possibly due to the prevailing wind direction.

The Detailed Assessment recommended that two areas within Coalville should be declared as an AQMA; properties 21, 27, 29 and 44 on Broom Leys Road and properties on the northern site of Bardon Road, from the junction with Stephenson Way to the junction with Bardon Close.

The assessment noted that these recommendations were based on the 36µgm⁻³ contour line which is in-line with the precautionary approach detailed within LAQM.TG(09), (DEFRA, 2009). In January 2008 the District Council declared the Coalville AQMA encompassing one hundred and seventy two residential properties

on both sides of Bardon Road and four residential properties at Broom Leys Junction. The boundaries of the Coalville AQMA are presented in Figure 2.



Figure 2 Coalville Air Quality Management Area (Bardon Road and Broom Leys Junction)

Conestoga-Rovers & Associates (Europe) Ltd (CRA) were commissioned by North West Leicestershire District Council to conduct a Further Assessment of the Coalville AQMA. This report represents the findings of the Further Assessment of the Coalville AQMA. The Further Assessment considers the original Detailed Assessment and assesses additional monitoring data to determine whether amendments to the geographical extent of the AQMA are required. A preliminary source apportionment study has been conducted and the improvement in air quality required to meet the Air Quality Objective calculated.

1.5 DEVELOPMENTS SINCE THE DECLARATION OF THE AQMA

1.5.1 LOCAL DEVELOPMENTS

Since the declaration of the Coalville AQMA in 2007 there have been no substantial changes to the road layout on Bardon Road or at Broom Leys Junction which would have an impact on NO₂ concentrations. However, automated speed limit signs have

been erected on Bardon Road, both east and west bound to ensure vehicle speeds are below the 30 miles per hour (mph) limit.

Improvements at the Broom Leys Junction are scheduled to be undertaken in 2009 under the Leicestershire County Council's Transport Schemes Development Capital Programme. The improvements are detailed within the Local Transport Plan (LTP) 2006-2010 (LCC, 2006) and include plans to install separate signalled right turn movements from Broom Leys Road onto the A511 (Stephenson Way) and from A511 to Broom Leys Road. Right and left turn manoeuvres are to be prohibited from A511 to Broom Leys Road (Coalville town side) and from A511 (from Bardon Road direction) to Broom Leys Road respectively. These improvements are designed both to reduce accidents at the junction and to improve traffic flow which in turn may lead to an improvement in air quality in the vicinity of the junction.

1.5.2 NATIONAL DEVELOPMENTS

The technical guidance, LAQM.TG has been revised by the Department of Environment, Food and Rural Affairs (DEFRA) with a draft being issued for public consultation in August 2008. The finalised document, LAQM.TG(09) issued in February 2009 (DEFRA, 2009) supersedes all previous technical guidance.

3.0 <u>MONITORING</u>

Nitrogen dioxide is produced during any combustion process; however, the main source is road transport, particularly in congested urban centres and motorways.

Nitrogen dioxide concentrations are monitored within North West Leicestershire using diffusion tubes. The monitoring locations within the Local Authority area are presented in Appendix A. Diffusion tubes are passive samplers which absorb the pollutant from the surrounding air without the need for a power supply. They consist of small plastic tubes with an open and a closed end. The closed end contains an absorbent for NO_2 and after one month the tubes are closed and returned to a laboratory for analysis. North West Leicestershire District Council use Gradko laboratories for analysis of diffusion tubes using 50% Tri-ethanol amine (TEA) in acetone.

Diffusion tubes are inexpensive and are able to provide good spatial coverage, however they should ideally, be supported by more expensive automatic techniques, as laboratory analysis will introduce different levels of bias depending on the laboratory used. The technical guidance LAQM.TG(09) therefore recommends that a 'local bias adjustment factor' is used for diffusion tube measurements. This should be determined by undertaking a co-location study, with a diffusion tube and a real time (reference method) analyser monitoring at the same location. The factor difference can then be applied to all diffusion monitoring undertaken in the district. North West Leicestershire District Council co-located two NO₂ diffusion tubes with a real-time NO₂ chemiluminescence analyser to determine a local bias adjustment factor. This local bias adjustment factor; calculated as 1.04 is applied to all NO₂ diffusion tube results reported by North West Leicestershire District Council.

3.1 CURRENT MONITORING LOCATIONS

There are currently eight NO₂ diffusion tubes located in the Coalville AQMA; two tubes are located at Broom Leys Junction and the remaining six tubes are located at various sites on Bardon Road. Monitoring data is available from 2004 for the diffusion tubes located on Bardon Road; Bardon and Bardon Road West and the two diffusion tubes locations on Broom Leys Junction; Broom and Broom Leys. All four of these diffusion tubes are located at roadside locations. Three additional diffusion tubes were installed after the Updating and Screening Assessment undertaken by North West Leicestershire District Council in 2006 (NWLDC, 2006). These three diffusion tubes were located on the façade of residential properties at 155, 252 and 66 Bardon Road to enable NO₂ concentrations at relevant receptor locations to be determined. These diffusion tubes were relocated in January 2008 to 62, 87 and 134

Bardon Road and an additional diffusion tube was located on the façade of 181 Bardon Road. The diffusion tube monitoring locations are detailed in Table 2 and presented in Appendix A.

4.0 <u>RESULTS</u>

The results of the NO₂ diffusion tube monitoring conducted within the Coalville AQMA by North West Leicestershire District Council are presented in Table 2. The local bias adjustment factor of 1.04 has been applied to all NO₂ concentrations. Using the year adjustment factors detailed within the technical guidance, LAQM.TG(09), (DEFRA, 2009) the annual mean results from each monitoring location have been projected forward for 2009 and 2010.

Monitoring	Pocontor Tuno	Annual Mean NO ₂ Concentration (µgm ⁻³)			
Location	Receptor Type	2007	2008	2009	2010
Broom (Broom Leys Junction)	Roadside	45.22	44.31	42.76 ¹	41.12 ²
Broom Leys	Roadside	39.16	43.84	42.31 ¹	40.68 ²
Bardon (Bardon Road)	Roadside	36.88	35.27	34.04 ¹	32.73 ²
Bardon Road West	Roadside	50.83	48.96	47.25 ¹	45.43 ²
62 Bardon Road ³	Residential Façade		25.77	24.87 ¹	23.91 ²
87 Bardon Road ³	Residential Façade		26.34	25.42 ¹	24.44 ²
134 Bardon Road ³ Residential Façade			27.32	26.36 ¹	25.35 ²
181 Bardon Road ³	Residential Façade		30.97	29.89 ¹	28.74 ²

Table 2: NO₂ diffusion tube monitoring results

Note 1 2009 concentrations predicted from 2008 concentrations using year adjustment factor of 0.965 (DEFRA, 2009)

Note 2 2010 concentrations predicted from 2008 concentrations using year adjustment factor of 0.928 (DEFRA, 2009)

Note ³ Monitoring location commissioned in January 2008

Roadside monitoring locations are not considered to represent sites of relevant exposure; which for the annual mean Air Quality Objective are residential properties, schools and hospitals (DEFRA, 2009). To estimate annual mean NO₂ concentrations at relevant receptors; the façade of residential properties, distance correction calculations detailed within the technical guidance (DEFRA, 2009) have been performed on the concentrations monitored at roadside locations; Broom, Broom Leys, Bardon and Bardon Road West. The predicted relevant receptor NO₂ concentrations are presented in Table 3.

Monitoring Location	Measured 2008 Annual Mean NO ₂ Conc. (µgm ⁻³)	Background NO2 Conc. (μgm ⁻³) ¹	Distance from Kerb to Monitoring Location (metres)	Distance from Kerb to Nearest Residential Façade (metres)	Predicted Annual Mean NO2 Conc. (μgm ⁻³) at Nearest Relevant Receptor Location
Broom (Broom Leys Junction)	44.31	16.24	4	6	41.13
Broom Leys (Broom Leys Junction)	43.84	16.24	5	7	41.07
Bardon (Bardon Road)	35.27	16.24	2	10	28.10
Bardon Road West	48.96	16.24	5	10	42.19

 Table 3: Distance Corrected Annual Mean NO2 Concentrations at Relevant

 Receptor Locations

^{Note 1} Background NO₂ concentration determined from 2005 background maps predicted forward to 2008 using year adjustment factor of 0.969 (DEFRA, 2009)

The Broom diffusion tube located at Broom Leys Junction recorded an annual mean NO₂ concentration in 2007 above the 40µgm⁻³ Air Quality Objective at 45.22µgm⁻³, whilst the NO₂ concentration recorded at the second monitoring location, Broom Leys was just below the objective at 39.16µgm⁻³. The results from the Broom diffusion tube location show a decrease in annual mean NO₂ concentration in 2008, reducing to 44.31µgm⁻³ whilst the annual mean NO₂ concentration increased by 4.68µgm⁻³ to 43.84µgm⁻³ at the Broomleys monitoring location.

The 2009 and 2010 annual mean NO_2 concentrations have been predicted for both Broom Leys Junction monitoring locations, using the 2008 monitored results and year adjustment factors detailed within the technical guidance, LAQM.TG(09), (DEFRA, 2009). The annual mean NO_2 concentrations are predicted to decrease at both sites from those recorded in 2008; however the annual mean NO_2 concentration will remain above the 40µgm⁻³ annual mean Air Quality Objective at both monitoring locations in 2009 and 2010.

The predicted annual mean NO_2 concentrations at the façade of the closest residential properties to the Broom Leys monitoring locations have been calculated to determine the concentration at relevant receptors using the distance correction formula detailed within the technical guidance, (DEFRA, 2009). The predicted annual mean NO_2 concentration at the closest residential properties to the Broom and Broom Leys diffusion tube monitoring locations remain above the 40µgm⁻³ Air Quality Objective; 41.13µgm⁻³ and 41.07µgm⁻³ respectively.

The results of the 2008 annual mean concentrations recorded at the roadside monitoring locations at Broom Leys Junction and the predicted concentrations at the closest residential properties demonstrate that the declaration of the AQMA in 2008 was justified.

The results from monitoring conducted at the roadside using diffusion tubes located at two sites on Bardon Road; Bardon and Bardon Road West recorded annual mean NO₂ concentrations in 2007 of 36.88µgm⁻³ and 50.83µgm⁻³ respectively. The annual mean concentration recorded at the Bardon Road West monitoring location is significantly above the 40µgm⁻³ annual mean Air Quality Objective for NO₂. The 2008 annual mean NO₂ concentrations were lower than those monitored in 2007 at both locations, however the 40µgm⁻³ Air Quality Objective was still exceeded at the Bardon Road West monitoring location. The annual mean Air Quality Objective is predicted only to be exceeded at the Bardon Road West monitoring location in 2009 and 2010; 47.25µgm⁻³ and 45.35µgm⁻³ respectively.

The predicted annual mean NO₂ concentrations at the façade of the closest residential properties to the Bardon and Bardon Road West monitoring locations has been calculated to determine the concentration at a relevant receptor using the distance correction formula detailed within the technical guidance, (DEFRA, 2009). The façade concentrations at Bardon and Bardon Road West are predicted to be 28.10µgm⁻³ and 42.19µgm⁻³ respectively. The annual mean 40µgm⁻³ Air Quality Objective is therefore only predicted to be breached at the Bardon Road West monitoring location.

The NO₂ results recorded at the four residential façade locations, commissioned in January 2008; 62, 87, 134 and 181 Bardon Road, demonstrate that in 2008 the annual mean NO₂ concentrations were significantly below the 40µgm⁻³ Air Quality Objective; 25.77µgm⁻³, 26.34µgm⁻³, 27.32µgm⁻³ and 30.97µgm⁻³ respectively. Using these 2008 monitoring results and the year adjustment factors detailed within the technical guidance (DEFRA, 2009) the annual mean concentrations have been predicted for 2009 and 2010. The annual mean NO₂ concentrations are predicted to decrease in 2009 and again in 2010 and will remain significantly below the annual mean Air Quality Objective at the façade of residential properties on Bardon Road.

The results of the 2008 annual mean concentrations recorded at monitoring locations on the façade of residential properties on Bardon Road demonstrate that the annual mean Air Quality Objective is not being exceeded. However, the roadside monitoring location, Bardon Road West recorded an annual mean NO₂ concentration in 2008 significantly above the 40µgm⁻³ Air Quality Objective. The distance correction methodology detailed with the technical guidance (DEFRA, 2009) was applied to the Bardon Road West data with the predicted façade concentration at the closest relevant receptor location, remaining above the Air Quality Objective. The monitored and predicted annual mean NO₂ concentrations demonstrate that the declaration of the AQMA in 2007 was justified and that no alterations to the boundaries of the AQMA are required.

5.0 AIR QUALITY IMPROVEMENTS

The degree of improvement required in order for the annual mean NO_2 Air Quality Objective to be achieved can be defined as the difference between the monitored annual mean concentrations and the objective level of $40\mu gm^{-3}$. The reduction in NO_2 concentrations required at each monitoring location in order to achieve the annual mean Air Quality Objective within the Coalville AQMA is presented in Table 4.

Table 4: Reduction in Annual Mean NO₂ Concentrations Required to Achieve Air Quality Objective at Monitoring Locations within the Coalville AQMA

Monitoring Location	2008 Annual Mean NO ₂ Concentration (μgm ⁻³)	Required Reduction in NO ₂ Concentration (µgm ⁻³) to Achieve 40µgm ⁻³ Annual Mean Air Quality Objective
Broom (Broom Leys)	44.31	4.31
Broom Leys	43.84	3.84
Bardon (Bardon Road)	35.27	-
Bardon Road West	48.96	8.96
62 Bardon Road	25.77	-
87 Bardon Road	26.34	-
134 Bardon Road	27.32	-
181 Bardon Road	30.97	-

To achieve the 40μ gm⁻³ annual mean NO₂ Air Quality Objective at the Broom Leys monitoring locations an improvement of between 3.84μ gm⁻³ and 4.31μ gm⁻³ is required. Only one monitoring location on Bardon Road recorded concentrations above the 40μ gm⁻³ annual mean Air Quality Objective in 2008; Bardon Road West. In order to achieve the annual mean Air Quality Objective at this monitoring location an improvement of 8.96μ gm⁻³ NO₂ is needed.

6.0 SOURCE APPORTIONMENT

A source apportionment assessment is used to identify the predominant sources that contribute to air quality exceedences. The aim is to separate regional and local background air pollutant concentrations from those emitted by local sources. This information can then be used to target the action plan to the principle sources.

Source apportionment requires the use of regional and local background data along with annual mean NO₂ concentrations recorded at relevant receptors. In this source apportionment assessment 2007 data has been utilised as more recent 2008 data was unavailable.

Regional background concentrations are monitoring by the Automatic Urban and Rural Network (AURN), operated by Bureau Veritas. The Lady Bower monitoring station located in the High Peak, Peak District, approximately 60km north-west of Coalville; concentrations monitored by this station have been used as the regional background concentrations. The mean annual NO₂ concentration for 2007 was 8.40µgm⁻³ and the mean annual NO_x concentration for the same year was 11.65µgm⁻³.

The local background NO₂ concentrations for Broom Leys Junction and Bardon Road were estimated using background air pollution maps at 1km x 1km grid resolution published on the UK National Air Quality Archive website (www.airquality.co.uk/archive/laqm/tools.php?tools=background). The estimated background annual mean concentration for grid references 444500:313500 and 443500:314500 were determined from the published 2005 map. The year adjustment factors provided in the LAQM.TG (03) (DEFRA, 2003) were utilised to project this concentration forward to 2007, giving a NO₂ concentration of 22.14µgm⁻³.

The highest 2007 annual mean NO₂ concentration monitored within the Coalville AQMA was recorded at the Bardon Road West monitoring location. However, as this is a roadside location it does not represent a relevant receptor location as prescribed within the technical guidance (DEFRA, 2009). To convert the roadside concentration to a relevant receptor location concentration, a distance correction calculation, as described in LAQM.TG(09) was performed. The annual mean concentration was predicted to be 43.68µgm⁻³.

The results of traffic monitoring undertaken by Leicestershire County Council at locations within the Coalville AQMA have been used to determine the proportion of cars, Light Diesel Vehicles (LDVs), Heavy Goods Vehicles (HGVs) and buses using the road. This data was collected between 2001 and 2004 at two locations; Broom Leys Road at the junction with Greenhill Road and Bardon Road/Shaw Lane/Beveridge Lane. The results for the traffic monitoring demonstrate that 87.9% of the traffic using Bardon Road and Broom Leys Junction were cars and LDVs and the remaining 12.1% were HGVs and buses. These values are comparable with the modelled proportions used in the Detailed Assessment conducted in 2007 (NWLDC, 2007).

Preliminary source apportionment has been conducted using the methodology described within the technical guidance, LAQM.TG(09). The results of the source apportionment assessment are presented in Table 5.

Source	NO ₂ Concentration (µgm ⁻³)	Contribution to NO ₂ Concentrations in AQMA (%)
Regional Background	8.40	19.2
Local Background	4.80	11.0
Cars and LDVs	26.79	61.3
HGVs and Buses	3.69	8.5
Total	43.68	100

 Table 5: Results of Preliminary Source Apportionment Assessment

The preliminary source apportionment assessment demonstrates that the significant proportion (69.8%) of NO₂ concentrations within the Coalville AQMA arise from road traffic emissions. Emissions from cars and LDVs accounted for 61.3% of the NO₂ concentrations monitored on Bardon Road; whilst HGVs and buses accounted for 8.5%.

7.0 DISCUSSION AND RECOMMENDATIONS

The report presents the findings of the Air Quality Further Assessment which has been conducted following the declaration of the Coalville AQMA by North West Leicestershire District Council in December 2007. The AQMA was declared by the Local Authority as a result of monitored and predicted exceedences of the 40µgm⁻³ annual mean Air Quality Objective due to road traffic emissions.

At Broom Leys Junction, the results of NO₂ diffusion tube monitoring conducted in 2008 have demonstrated exceedences of the annual mean 40µgm⁻³ Air Quality Objective at both roadside monitoring locations, Broom and Broom Leys; 44.31µgm⁻³ and 43.84µgm⁻³ respectively. Distance correction calculations were applied to the annual mean NO₂ concentrations recorded at the roadside monitoring sites to determine the concentrations at relevant receptor locations; the closest residential properties. The predicted façade annual mean NO₂ concentrations were 41.13µgm⁻³ and 41.07µgm⁻³ at the Broom and Broom Leys monitoring locations respectively; exceeding the 40µgm⁻³ annual mean Air Quality Objective.

Using year adjustment factors the annual mean NO_2 concentration at both Broomleys monitoring locations are predicted to remain above the 40μ gm⁻³ Air Quality Objective in both 2009 and 2010; based on the monitored 2008 results. The monitored and predicted annual mean NO_2 concentrations at Broom Leys Junction therefore support the original AQMA declaration and demonstrate that no changes to the geographical extent of the AQMA at Broom Leys Junction is required.

The results of diffusion tube monitoring conducted in 2008 at four façade locations on Bardon Road have demonstrated no exceedence of the annual mean NO_2 Air Quality Objective. Using the year adjustment factors detailed within the technical guidance (DEFRA, 2009) the annual mean NO_2 concentrations are predicted to decrease in 2009 and 2010 and will remain below the $40\mu gm^{-3}$ Air Quality Objective.

The results of diffusion tube monitoring conducted at two roadside locations on Bardon Road, have demonstrated an exceedence of the annual mean Air Quality Objective at one monitoring location, Bardon Road West; 48.96µgm⁻³, whilst the NO₂ concentration at the second roadside location, Bardon is below the Objective; 35.27µgm⁻³. When distance correction calculations are applied to the roadside monitored data the predicted annual mean concentrations at the façade of the closest residential properties were below the Air Quality Objective at Bardon Road; 28.10µgm⁻³ but above the Objective at Bardon Road West; 42.19µgm⁻³.

The monitored and predicted annual mean NO_2 concentrations at Bardon Road West support the original AQMA declaration and demonstrate that no changes to the

geographical extent of the AQMA on Bardon Road is required. However, as the annual mean concentrations measured at the façade of residential properties on Bardon Road, which represent relevant receptor locations, were significantly below the 40μ gm⁻³ Air Quality Objective, monitoring should continue at these locations.

An assessment of the improvement in NO₂ concentrations which would be required within the Coalville AQMA, in order to achieve the 40µgm⁻³ annual mean Air Quality Objective was conducted. An improvement of between 3.84µgm⁻³ and 4.31µgm⁻³ in the NO₂ concentration is required at Broom Leys Junction, whilst at the Bardon Road West monitoring location an improvement of 8.96µgm⁻³ would be necessary in order to achieve the Air Quality Objective. In order to achieve these reductions the Local Authority will need to implement some far reaching air quality improvement measures.

A preliminary source apportionment assessment has been conducted for the Coalville AQMA to identify the predominant sources that contribute to air quality exceedences, with the aim of separating regional and local background air pollutant concentrations from local sources. The source apportionment assessment determined that over 69% of the NO₂ concentrations monitored within the Coalville AQMA arose from road traffic emissions; 61.3% from cars and LDVs and 8.5% from buses and HGVs. The results of the source apportionment assessment indicate that air quality improvement measures should be targeted at road traffic sources.

The findings of the Further Assessment support the original declaration of the AQMA comprising the four residential properties at Broom Leys Junction and the one hundred and seventy two residential properties on Bardon Road. Based on the findings of this Further Assessment the following recommendations are made to North West Leicestershire District Council:

- An Air Quality Action Plan be developed in partnership with Leicestershire County Council, detailing a range of options for reducing NO₂ concentrations within the Coalville AQMA with particular attention paid to options which would have a significant impact on road traffic emissions. North West Leicestershire District Council must submit the Coalville AQMA Air Quality Action Plan within twelve months following the submission of this Further Assessment to DEFRA.
- The diffusion tubes located at the roadside at Broom Leys Junction should be relocated to the façade of the closest residential properties to ensure that the NO₂ concentrations are monitored at relevant receptor locations.

• The monitoring of NO₂ concentrations on the façade of residential properties on Bardon Road should continue to determine if any alterations in the geographical extent of the AQMA occurs in the future.

8.0 <u>REFERENCES</u>

CRA (2008) *Air Quality Progress Report 933628.* Conestoga-Rovers & Associates (Europe) Ltd prepared on behalf of North West Leicestershire District Council, April 2006.

DEFRA (2007a) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.* Department for Food and Rural Affairs July 2007. Cmd Paper No. 7169.

DEFRA (2007b) *National Atmospheric Emissions Inventory.* <u>www.naei.org.uk</u> Department for Food and Rural Affairs

DEFRA (2007c) *Air Quality Archive* via the internet <u>www.airquality.co.uk</u> Department for Food and Rural Affairs

DEFRA (2009) *Local Air Quality Management Technical Guidance* (LAQM.TG(09)). Department for Food and Rural Affairs

DfT (2008) Annual Average Daily Traffic Flows. Department for Transport www.dft.gov.uk/matrix

Highways Agency (2007) *Environmental Assessment Techniques - Design Manual for Roads and Bridges.* Highways Agency. Volume 11, Section 3.

HMSO (2000) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.* CM 4548, Her Majesty's Stationary Office Publication

HMSO (2002) *The Air Quality (England) (Amendment) Regulations 2002* Statutory Instrument 3043. ISBN 0 11044220 2, Her Majesty's Stationary Office Publication

Laxen & Marner (2003) *Analysis of the Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites.* Available from DEFRA, 2007b.

LCC (2006) Leicestershire Local Transport Plan 2006-2010. Leicestershire County Council. www.leics.gov.uk/ltp

NWLDC (2006) *Air Quality Updating and Screening Assessment.* North West Leicestershire District Council, April 2006.

NWLDC (2007) *Air Quality Detailed Assessment for Coalville and Castle Donington.* North West Leicestershire District Council, April 2007.

UK National Air Quality Archive (2008) *Background Air Quality Pollutant Maps.* <u>www.airquality.co.uk/archive/laqm/tools.php?tools=background</u> APPENDICES

APPENDIX A

DIFFUSION TUBE MONITORING LOCATIONS