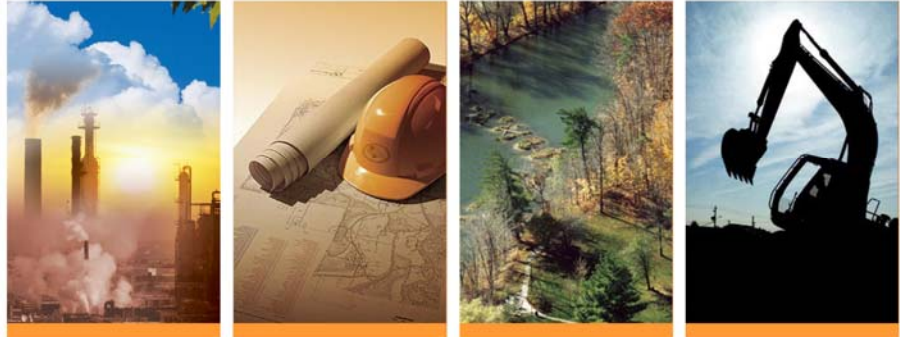


Worldwide Engineering, Environmental, Construction, and IT Services



# **COPT OAK AIR QUALITY DETAILED ASSESSMENT**

**NORTH WEST LEICESTERSHIRE DISTRICT COUNCIL,  
COUNCIL OFFICES, COALVILLE**

PREPARED FOR NORTH WEST LEICESTERSHIRE  
DISTRICT COUNCIL

**JANUARY 2009**  
Ref. No. 933690 (2)



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## EXECUTIVE SUMMARY

Conestoga-Rovers & Associates (Europe) Ltd (CRA) have been commissioned by North West Leicestershire District Council (NWLDC) to conduct an Air Quality Detailed Assessment of nitrogen dioxide (NO<sub>2</sub>) concentrations arising from road traffic emissions in the village of Copt Oak, Leicestershire. The Detailed Assessment was required following the recommendations of an Air Quality Progress Report conducted in April 2008 (CRA, 2008), which concluded that the annual mean Air Quality Objective for NO<sub>2</sub> of 40µgm<sup>-3</sup> was being exceeded at a number of locations within the village. In total 17 residential properties were evaluated in the Detailed Assessment. These properties are situated within the boundaries of both North West Leicestershire District Council and Hinckley and Bosworth Borough Council. It should be noted that Hinckley and Bosworth Borough Council is not statutorily obliged to act on any of the finding of this Air Quality Detailed Assessment.

The results of NO<sub>2</sub> diffusion tube monitoring has indicated exceedences of the annual mean 40µgm<sup>-3</sup> NO<sub>2</sub> Air Quality Objective at two of the three monitoring locations; Copt Oak Road and Warren Hills Road, in both 2007 and 2008 (January to September). The third monitoring location, commissioned in January 2008 following the recommendations of the Detailed Assessment (NWLDC, 2007) on the façade of End Cottage, Copt Oak recorded an average NO<sub>2</sub> concentration in 2008 of 33.19µgm<sup>-3</sup>.

Air Dispersion Modelling was undertaken using the Breeze Roads model to predict the annual mean concentration of NO<sub>2</sub> for 2008 in Copt Oak due to road traffic emissions. Thirteen specific receptor points were modelled, comprising both current monitoring locations and façades of residential properties; which constitute locations of relevant public exposure. The residential properties modelled as specific receptors were located in both North West Leicestershire District Council and Hinckley and Bosworth Borough Council Authority areas. The annual NO<sub>2</sub> concentrations at the façade of 11 of the 17 residential properties have been modelled; the row of cottages comprising End Cottage, Pepper Cottage, Laycroft bungalow, Laycroft Cottage and Leycroft Cottage where modelled as two receptor points (End Cottage and Leycroft Cottage) and the four dwellings comprising Corner Farm were modelled as a single receptor location (Corner Farm). Due to their proximity, the predicted NO<sub>2</sub> concentrations at the façade of those properties not specifically modelled will be identical to those modelled receptor locations.

The model results predict that the annual mean NO<sub>2</sub> 40µgm<sup>-3</sup> Air Quality Objective will be exceeded in 2008 at 13 of the residential properties in Copt Oak. Ten of these properties are located in North West Leicestershire and four in Hinckley and

Bosworth. The predicted 2008 annual mean NO<sub>2</sub> concentration at the façades of the remaining four properties (No.'s 1 - 4 Whitwick Road); which are situated within Hinckley and Bosworth Borough Council's boundaries are not expected to exceed the 40µgm<sup>-3</sup> objective in 2008. However, the annual mean NO<sub>2</sub> concentrations in 2008 at these properties is predicted to be greater than 36µgm<sup>-3</sup> which is within one standard deviation (4µgm<sup>-3</sup>) of the 40µgm<sup>-3</sup> Air Quality Objective. DEFRA Technical Guidance (LAQM.TG(03)) (DEFRA, 2003) suggests that to allow for modelling uncertainty exceedences of 36µgm<sup>-3</sup> be used to define any AQMAs. The European Union and UK Government support this precautionary approach (DEFRA, 2003).

The results of NO<sub>2</sub> monitoring undertaken and air dispersion modelling at specific receptor locations indicate that North West Leicestershire District Council should declare an Air Quality Management Area (AQMA) in compliance with the Council's obligations under Part IV of the Environment Act 1995 due to predicted exceedences of the 40µgm<sup>-3</sup> annual mean Air Quality Objective due to road traffic emissions. The proposed AQMA should encompass the ten residential properties which are situated within North West Leicestershire District Council's boundaries; the Old Vicarage, End Cottage, Peppers Cottage, Laycroft Bungalow, Laycroft Cottage, Leycroft Cottage and the 4 properties which comprise Corner Farm.

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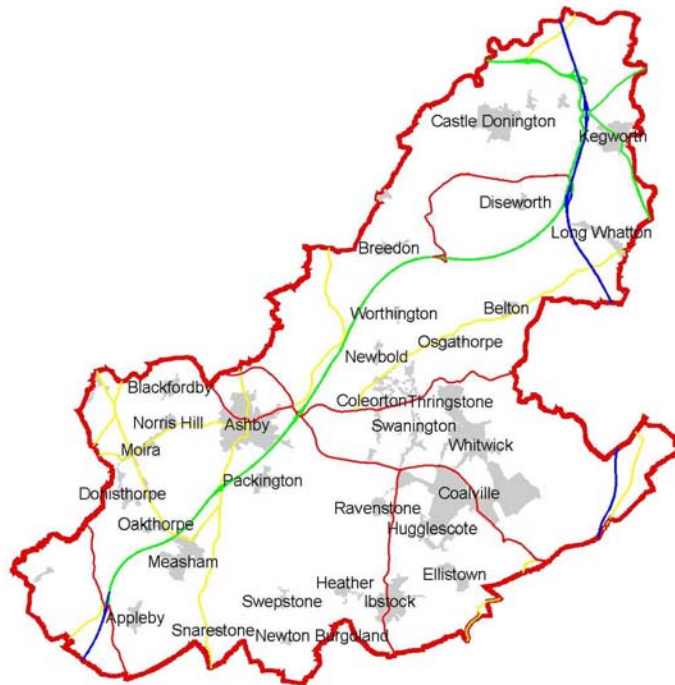
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## 1.0 INTRODUCTION

### 1.1 DESCRIPTION OF THE DISTRICT

North West Leicestershire lies within the East Midlands, between Leicester, Burton-on-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 Burton-on-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(03)) (DEFRA, 2003) 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 Air Quality Management Area (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.

Conestoga-Rovers & Associates (Europe) Ltd (CRA) have been commissioned by North West Leicestershire District Council (NWLDC) to conduct an Air Quality Detailed Assessment of nitrogen dioxide (NO<sub>2</sub>) concentrations arising from road traffic emissions in the village of Copt Oak, Leicestershire. The Detailed Assessment was required following the recommendations of an Air Quality Progress Report conducted in April 2008 (CRA, 2008), which concluded that the annual mean Air Quality Objective for NO<sub>2</sub> of 40µgm<sup>-3</sup> was being exceeded at a number of locations within the village. In total 17 residential properties were evaluated in the Detailed Assessment. These properties are situated within the boundaries of both North West Leicestershire District Council and Hinckley and Bosworth Borough Council.

### 1.3 AIR QUALITY OBJECTIVES

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 NO<sub>2</sub>. Short-term exposure to high concentrations of NO<sub>2</sub> 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 NO<sub>2</sub> objective is unlikely to be exceeded unless the annual mean NO<sub>2</sub> concentration is greater than 60µgm<sup>-3</sup> (Laxen & Marner, 2003). Thus, exceedences of 60µgm<sup>-3</sup>, as an annual mean NO<sub>2</sub> concentration, may be used as an indicator of potential exceedences of the 1-hour mean NO<sub>2</sub> objective.

The European Union has also set limit values for NO<sub>2</sub>. Achievement of these values is a national obligation rather than a local one. The limit values for NO<sub>2</sub> are the same levels as the UK objective, but are to be achieved by 2010.

**Table 1: Air Quality Objectives for NO<sub>2</sub>**

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

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 in the annual mean NO<sub>2</sub> Air Quality Objective (40µgm<sup>-3</sup>) 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 NO<sub>2</sub> concentrations exceeded the annual mean Air Quality Objective due to road traffic emissions. The Detailed Assessments conducted in both Castle Donington and Coalville in 2007 (NWLDC, 2007) concluded that AQMAs should be declared in both areas. The AQMAs were formally declared in December 2007.

The most recent Progress Report, conducted in April 2008 (CRA, 2008) identified two further locations; residential properties surrounding East Midlands Airport and the village of Copt Oak, where Detailed Assessments of NO<sub>2</sub> concentrations should be conducted.

This report represents the findings of the Detailed Assessment undertaken for the village of Copt Oak which lies to the east of Coalville adjacent to the southbound carriageway of the M1. The village is situated on the boundary of North West Leicestershire District Council and Hinckley and Bosworth Borough Council. A location plan of Copt Oak including administrative boundaries is presented in Figure 2, Appendix A.

The impact of road traffic emissions on 17 residential properties which form the village of Copt Oak have been assessed as part of this study. Of these 17 properties, the following lie within the boundaries of North West Leicestershire District Council:

- The Old Vicarage
- End Cottage
- Peppers Cottage
- Laycroft Bungalow
- Laycroft Cottage
- Leycroft Cottage
- 4 properties which comprise Corner Farm

The remaining 7 properties are situated within the boundaries of Hinckley and Bosworth Borough Council:

- The Lodge
- The Old School House
- Property on the corner of Copt Oak Road and Whitwick Road
- 1 Whitwick Road
- 2 Whitwick Road
- 3 Whitwick Road
- 4 Whitwick Road

For completeness the impact of road traffic emissions at all 17 residential properties have been evaluated within this study. It should be noted however, that Hinckley and Bosworth Borough Council is not statutorily obliged to act on any of the findings of this Air Quality Detailed Assessment.

## 2.0 MONITORING

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

Monitoring at Copt Oak is conducted using NO<sub>2</sub> diffusion tubes. These are small plastic tubes with one open end that passively absorb NO<sub>2</sub>. 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 Department of Food and Rural Affairs (DEFRA) Technical Guidance LAQM.TG(03) 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 NO<sub>2</sub> diffusion tubes with a real time NO<sub>2</sub> chemiluminescence analyser to determine a local bias adjustment factor. This local bias adjustment factor; calculated as 1.04 is applied to all NO<sub>2</sub> diffusion tube results reported by North West Leicestershire District Council.

### 2.1 CURRENT MONITORING LOCATIONS

There are currently two NO<sub>2</sub> diffusion tubes located in Copt Oak which are monitored by the District Council. The first is located on a road sign on the westbound side of Warren Hills Road approximately 50 metres from the bridge over the M1. Figure 3, Appendix B illustrates the location of this diffusion tube which is referred to as Copt Oak 21. The second diffusion tube commissioned in January 2008 is located on the façade of End Cottage Copt Oak, Figure 4 Appendix B. An additional NO<sub>2</sub> diffusion tube is situated alongside Copt Oak Road in the village of Charley, north east of Copt Oak. Results from these tubes are supported by data supplied by ARUP on behalf of the Highways Agency. Two diffusion tubes are co-located below a road sign on a lamp post on Copt Oak Road; Figure 5 Appendix B and are part of the monitoring network related to the M1 widening scheme.

### 3.0 MONITORING RESULTS

The results of NO<sub>2</sub> diffusion tube monitoring conducted in Copt Oak, by both North West Leicestershire District Council and ARUP are presented in Table 2. The local bias adjustment factor of 1.04 has been applied to all NO<sub>2</sub> concentrations.

**Table 2: NO<sub>2</sub> Diffusion Tube Concentrations (µgm<sup>-3</sup>) at Monitoring Locations in Copt Oak**

Monitoring Period	NO <sub>2</sub> Concentration (µgm <sup>-3</sup> )				
	Copt Oak (21) <sup>1</sup>	End Cottage Copt Oak <sup>1,2</sup>	Charley <sup>1</sup>	Copt Oak Road Tube 1 <sub>3,4</sub>	Copt Oak Road Tube 2 <sub>3,4</sub>
<b>2005 Annual Mean</b>	<b>44.40</b>	-	<b>37.14</b>	-	-
<b>2006 Annual Mean</b>	<b>41.61</b>	-	<b>33.77</b>	<b>39.81</b>	<b>38.63</b>
January 2007	45.30	-	34.52	48.17	45.41
February 2007	47.13	-	36.42	53.87	57.22
March 2007	43.74	-	37.04	46.91	46.97
April 2007	45.42	-	38.11	47.49	44.85
May 2007	44.04	-	36.31	37.31	37.55
June 2007	48.74	-	37.60	46.12	46.29
August 2007	48.64	-	37.97	45.19	45.99
September 2007	48.65	-	38.08	38.66	45.09
October 2007	56.59	-	45.98	50.00	43.96
November 2007	58.37	-	Missing <sup>5</sup>	64.68	63.92
December 2007	35.93	-	35.83	58.19	58.28
<b>2007 Annual Mean</b>	<b>43.55</b>	-	<b>34.35</b>	<b>48.78</b>	<b>48.68</b>
January 2008	39.40	-	31.97	39.50	46.12
February 2008	47.41	39.90	39.07	60.36	44.70
March 2008	39.97	Missing <sup>5</sup>	29.84	50.12	56.32
April 2008	53.95	41.12	41.55	50.59	50.86
May 2008	39.51	22.75	33.05	43.09	44.62
June 2008	Missing <sup>5</sup>	Missing <sup>5</sup>	Missing <sup>5</sup>	43.82	48.69
July 2008	44.76	29.36	33.24	33.36	44.36
August 2008	54.14	35.31	36.70	47.18	39.54
September 2008	44.36	35.30	36.37	47.98	43.71
<b>2008 Average <sup>6</sup></b>	<b>45.43</b>	<b>33.96</b>	<b>35.22</b>	<b>46.22</b>	<b>46.55</b>

Note 1 Diffusion tube monitoring conducted by North West Leicestershire District Council

Note 2 Monitoring commenced at this location in January 2007

Note 3 Diffusion tube monitoring conducted by ARUP on behalf of the Highways Agency

Note 4 Monitoring commenced at this location in January 2006

Note 5 No results recorded due to missing diffusion tubes

Note 6 2008 average NO<sub>2</sub> concentration based on 9 months of data from January to September 2008

The NO<sub>2</sub> concentrations recorded both by the Highways Agency operated diffusion tubes (Copt Oak Road 1 and 2) and the Council operated Copt Oak 21 diffusion tube recorded annual mean concentrations in excess of the 40µgm<sup>-3</sup> Air Quality Objective in 2007; 48.78µgm<sup>-3</sup>, 48.68µgm<sup>-3</sup> and 49.49µgm<sup>-3</sup> respectively. The diffusion tube located to the north of Copt Oak on Copt Oak Road in the village of Charley recorded an annual mean NO<sub>2</sub> concentration of 39.09µgm<sup>-3</sup> in 2007 just below the annual average Air Quality Objective of 40µgm<sup>-3</sup>. A mean annual NO<sub>2</sub> concentration of 60µgm<sup>-3</sup> or greater indicates that the 1-hour Air Quality Objective of 200µgm<sup>-3</sup> is likely to be exceeded (Laxen & Marner, 2003).

The diffusion tube located on the façade of End Cottage, Copt Oak was not commissioned until January 2008.

The average NO<sub>2</sub> concentrations between January and September 2008 show a decrease compared to the 2007 annual average results at Copt Oak Road 1 and 2, Copt Oak 21 and Charley. The average NO<sub>2</sub> concentrations are however still above the annual mean Air Quality Objective of 40µgm<sup>-3</sup> at three of the four monitoring locations; Copt Oak Road 1 46.22µgm<sup>-3</sup>, Copt Oak Road 2 46.55µgm<sup>-3</sup> and Copt Oak 21 45.59µgm<sup>-3</sup>. The average NO<sub>2</sub> concentrations recorded by the diffusion tube located on Copt Oak Road in Charley for 2008 was 35.06µgm<sup>-3</sup>. This monitoring result is in-line with previous year's annual mean NO<sub>2</sub> concentrations recorded at this location and indicates that the annual mean Air Quality Objective is not being exceeded in the vicinity of Copt Oak Road, Charley.

The average NO<sub>2</sub> concentration recorded at the façade of End Cottage, Copt Oak was significantly below the 40µgm<sup>-3</sup> annual mean Air Quality Objective, at 33.69µgm<sup>-3</sup>.

As all average concentrations recorded in Copt Oak in 2008 (January to September 2008) were significantly below 60µgm<sup>-3</sup> it is unlikely that the 1-hour objective will be exceeded at any location in Copt Oak.

Due to exceedences of the annual mean Air Quality Objective at three of the monitoring locations, air dispersion modelling has been conducted to predict the NO<sub>2</sub> concentrations within the village of Copt Oak and at specific receptor points. The modelling results are presented in the following section.

## 4.0 AIR DISPERSION MODELLING

### 4.1 METHODOLOGY

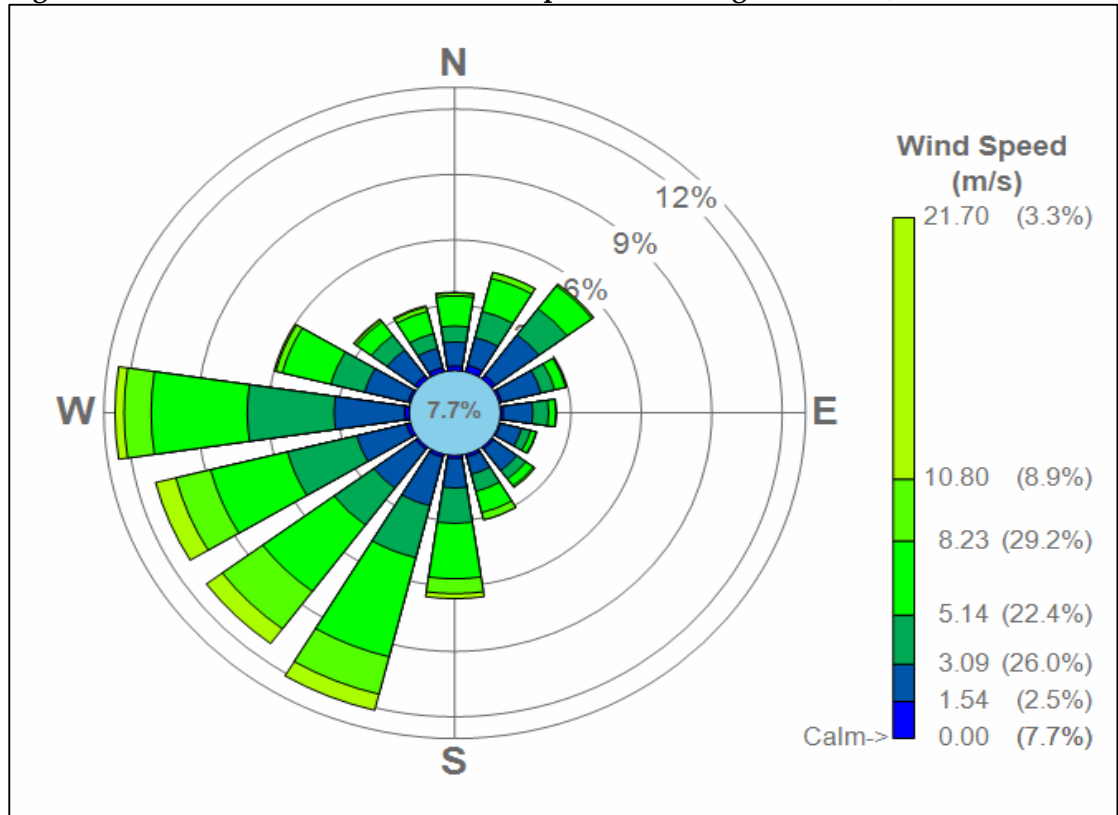
Detailed air dispersion modelling has been undertaken using Breeze Roads; an advanced dispersion model based on Gaussian plume theory. The model has been used to predict NO<sub>2</sub> concentrations from road traffic emissions in Copt Oak. The NO<sub>2</sub> concentrations at individual receptor locations, where relevant public exposure is likely, have also been predicted using the Breeze Roads model. Relevant exposure is defined within LAQM.TG (03) (DEFRA, 2003) as a location where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. For the annual mean Air Quality Objective, relevant exposure is limited to residential properties, schools and hospitals. In total 17 residential properties have been identified within the study area. The annual NO<sub>2</sub> concentrations at the façade of 11 of the 17 residential properties have been predicted using the Breeze Roads model. These receptor locations were selected as they represent locations of relevant public exposure. A number of adjoining properties were considered by a single receptor location; the closest properties to the M1 of those 4 dwellings which comprise Corner Farm and End Cottage and Leycroft Cottage for the row of five terraced cottages in this area. Due to their proximity the predicted NO<sub>2</sub> concentrations at the façade of those properties not specifically modelled will be identical to those modelled receptor locations.

#### 4.1.1 MODEL INPUT DATA

A summary of all input data utilised in the model is contained within Appendix C.

The most recent years' meteorological data (2007) has been used from East Midlands Airport Meteorological Station. The wind rose from East Midlands Airport Meteorological Station presented in Figure 6 highlights the dominant south-westerly wind direction.

**Figure 6: Wind Rose for East Midlands Airport Meteorological Station, 2007**



North West Leicestershire District Council commissioned Leicestershire County Council to conduct manual traffic counts of all road junctions in Copt Oak. The counts were conducted on 30<sup>th</sup> October 2008, 07:00 to 19:00 at both junctions; Copt Oak Road/Warren Hills Road and Copt Oak Road/Whitwick Road. The results of the traffic count are presented in Appendix C. Eight classes of vehicles were recorded; bicycles, motor bikes, cars, buses, Light Goods Vehicles (LGVs), Medium Goods Vehicles (MGVs) and Heavy Goods Vehicles (HGVs).

The 12 hour manual traffic data was converted to Annual Average Daily Traffic (AADT) counts using a conversion factor of 1.152; derived from similar previous studies (Cambridge City Council, 2007).

Traffic count data in the form of AADT for the M1 between junction 22 and 23 was obtained from the Department for Transport (DfT) website; [www.dft.gov.uk/matrix](http://www.dft.gov.uk/matrix) (DfT, 2008). The proportion of HGVs using the M1 between junctions 22 and 23 (16.3%) was also obtained from the DfT website.

In the absence of monitored traffic speed data, average traffic speeds were assumed to be identical to the national speed limits of those roads; 30mph (50kph) for Copt Oak Road, Warren Hills Road and Whitwick Road and 70mph (110kph) for the M1.

The background annual mean NO<sub>2</sub> concentration for Copt Oak was 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](http://www.airquality.co.uk/archive/laqm/tools.php?tools=background)). The estimated background annual mean concentration for grid reference 448141:448122 was determined from the published 2005 map. The year adjustment factors provided in the LAQM Technical Guidance (DEFRA, 2003) were utilised to project this concentration forward to 2008.

#### 4.1.2 UNCERTAINTY AND MODEL VERIFICATION

There is an element of uncertainty in all measured and modelled data. All values presented in this report are the best possible estimates, but uncertainties in the results might cause over or under-predictions. All of the measurements presented have an intrinsic margin of error. DEFRA (2007b) suggest that this is of the order of plus or minus 20% for diffusion tube data and plus or minus 10% for automatic measurements. There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that:

- The emissions per vehicle conform to the factors published in the Design Manual for Roads and Bridges (DMRB) version 11.3 (Highways Agency, 2007);
- Wind conditions measured at East Midlands Airport during 2007 were representative of wind conditions in Copt Oak during 2007; and
- The subsequent dispersion of emitted pollutants will conform to a Gaussian distribution over flat terrain.

An important step in the assessment is verifying the dispersion model against the measured data. By comparing the model results with measurements, data can be corrected for any overall under or over-prediction. Verification of the NO<sub>2</sub> modelled data has been conducted using NO<sub>2</sub> diffusion tube monitoring results from 2007 for both tubes located on Copt Oak Road and the Council operated Copt Oak 21 site.

A correction factor of 1.01 was applied to the modelled results to bring them in line with the monitored data. Full details of the verification procedure are provided within Appendix B.

The UK Government's Air Quality Expert Group (AQEG) has published a draft report on trends in primary NO<sub>2</sub> in the UK (AQEG, 2006). This examines evidence



that shows that while NO<sub>x</sub> emissions have fallen in line with predictions made a decade previously, the composition of NO<sub>x</sub> has, in some urban environments, changed. This may have caused NO<sub>2</sub> levels at some locations to fall less rapidly than was expected. The latest guidance from DEFRA (DEFRA, 2003) has been followed regarding NO<sub>x</sub> to NO<sub>2</sub> relationships, but there is still uncertainty as to whether these relationships will continue to apply in 2010 and 2015. Any effect is likely to be greatest close to major roads, where future baseline concentrations may have been underestimated.

#### 4.2 MODEL RESULTS

The Breeze Roads model was utilised to predict 2008 annual mean NO<sub>2</sub> concentrations from road traffic emissions in the village of Copt Oak. A contour plot of the predicted total annual average NO<sub>2</sub> concentration for 2008 in Copt Oak is presented in Figure 7. The two blue contour lines represent the annual mean Air Quality Objective of 40µgm<sup>-3</sup>. All sensitive receptors between the two blue 40µgm<sup>-3</sup> contour lines will be subject to annual mean NO<sub>2</sub> concentrations in excess of the Air Quality Objective.

The model was also utilised to predict annual mean NO<sub>2</sub> concentrations in 2008 at 2 monitoring locations and 11 specific receptors within Copt Oak. Descriptions of the 13 receptor locations and the modelled predicted annual mean NO<sub>2</sub> concentrations (µgm<sup>-3</sup>) for 2008 are presented in Table 3 and the locations of the receptors are presented in Figure 8.

Figure 7: Predicted Total Annual Average NO<sub>2</sub> Concentration (µg<sub>m</sub><sup>-3</sup>) for 2008 in Copt Oak

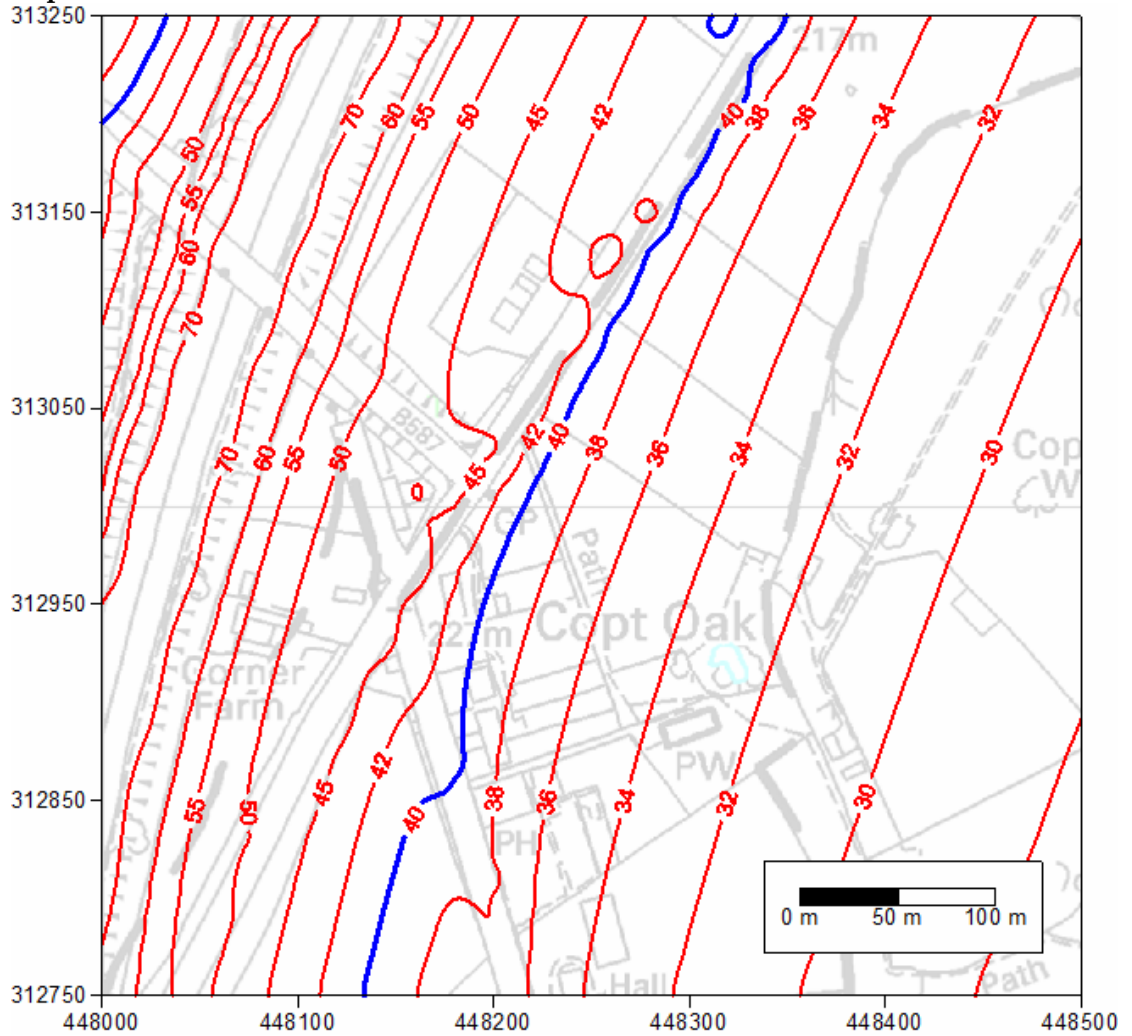
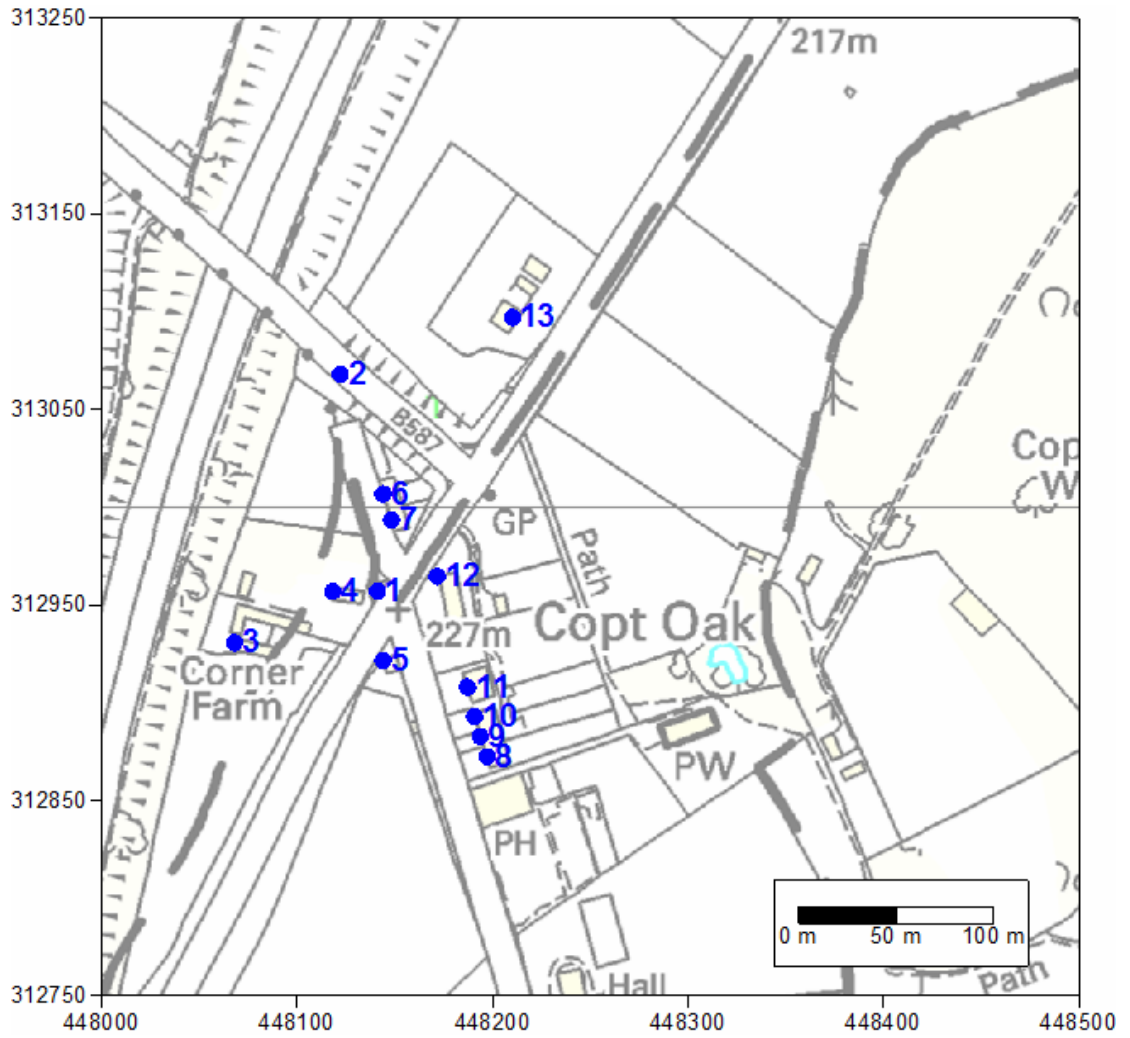


Figure 8: Copt Oak Receptor Locations



**Table 3: Copt Oak Receptor Air Dispersion Modelling Results**

Receptor	Location	Grid Reference	2008 Predicted NO <sub>2</sub> Concentration (µgm <sup>-3</sup> )	
			Road Contribution	Total
1	Diffusion Tube Monitoring Location Copt Oak Road	448141 : 312957	25.9	45.5
2	Diffusion Tube Monitoring Location Copt Oak 21	448122 : 313068	38.9	53.6
3	Corner Farm Properties (4 dwellings)	448068 : 312931	42.4	55.5
4	The Lodge	448118 : 312957	28.4	47.3
5	Old School House	448144 : 312922	24.2	44.3
6	End Cottage	448144 : 313007	26.6	46.0
7	Leycroft Cottage	448148 : 312993	25.5	45.3
8	4 Whitwick Road	448197 : 312872	16.8	38.3
9	3 Whitwick Road	448194 : 312883	17.3	38.8
10	2 Whitwick Road	448191 : 312893	17.8	39.2
11	1 Whitwick Road	448187 : 312908	18.4	39.8
12	Copt Oak Road	448172 : 312965	22.7	43.2
13	The Old Vicarage	448210 : 313097	22.1	42.7

The Breeze Road model predicts the annual average NO<sub>2</sub> concentration in 2008 will exceed the 40µgm<sup>-3</sup> annual mean Air Quality Objective at both monitoring locations; Copt Oak Road and Copt Oak 21 and at 7 of the 11 receptor locations assessed. This equates to a breach of the Air Quality Objective at 13 of the 17 residential properties in Copt Oak; of which 10 are located within North West Leicestershire District Council's boundaries. The highest 2008 annual mean NO<sub>2</sub> concentration of 55.5µgm<sup>-3</sup> is predicted at the 4 properties which comprise Corner Farm, which is significantly above the 40µgm<sup>-3</sup> Air Quality Objective.

The contribution of road traffic emissions to the predicted total NO<sub>2</sub> concentrations at each receptor location has been modelled and the results presented in Table 3. The NO<sub>2</sub> concentration due solely to road traffic emissions at the properties which comprise Corner Farm is predicted to be 42.4µgm<sup>-3</sup> in 2008 which exceeds the annual mean Air Quality Objective. Corner Farm is situated within 30 metres of the south bound carriageway of the M1.

The predicted 2008 annual mean NO<sub>2</sub> concentration at the façades of the remaining 4 properties (No.'s 1 - 4 Whitwick Road); situated within Hinckley and Bosworth Borough Council's boundaries are not expected to exceed the 40µgm<sup>-3</sup> objective in

2008. However, the annual mean NO<sub>2</sub> concentrations in 2008 are predicted to be greater than 36µgm<sup>-3</sup> which is within one standard deviation (4µgm<sup>-3</sup>) of the 40µgm<sup>-3</sup> Air Quality Objective. DEFRA Technical Guidance (LAQM.TG(03)) (DEFRA, 2003) suggests that to allow for modelling uncertainty exceedences of 36µgm<sup>-3</sup> be used to define any AQMAs. The European Union and UK Government support this precautionary approach (DEFRA, 2003).

Taking into account this guidance the predicted 2008 annual mean NO<sub>2</sub> concentrations at all residential properties in the village of Copt Oak would require the declaration of an AQMA.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

### 5.1 CONCLUSIONS

A Detailed Assessment has been conducted at Copt Oak to assess the NO<sub>2</sub> concentrations arising from road traffic emissions. In total 17 residential properties were evaluated in the Detailed Assessment. These properties are situated within the boundaries of both North West Leicestershire District Council and Hinckley and Bosworth Borough Council.

In Copt Oak, the results of NO<sub>2</sub> diffusion tube monitoring has demonstrated exceedences of the annual mean 40µgm<sup>-3</sup> Air Quality Objective at two of the three monitoring locations; Copt Oak Road and Warren Hills Road in both 2007 and 2008 (January to September). The third monitoring location, commissioned in January 2008 following the recommendations of the Detailed Assessment (NWLDC, 2007) on the façade of End Cottage, Copt Oak recorded an average NO<sub>2</sub> concentration in 2008 of 33.19µgm<sup>-3</sup>.

Air Dispersion Modelling was undertaken using the Breeze Roads model to predict the annual mean concentration of NO<sub>2</sub> for 2008 in Copt Oak due to road traffic emissions. Thirteen specific receptor points were also modelled comprising both current monitoring locations and façades of residential properties; with receptors located in both North West Leicestershire District Council and Hinckley and Bosworth Borough Council Authority areas. The annual NO<sub>2</sub> concentrations at the façade of eleven of the seventeen residential properties have been predicted using the Breeze Roads model. The remaining six properties adjoin residential properties which have been modelled and it can therefore be assumed that the predicted NO<sub>2</sub> concentrations at the façade of these properties will be in-line with the modelled concentrations.

The model results predict that the annual mean NO<sub>2</sub> Air Quality Objective of 40µgm<sup>-3</sup> will be exceeded in 2008 at 13 of the residential properties in Copt Oak; nine in North West Leicestershire and four in Hinckley and Bosworth and will be greater than 36µgm<sup>-3</sup> (within one standard deviation; or 4µgm<sup>-3</sup> of the Air Quality Objective) at the remaining four residential properties in Hinckley and Bosworth.

Based on the findings of this Detailed Assessment the following recommendations are made to North West Leicestershire District Council:

- An AQMA be declared encompassing ten residential properties within North West Leicestershire District Council's boundaries which are adjacent to Copt

Oak Road, Copt Oak due to monitored and predicted exceedences of the  $40\mu\text{gm}^{-3}$  annual mean Air Quality Objective as a result of road traffic emissions. This AQMA should encompass the ten residential properties which are situated within North West Leicestershire District Council's boundaries; the Old Vicarage, End Cottage, Peppers Cottage, Laycroft Bungalow, Laycroft Cottage, Leycroft Cottage and the four properties which comprise Corner Farm. The proposed boundaries of the AQMA are presented in Figure 9, Appendix D.

- Discussions are held between North West Leicestershire District Council and Hinckley and Bosworth Borough Council regarding the conclusions of this report. It should be noted that the findings of this Detailed Assessment place no statutory duty on Hinckley and Bosworth Borough Council to investigate predicted exceedences of the annual mean Air Quality Objective at residential properties in their Borough.
- North West Leicestershire District Council should continue to monitor  $\text{NO}_2$  concentrations in Copt Oak at the current diffusion tube locations in order to ensure that any future changes in air quality are detected. The façade of End Cottage, Copt Oak should continue to be used as a diffusion tube monitoring location as it represents a site of relevant public exposure.
- Consultation is undertaken with the residents of Copt Oak to publicise the results of this report and the proposed declaration of an AQMA.
- A Further Assessment is undertaken within 12 months of the declaration of the AQMA to confirm the conclusions of this Detailed Assessment, to apportion the pollutant source contributions and to estimate the reductions in emissions required to achieve the annual mean Air Quality Objective.

## 6.0 REFERENCES

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