Air Quality CONSULTANTS

Detailed Assessment of Air Quality for Harborough District Council

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Experts in air quality management & assessment

Document Control

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Harborough District Council confirms that it accepts the recommendations made in this report.

1 Introduction

1.1 Air Quality Consultants Ltd has been commissioned by Harborough District Council to undertake a Detailed Assessment of air quality in Kibworth. In 2016, Harborough District Council completed an Annual Status Report (ASR) for air quality, which highlighted that a measured exceedance of the nitrogen dioxide annual mean objective occurred in Kibworth in 2015, albeit based on low data capture. Concentrations recently measured in 2016 continued to be above the annual mean nitrogen dioxide objective, so the Council has concluded that a Detailed Assessment is required.

1.2 The aim of this Detailed Assessment is to determine whether the annual mean nitrogen dioxide objective is exceeded at relevant locations and, if so, the extent of exceedances to inform the boundary of the Air Quality Management Area (AQMA) required.

Background

1.3 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra, 2007) 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 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. These locations must be designated as AQMAs and a subsequent Air Quality Action Plan (AQAP) developed in order to reduce pollutant emissions in pursuit of the objectives.

1.4 Technical Guidance for Local Air Quality Management (LAQM.TG(16)) (Defra, 2016a) sets out a streamlined approach to the Review and Assessment process. This prescribes the submission of a single Annual Status Report (ASR) which all local authorities in England and Scotland must submit each year by the 30th June. It should identify new non-compliant areas and report progress made within existing AQMA's. When an exceedance has been identified, the local authority can either use the "Fast Track Option" and immediately declare an AQMA, or obtain further information and/or data before deciding on the declaration of an AQMA. The latter approach is being treated as a 'Detailed Assessment' for the purposes of this report[1].

1.5 The purpose of this Detailed Assessment is to determine whether an exceedance of an air quality objective is likely and the geographical extent of that exceedance, which will determine the extent of the AQMA that has to be declared. Subsequent to the declaration of an AQMA, an Air Quality Action Plan (AQAP) should ideally be prepared within one year and approved by Defra. The

[1] Detailed Assessments were part of the previous approach to LAQM, but they are no longer required in current TG(16) guidance.

AQAP will identify measures to improve local air quality and to achieve the air quality objectives. In order to inform the Action Plan process, source apportionment should be undertaken to ascertain the sources contributing the exceedences, and the magnitude of reduction in emissions required to achieve the objective should also be calculated.

The Air Quality Objectives

1.6 The Government's Air Quality Strategy (Defra, 2007) provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. 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. They take account of the costs, benefits, feasibility and practicality of achieving the standards. 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 (Stationery Office, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (Stationery Office, 2002). Table 1 summarises the objectives which are relevant to this report. Appendix 1 provides a brief summary of the health effects of nitrogen dioxide.

Table 1: Air Quality Objectives for Nitrogen Dioxide

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year
	Annual mean	40 $\mu g/m^3$

1.7 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.

1.8 Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded unless the annual mean nitrogen dioxide concentration is greater than 60 $\mu g/m^3$ (Defra, 2016). Thus exceedances of 60 $\mu g/m^3$ as an annual mean nitrogen dioxide concentration are used as an indicator of potential exceedances of the 1-hour nitrogen dioxide objective.

2 Assessment Methodology

Monitoring

2.1 Monitoring of nitrogen dioxide has been carried out by Harborough District Council using passive diffusion tubes. The monitoring sites and study area are shown in Figure 1. Diffusion tubes were prepared and analysed by ESG Didcot using the 50% TEA in acetone. It is necessary to adjust diffusion tube data to account for laboratory bias. A national bias adjustment factor of 0.77 has been applied to the diffusion tube data, derived from the database of national factors provided by Defra (Defra, 2017b).

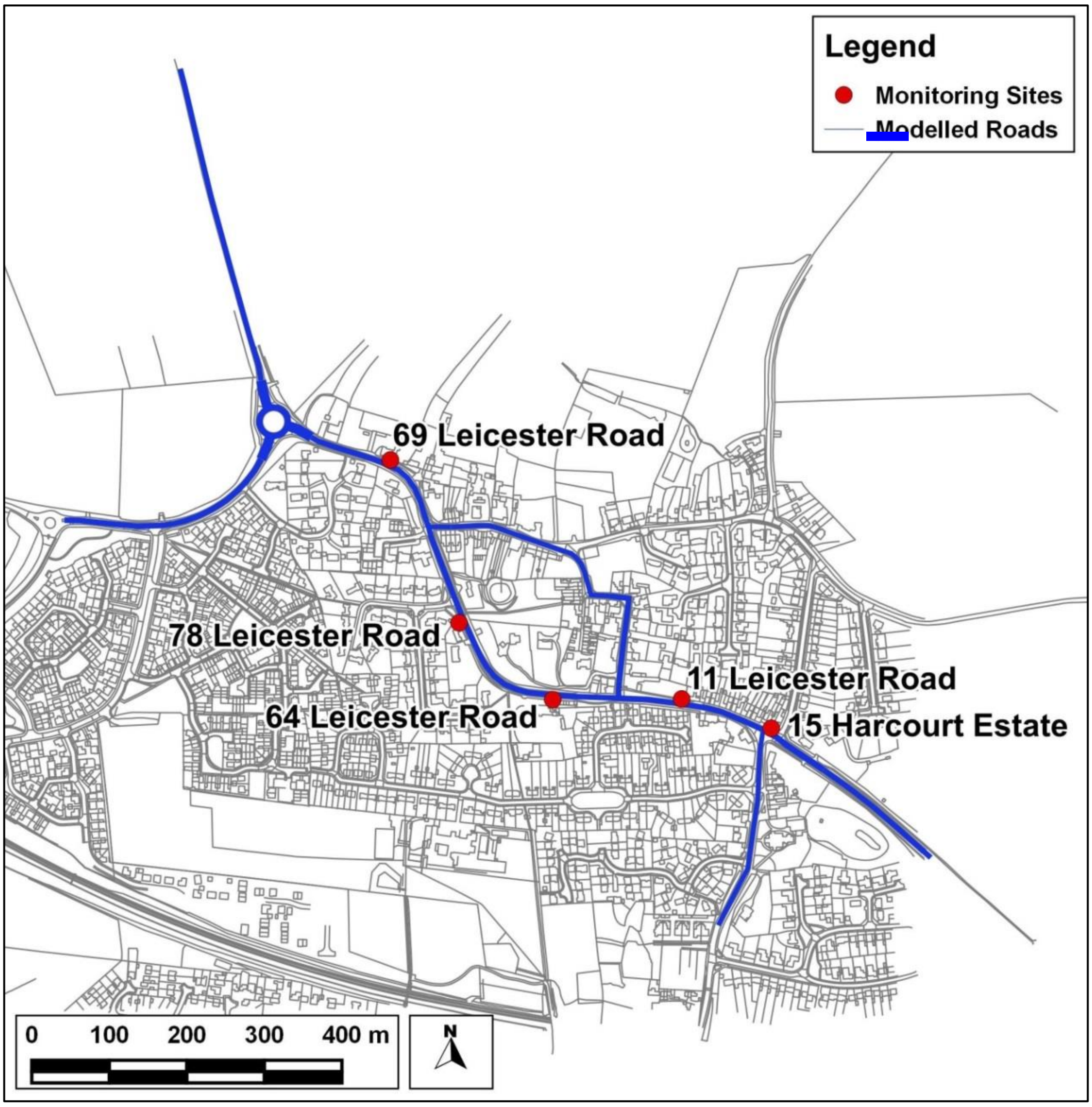

Figure 1: Monitoring Locations and Roads Explicitly Included in the Model (shown in blue)

Modelling

2.2 Annual mean nitrogen dioxide concentrations have been predicted using detailed dispersion modelling (ADMS-Roads v4.1). The input data used are described in Appendix 2. The model outputs have been verified against measured concentrations at the diffusion tube monitoring sites located at 64 Leicester Road, 69 Leicester Road and 15 Harcourt Estate. The monitoring sites located at 11 Leicester Road and 78 Leicester Road have not been included in the model verification due to poor data capture (<42%). Further details of model verification are provided in Appendix 2. Concentrations have been predicted for 18 worst-case locations representing sensitive properties, as well as a grid of receptors across the study area, as shown in Figure 2, to allow concentration contours to be plotted. All concentrations have been predicted at a height of 1.5 m (breathing height).

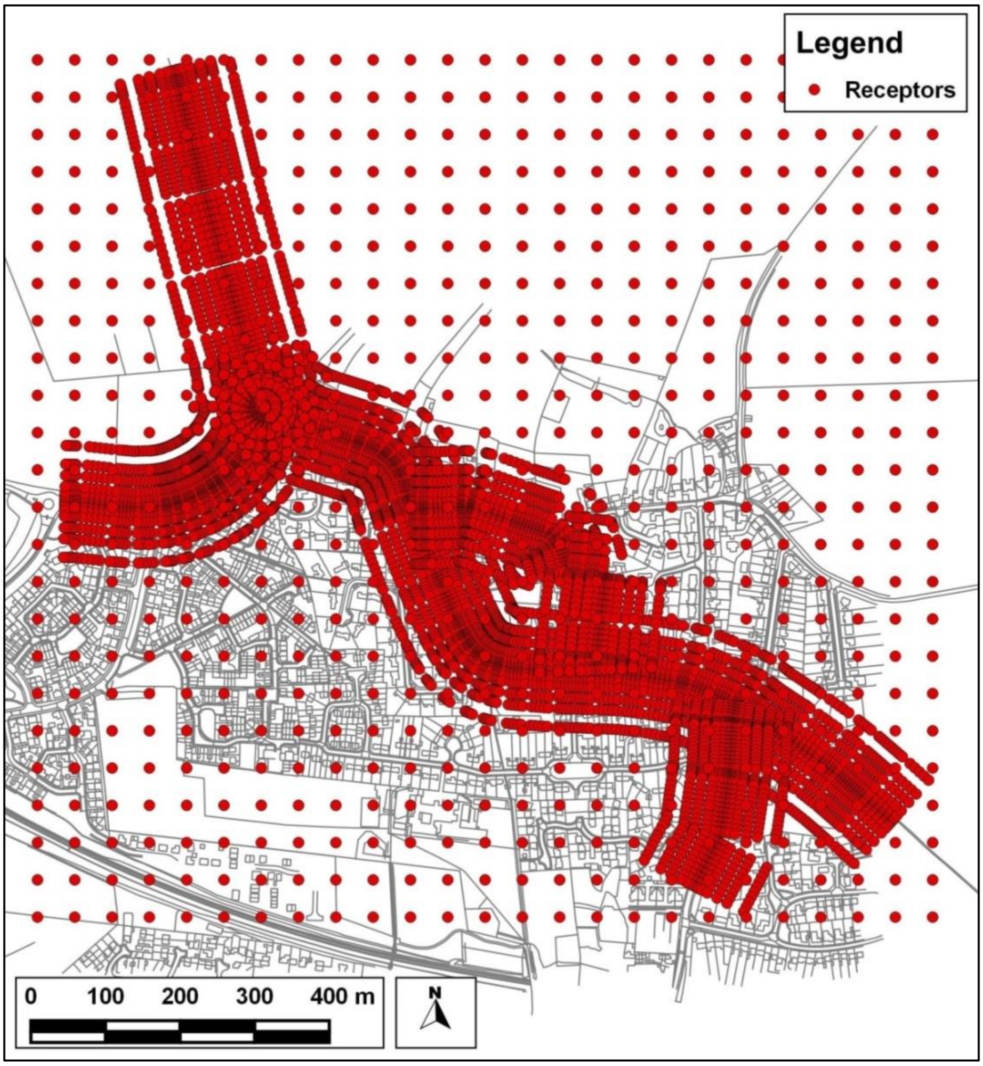

Figure 2: Gridded Receptor Points used for the Model

Uncertainty

2.3 Uncertainty is inherent 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 measured concentrations presented have an intrinsic margin of error. Defra (2011) suggests that this is of the order of plus or minus 20% for diffusion tube data and plus or minus 10% for automatic measurements. The model results rely on traffic data and any uncertainties inherent in these data will carry into this assessment. There will be additional uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. An important step in the assessment is verifying the dispersion model against the measured data. Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of concentrations for the year of 2016.

2.4 The limitations to the assessment should be borne in mind when considering the results set out in the following sections. While the model should give an overall accurate picture, i.e. one without bias, there will be uncertainties for individual receptors. The results are ‘best estimates’ and have been treated as such in the discussion.

3 Results

Monitoring

3.1 Monitoring data for the last five years (2012 – 2016) for the sites within the study areas (Figure 1) are summarised in Table 2.

Table 2: Annual Mean Nitrogen Dioxide Concentrations Measured in Kibworth (µg/m^3) [a, b]

Site	Site Type	Site Description	2012	2013	2014	2015	2016
12n	Roadside	15 Harcourt Estate	32.2	30.4	28.2	29.7	30.1
31n	Roadside	69 Leicester Road	-	-	-	33.1	34.3
34n	Roadside	64 Leicester Road	-	-	-	**55.0**	**54.9**
35n	Roadside	78 Leicester Road	-	-	-	-	36.4 [c]
36n	Roadside	11 Leicester Road	-	-	-	-	**42.7** [c]
Objective			**40**				

[a] Exceedances of the objective value are shown in bold.

[b] 2012 to 2015 data have been taken from the Harborough District Council 2016 Annual Status Report (Harborough District Council, 2016). 2016 data have been provided by the Council.

[c] Data capture was less than 42%. The 2016 results have therefore been annualised by the Council to allow for the incomplete year of monitoring data.

3.2 Measured annual mean concentrations were above the objective level (40 µg/m^3) at the monitoring site located at 64 Leicester Road in both 2015 and 2016. Although the data capture was only 41.7% at the monitoring site located at 11 Leicester Road in 2016, annualised concentrations do indicate that concentrations may also be above the objective level at this location. Concentrations at the other monitoring sites were below the objective level. There are no clear trends in the monitoring data for the past five years.

3.3 The measured concentrations are below 60 µg/m^3 at all of the monitoring sites within the study area between 2012 and 2016. It is therefore unlikely that the 1-hour objective is exceeded anywhere within the study area.

Modelling

3.4 Annual mean nitrogen dioxide concentrations have been predicted at each of the grid receptor locations shown in Figure 2. A maps of the modelled annual mean nitrogen dioxide concentrations at ground-floor level within the study area is presented in Figure 3. A more detailed image (Figure A3.1) is provided in Appendix 3, which allows individual properties to be identified. The modelling shows that the annual mean objective is likely to be exceeded at sensitive properties close to Leicester Road (A6) in Kibworth.

3.5 To allow for uncertainty, it is appropriate to consider properties with concentrations within 10% of the objective, i.e. above 36 µg/m^3. There are approximately 14 residential properties predicted to be experiencing concentrations above 36 µg/m^3. Assuming that each property has, on average, two occupants, this equates to approximately 28 residents.

3.6 No exceedances of 60 µg/m^3 as an annual mean nitrogen dioxide concentration have been identified at locations of relevant exposure; exceedances of the 1-hour mean objective are therefore unlikely within this study area.

Summary

3.7 One diffusion tube monitoring site, at 64 Leicester Road in Kibworth, has experienced annual mean nitrogen dioxide concentrations well above the objective level in the last two years, and it is likely that one other site, 11 Leicester Road, has also experienced an annual mean concentration above the objective level. The modelling has also shown that several relevant receptors along Leicester Road have experienced an annual mean concentration above the objective, There is inevitable uncertainty surrounding both the measured and modelled concentrations. It is therefore recommended that an AQMA is declared to include, as a minimum, those residential properties which experience concentrations >36 µg/m^3 contour. Modelling has predicted concentrations above 36 µg/m^3 at 14 residential properties at the ground-floor level.

3.8 On the basis of monitoring and modelled results it is recommended that Harborough District Council declare an AQMA on Leicester Road (A6) between Wistow Road and Church Road, to include the 14 properties specified in Appendix 3.

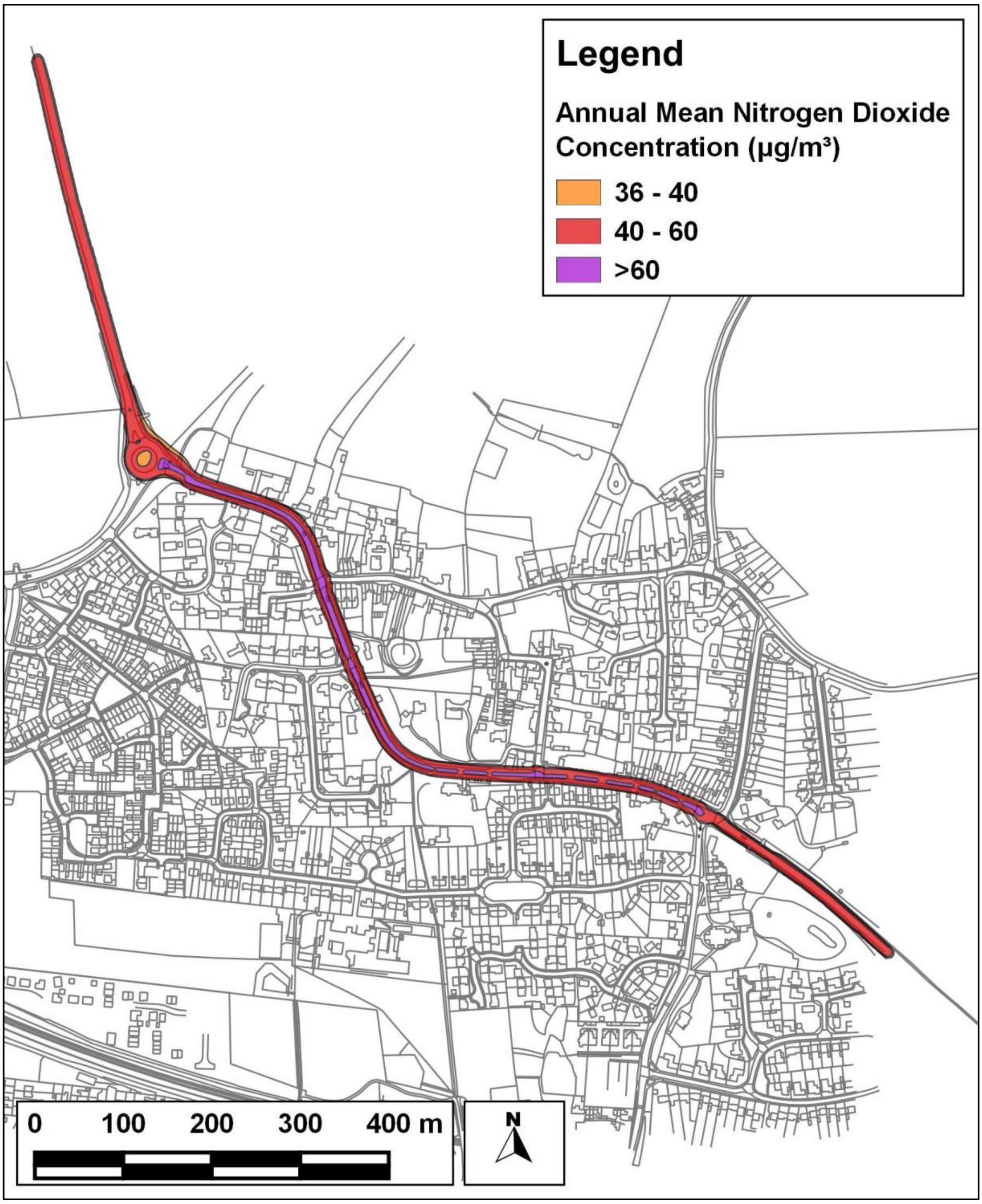

Figure 3: Extent of the Modelled Annual Mean Nitrogen Dioxide Concentrations >60 μg/m^3 (purple), 40-60 μg/m^3 (red) and 36-40 μg/m^3 (orange) in 2016 along the A6 in Kibworth (modelled at 1.5 m)

Source Apportionment

3.9 As the report recommends that an AQMA be declared along Leicester Road (A6), the sources contributing to objective exceedances along Leicester Road have been identified. The data presented here can be used to help develop an appropriate Action Plan and to inform future traffic management decisions.

3.10 Table 3 and Figure 4 set out the relative contributions of local traffic emissions on top of the local background. The following categories have been included in the source apportionment:

- Ambient Background (Background);
- Light Duty Vehicles (LDVs);
- Rigid Heavy Goods Vehicles (Rigid HGVs);
- Articulated Heavy Goods Vehicles (Artic HGVs); and
- Buses.

3.11 The worst-case location with relevant exposure predicted from the modelling (identified to be 14 Leicester Road) has been used to provide an overview of source contributions. Table 3 and Figure 4 show that the most significant component along Leicester Road is emissions from LDVs (although not shown, diesel cars will have a greater contribution than petrol cars), followed by emissions from rigid HGVs and ambient background concentrations.

Table 3: Predicted Annual Mean Nitrogen Dioxide Concentrations (2016) and the Contribution of Each Source Type to the Total, at 14 Leicester Road

	Source Apportionment					
	Background	LDV	Rigid HGV	Arctic HGV	Bus	Total
Concentration (µg/m^3)	13.5	19.1	13.5	2.6	3.0	51.7
% Contribution to Total	26	37	26	5	6	100

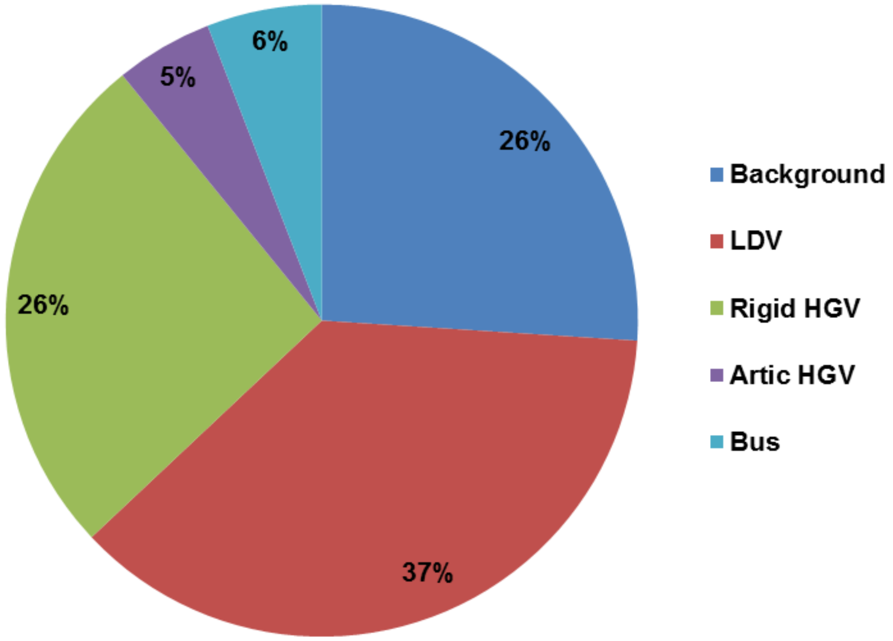

Figure 4: Percentage Contribution of Each Source Type to the Total Predicted Annual Mean Nitrogen Dioxide Concentration at 14 Leicester Road

Air Quality Improvements Required

3.12 The degree of improvement needed in order for the annual mean nitrogen dioxide objective to be achieved is defined by the difference between the highest measured or predicted concentration and the objective level (40 µg/m^3). The highest nitrogen dioxide concentration has been predicted at 14 Leicester Road (51.7 µg/m^3), requiring a reduction of 11.7 µg/m^3 in order for the objective to be achieved.

3.13 In terms of describing the reduction in emissions required, it is more useful to consider nitrogen oxides (NOx). The required reduction in local nitrogen oxides emission has been calculated in line with guidance presented in LAQM.TG(16) (Defra, 2016a). A reduction of 29.8 µg/m^3 (34.8%) in local emissions of NOx would be required at this property in order for the annual mean objective to be achieved. At all other properties in the study area, where an exceedance is predicted, a reduction of less than 34.8% in local road traffic would be required to achieve the objective.

4 Conclusions and Recommendations

4.1 A Detailed Assessment has been carried out for nitrogen dioxide in Kibworth. This area was previously identified as being at risk of exceeding the annual mean air quality objective for nitrogen dioxide, in Harborough District Council's 2016 ASR.

4.2 The Detailed Assessment has been carried out using a combination of monitoring data and modelled concentrations. Concentrations of nitrogen dioxide have been modelled for 2016 using the ADMS-Roads dispersion model. The model was verified against measurements from three nitrogen dioxide diffusion tube monitoring locations, adjacent to the road network included in the model.

4.3 The assessment has identified that the annual mean nitrogen dioxide objective is exceeded at a number of relevant locations alongside Leicester Road (A6) within each study area. There is some uncertainty surrounding both the measured and modelled concentrations. It is therefore recommended that an AQMA is declared for the annual mean nitrogen dioxide objective along Leicester Road (A6) in Kibworth, between Wistow Road and Church Road, to include, as a minimum, those residential properties that lie within the 36 µg/m^3 contour (as specified in Appendix 3).

4.4 Potential exceedances of 60 μg/m^3 as an annual mean nitrogen dioxide concentration have not been identified at locations of relevant exposure. Exceedances of the 1-hour mean objective are thus unlikely to occur within the study area.

4.5 It is recommended that Harborough District Council continues monitoring nitrogen dioxide at the existing locations to determine whether concentrations continue to exceed the objective or decline with future implementation of AQAP measures. Monitoring results can then be used to inform the AQAP and the next ASR.

4.6 Source apportionment of the local traffic emissions has been undertaken. This shows that LDVs contribute the largest proportion to the overall concentration, followed by emissions from Rigid HGVs and ambient background concentrations.

4.7 A reduction in traffic emissions along Leicester Road (A6) would result in a decrease in the concentrations of nitrogen dioxide. Reductions in vehicle emissions from local traffic of up to 34.8% would be required to achieve the annual mean nitrogen dioxide objective where the highest concentrations are predicted to occur.

4.8 Finally, Harborough District Council should proceed with the preparation of an Air Quality Action Plan (AQAP) within 12 months of the declaration of this recommended AQMA, to improve air quality in Kibworth.

5 References

AQC (2016a) *CURED V2A*, [Online], Available: http://www.aqconsultants.co.uk/getattachment/Resources/Download-Reports/CURED-V2A.zip.aspx.

AQC (2016b) *Emissions of Nitrogen Oxides from Modern Diesel Vehicles*, [Online], Available: http://www.aqconsultants.co.uk/Resources/Download-Reports.aspx.

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Carslaw, D. and Rhys-Tyler, G. (2013) *Remote sensing of NO2 exhaust emissions from road vehicles*, July, [Online], Available: http://uk-air.defra.gov.uk/assets/documents/reports/cat05/1307161149_130715_DefraRemoteSensingReport_Final.pdf.

Defra (2016) *Review & Assessment: Technical Guidance LAQM.TG16*, Defra.

Defra (2017a) *Defra Air Quality Website*, [Online], Available: http://laqm.defra.gov.uk/.

Defra (2017b) *National Diffusion Tube Bias Adjustment Factor Spreadsheet, Spreadsheet Version Number: 03/17 V2*, [Online], Available: https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html.

DfT (2016) *DfT Automatic traffic Counters Table TRA0305-0307*, [Online], Available: https://www.gov.uk/government/statistical-data-sets/tra03-motor-vehicle-flow.

Harborough District Council (2016) *2016 Air Quality Annual Status Report (ASR)*.

6 Glossary

AADT	Annual Average Daily Traffic flows
AQMA	Air Quality Management Area
ADMS-Roads	Atmospheric Dispersion Modelling System for Roads
DfT	Department for Transport
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate air quality objective
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
LDV	Light Duty Vehicle
NO_X	Nitrogen oxides (taken as NO + NO_2)
NO	Nitric Oxide
NO_2	Nitrogen dioxide
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date, taking into account costs, benefits, feasibility and practicality. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
Roadside	A site sampling between 1 m of the kerbside of a busy road and the back of the pavement. Typically this will be within 5 m of the road, but could be up to 15 m (Defra, 2009)
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
$\mu g/m^3$	Microgrammes per cubic metre.

A1 Appendix 1 – Summary of Health Effects of Nitrogen Dioxide

Table A1.1: Summary of Health Effects of Nitrogen Dioxide

Pollutant	Main Health Effects
Nitrogen Dioxide	Short-term exposure to high concentrations may cause inflammation of respiratory airways. Long term exposure may affect lung function and enhance responses to allergens in sensitised individuals. Asthmatics will be particularly at risk (Defra, 2007).

A2 Appendix 2 – Dispersion Modelling Methodology

A2.1 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable).

Emissions

A2.2 Vehicle emissions have been calculated based on vehicle flow, composition and speed data using AQC's Calculator Using Realistic Emissions for Diesels (CURED V2A) tool (AQC, 2016a). This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016b), and is important when considering source apportionment.

A2.3 A detailed analysis of emissions from modern diesel vehicles has been carried out (AQC, 2016b). This shows that, where previous standards had limited on-road success, the 'Euro VI' and 'Euro 6' standards that new vehicles have had to comply with from 2013/16[2] are delivering real on-road improvements. A detailed comparison of the predictions in Defra's latest Emission Factor Toolkit (EFT) v7.0 against the results from on-road emissions tests has shown that Defra's latest predictions still have the potential to under-predict emissions from some vehicles, albeit by less than has historically been the case (AQC, 2016b). In order to account for this potential under-prediction, the emissions from Euro IV, Euro V, Euro VI, and Euro 6 vehicles have been uplifted by applying the adjustments set out in Table A2.1 to the emission factors used within the EFT[3], using AQC's CURED (V2A) tool (AQC, 2016a). The justifications for these adjustments are given in AQC (2016b). The results using these emissions are likely to over-predict emissions from vehicles and thus provide a robust assessment.

2 Euro VI refers to heavy duty vehicles, while Euro 6 refers to light duty vehicles. The timings for meeting the standards vary with vehicle type and whether the vehicle is a new model or existing model.

3 All adjustments were applied to the COPERT functions. Fleet compositions etc. were applied following the same methodology as used within the EFT.

Table A2.1: Summary of Adjustments Made to Defra's EFT (V7.0)

Vehicle Type		Adjustment Applied to Emission Factors
All Petrol Vehicles		No adjustment
Light Duty Diesel Vehicles	Euro 5 and earlier	No adjustment
	Euro 6	Increased by 78%
Heavy Duty Diesel Vehicles	Euro III and earlier	No adjustment
	Euro IV and V	Set to equal Euro III values
	Euro VI	Set to equal 20% of Euro III emissions [a]

[a] Taking account of the speed-emission curves for different Euro classes as explained in AQC (2016b).

Meteorological Data

A2.4 Hourly sequential meteorological data from Church Lawford for 2015 have been used in the model. The Church Lawford meteorological monitoring station is located at Satellite Mediaport Services Ltd, Lawford Heath Lane, approximately 30 km to the southwest of Kibworth. It is deemed to be the nearest monitoring station representative of meteorological conditions in the study area; the study area and the Church Lawford meteorological monitoring station are both located in flat-lying inland locations in the Midlands.

Background Concentrations

A2.5 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2017a). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030.

Traffic Data

A2.6 The ADMS Roads model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of different vehicle types, road characteristics and the vehicle speed.

A2.7 For the purposes of modelling, it has been assumed that all roads are street canyons formed by the buildings along those roads. The roads have a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher than they would be in areas with greater dispersion. The roads have, therefore, been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from plans, on-site measurements, local mapping and photographs.

A2.8 AADT flows and the proportion of Light Duty Vehicles (LDVs), rigid Heavy Goods Vehicles (HGVs), artic HGVs and buses and coaches for Main Street, Church Road and Leicester Road (south of Wistow Road) have been obtained from Automatic Traffic Count (ATC) surveys carried out for one week (25 - 31 March 2017), while data for Leicester Road (north of Wistow Road), Harborough

Road and Wistow Road have been determined from the interactive web-based map provided by the Department for Transport (DfT, 2015). Traffic speeds have been estimated from local speed restrictions and take account of the proximity to junctions. The traffic data used in this Detailed Assessment are presented in Table A2.2. Diurnal flow profiles for the traffic have been derived from the ATC data as well as the national diurnal profiles published by DfT (2016).

Table A2.2: Summary of traffic data used in the model (2016)

Road	AADT	LDV%	Rigid HGV%	Artic HGV%	Buses and Coaches
Leicester Road (A6) north of Wistow Road	17,223	96.6	1.8	1.1	0.5
Leicester Road (A6) south of Wistow Road	17,052	90.1	7.7	1.0	1.2
Harborough Road (A6) south of Church Road	19,545	96.1	2.0	1.1	0.8
Main Street	2,530	90.7	7.7	0.6	1.0
Church Road	4,316	91.5	5.7	0.2	2.6
Wistow Road	2,906	98.3	1.4	0.1	0.2

Model Verification

A2.9 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

A2.10 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2016 at the diffusion tube monitoring sites located at 64 Leicester Road, 69 Leicester Road and 15 Harcourt Estate. The monitoring sites located at 11 Leicester Road and 78 Leicester Road have not been included in the model verification due to poor data capture (<42%).

A2.11 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2017a).

A2.12 An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A2.1). The calculated adjustment factor of 1.618 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A2.13 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A2.2 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

A2.14 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

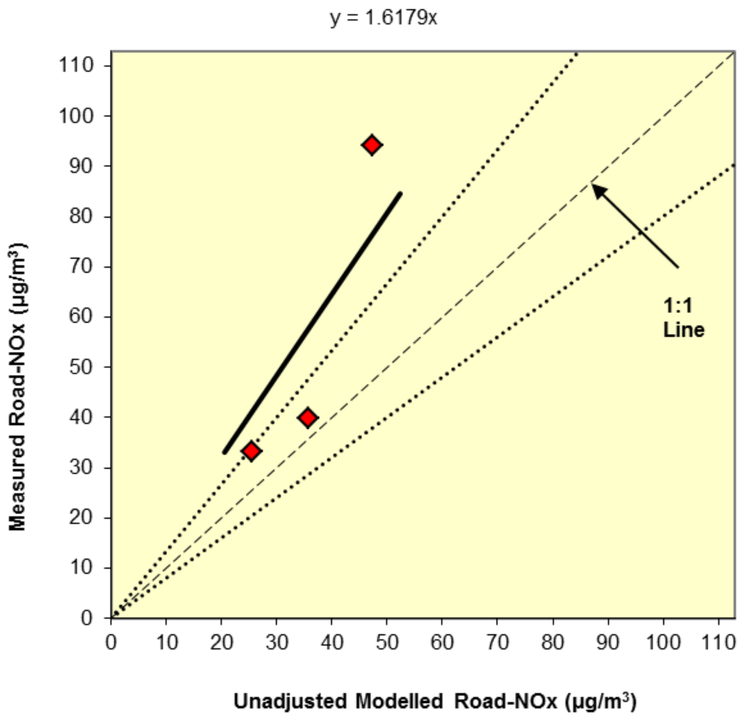

Figure A2.1: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

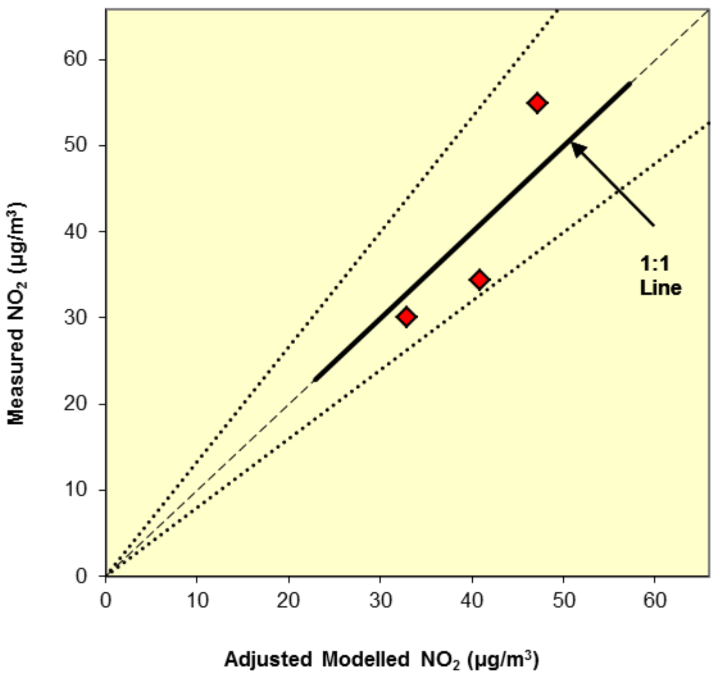

Figure A2.2: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Model Post-processing

A2.15 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2017a). The traffic mix within the calculator has been set to "All non-urban UK traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

A3 Appendix 3 – Detailed Contours for the Study Area

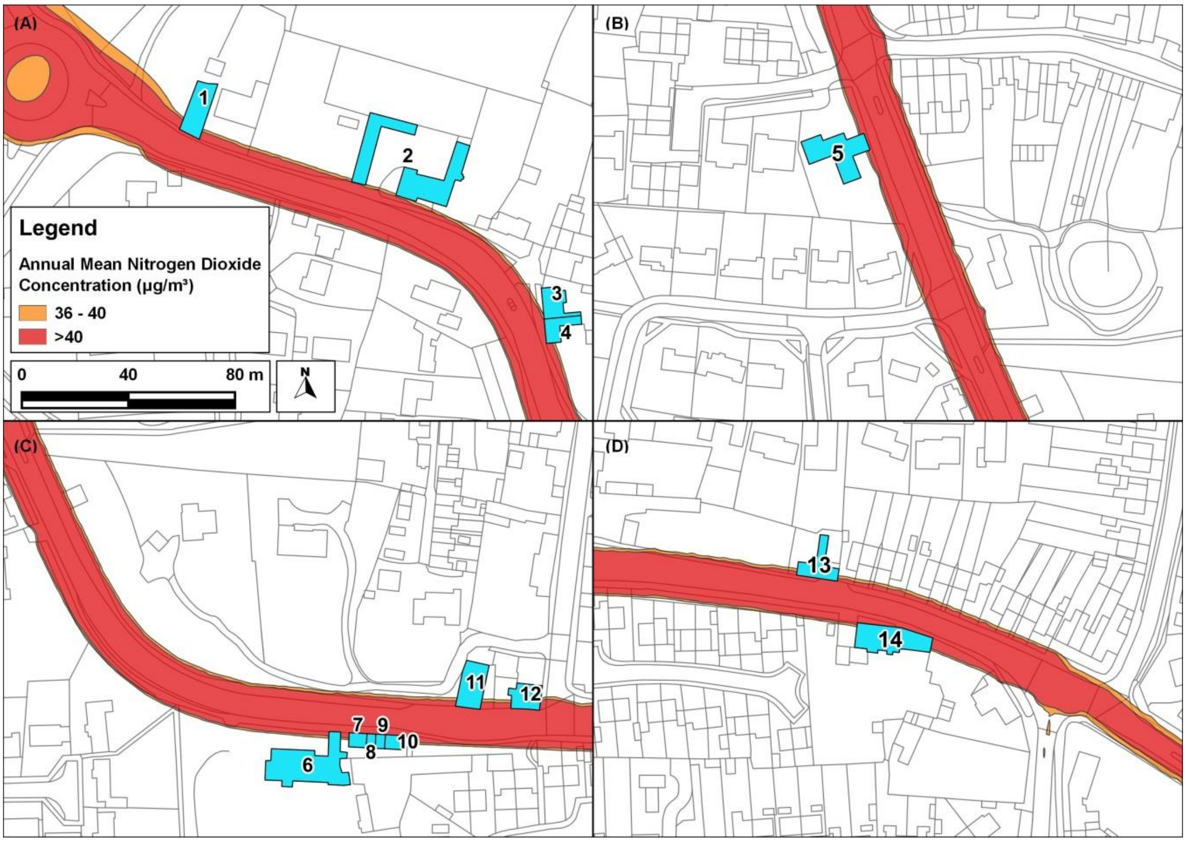

Figure A3.1: Extent of the Modelled Annual Mean Nitrogen Dioxide Concentrations >40 $\mu g/m^3$ (red) and 36-40 $\mu g/m^3$ (orange) in 2016 along Leicester Road (modelled at 1.5 m). The study area has been split into four sections, going south along Leicester Road, from Wistow Road (A) to Church Road (D), to provide greater detail than Figure 3. Specific properties with concentrations >36 $\mu g/m^3$ are highlighted (cyan).

Table A3.1: Specific Properties Within the Proposed AQMA

Property Number	Location
1	81 Leicester Road, Kibworth
2	The Paddocks Farm, 71 Leicester Road, Kibworth
3	53 Leicester Road, Kibworth
4	51 Leicester Road, Kibworth
5	1 Lodge Close, Kibworth
6	70 Leicester Road, Kibworth
7	62 Leicester Road, Kibworth
8	60 Leicester Road, Kibworth
9	58 Leicester Road, Kibworth
10	56 Leicester Road, Kibworth
11	25 Leicester Road, Kibworth
12	2 Main Street, Kibworth
13	11 Leicester Road, Kibworth
14	14 Leicester Road, Kibworth