APPENDIX 9.1:
AIR QUALITY MODELLING STUDY

Appendix 9.1: Air Quality Modelling Study

1.1 This Appendix presents the technical information and data upon which the air quality assessment is based.

Model

1.2 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; which requires a range of input data, which can include pollutant emissions rates, meteorological data and local topographical information.

1.3 The effect of the Development on local air quality was assessed using the advanced atmospheric dispersion model ADMS-Roads, taking into account the contribution of emissions from forecast road-traffic on the local road network and from the heating plant by the completion year.

1.4 The ADMS-Roads model is a comprehensive tool for investigating air pollution in relation to road networks, and can also take into account point sources such as emissions from heating plants. On review of the Site, and its surroundings, ADMS-Roads was considered appropriate for the assessment of the long and short term effects of the proposals on air quality. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations. It can predict long-term and short-term concentrations, including percentile concentrations. The use of the ADMS-Roads model was agreed with the air quality Environment Health Officer (EHO) at Cherwell District Council (CDC).

1.5 ADMS-Roads model is a formally validated model, developed in the United Kingdom (UK) by CERC (Cambridge Environmental Research Consultants). This includes comparisons with data from the UK's air quality Automatic Urban and Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC web site at www.cerc.co.uk.

Model Scenarios

1.6 In order to assess the effect of the Development on local air quality, future 'without Development' and 'with Development' scenarios were assessed. The Development is anticipated to be complete in 2031 and therefore this is the year in which these future without and with development scenarios were modelled. The cumulative North West Bicester development is anticipated to be complete in 2046 and therefore this is the year in which the cumulative assessment has been modelled. The year 2013 was modelled to establish the existing baseline situation because it is the year for which available monitoring data surrounding the Site is available against which the air quality model is verified (discussed further below). Base year traffic data for 2012 and meteorological data for 2013 were also used to be consistent with the verification year.

1.7 Taking into account recent analyses by Defra[1] showing that historical NO_x and NO_2 concentrations are not declining in line with emission forecasts, as outlined in main chapter, a sensitivity analysis has been undertaken on the basis of no future reductions in NO_x/NO_2 concentrations (i.e. considering the potential effects of the Development against the current baseline 2013 conditions by applying the 2031 road traffic data to 2013 background concentrations and road traffic emission rates). The results for this sensitivity analysis are presented further below.

Traffic Data

1.8 Traffic flow data comprising Annual Average Daily Traffic (AADT) flows, traffic composition (% HDVs – Heavy-Duty Vehicles) and speeds (kph) were used in the model as provided by Alan Baxter & Associates LLP for the surrounding road network. Table A1.1 presents the traffic data used within the air quality assessment. Baseline traffic data was supplied for 2012, however following consultation with Alan Baxter & Associates it was confirmed that there would not be a significant change in flows between 2012 and 2013 and therefore the 2012 flows have been used in the model assessment year of 2013 to be consistent with the most recent monitoring data available from CDC.

Vehicle Speeds

1.9 To take into account the presence of slow moving traffic near junctions and at roundabouts, the speed on each road was reduced using the following criteria recommended within LAQM.TG(09)[2]:

- For a busy junction, an average of 20kph (approximately 12mph) was applied; and
- For other junctions (non-motorway) and roundabouts, where some slowing of traffic occurs, the speed was reduced by 10kph compared to the speed limit.

Diurnal Profile

1.10 The ADMS-Roads model uses an hourly traffic flow based on the daily (AADT) flows. Traffic flows follow a diurnal variation throughout the day and week. Therefore, a diurnal profile was used in the model to replicate how the average hourly traffic flow would vary throughout the day and the week. This was based on data collated by Waterman from the Department for Transport (DfT) statistics Table *TRA0307: Traffic distribution by time of day on all roads in Great Britain, 2012*[3]. Figure A1.1 presents the diurnal variation in traffic flows that has been used within the model.

Figure A1.1: Diurnal Traffic Variation

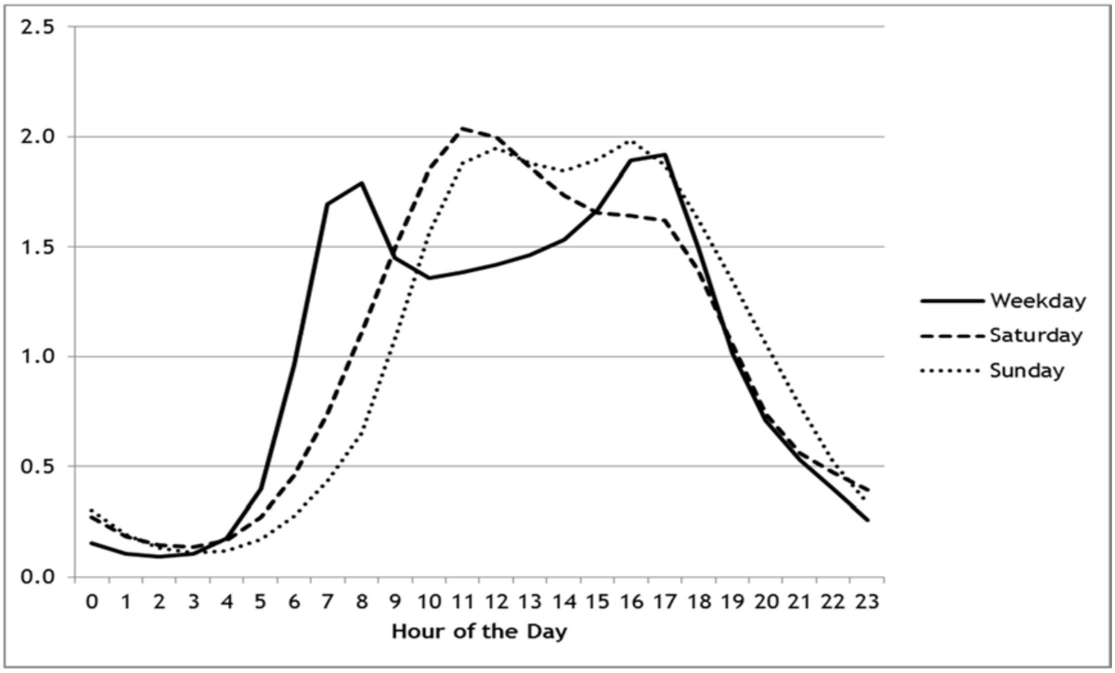


Table A1.1: 24 hour AADT Data Used within the Assessment

Link Name	%HDV	Base 2013	Without 2031	With 2031	2046 Base	2046 With Cumulative Schemes
A41 northbound, N of M40 J9	6.8	13,077	14,925	14,918	14,925	17,097
A41 southbound, N of M40 J9	6.8	11,195	12,148	12,202	12,148	13,976
A41 Oxford Rd, S of A41 junction	6.8	24,442	40,349	41,196	40,349	47,087
Vendee Drive, W of A41 junction	6.8	2,912	8,447	8,822	8,447	10,055
A41, N of Pingle Drive	6.8	15,356	21,597	22,212	21,597	25,365
Middleton Stoney Rd, W of Kings End	6.8	8,786	10,276	10,604	10,276	12,104
Middleton Stoney Rd, W of Howes Lane	6.8	5,859	5,617	8,134	5,617	8,954
Howes Lane, N of Middleton Stoney Rd	6.8	6,362	10,997	10,402	10,997	12,008
Howes Lane, E of Shakespeare Drive	6.8	7,731	10,886	11,113	10,886	12,703
Lords Lane, E of Bucknell Road	6.8	10,261	13,546	12,965	13,546	14,943
Lords Lane, W of Banbury Road	6.8	11,239	13,701	12,942	13,701	14,942
Bucknell Road, N of Lords Lane	6.8	2,124	3,333	2,810	3,333	3,296
Bucknell Road, S of Lords Lane	6.8	6,643	7,005	7,372	7,005	8,395
Banbury Road, N of Lords Lane	6.8	11,142	15,854	16,688	15,854	19,003
A4095 E of Banbury Road	6.8	18,244	20,653	20,858	20,653	23,873
Banbury Road, S of A4095	6.8	5,278	8,191	8,975	8,191	10,170
Buckingham Road, S of Skimmingdish Lane	6.8	7,542	12,143	13,021	12,143	14,794
Queens Avenue, S of Bucknell Road	6.8	12,042	19,870	20,407	19,870	23,308
A41 E of A41 Oxford Road	6.8	21,258	33,634	34,336	33,634	39,246
A4421 Neunkirchen Way	6.8	14,664	18,322	18,811	18,322	21,486
A41, E of London Road roundabout	6.8	22,685	17,422	17,591	17,422	20,134
A4421, E of Skimmingdish Lane	6.8	15,283	22,289	22,928	22,289	26,182
Shakespeare Drive, S of Howes Lane	6.8	1,422	1,079	1,435	1,079	1,593
M40 J10 northbound off slip road	14.5	5,230	6,202	6,824	6,202	7,730
Ardley Road (E of B430)	6.8	1,945	4,335	4,528	4,335	5,160
M40 J10 southbound on slip road (from A43)	14.5	4,896	3,895	3,927	3,895	4,496
B430 M40 over bridge	6.8	21,065	23,972	24,271	23,972	27,771
A4095 N of Chesterton	6.8	5,588	9,928	10,177	9,928	11,626
Shakespeare Drive, E of Middleton Stoney Road	6.8	5,157	8,820	9,537	8,820	10,824
The Approach, W of Bucknell Road	6.8	2,724	4,393	5,191	4,393	5,832
A41 East of Pioneer Road	6.8	21,863	29,434	29,530	29,434	33,827
Bicester Road, E of A4421 junction	6.8	6,193	4,843	4,837	4,843	5,544
A4421 N of Skimmingdish Lane	6.8	11,819	16,551	16,831	16,551	19,247
Fringford Road, N of Caversfield	6.8	900	1,389	1,402	1,389	1,605
B4100 Banbury Road, N of Bainton Road	6.8	11,142	14,282	14,501	14,282	16,586
Ardley Road, N of Bucknell	6.8	1,945	4,267	4,478	4,267	5,101
Middleton Road, W of Bucknell	6.8	189	300	1,267	300	1,311
B4030 Middleton Stoney Road, NW of NWB	6.8	5,859	5,631	6,458	5,631	7,280
Green Lane, W of Chesterton	6.8	3,711	5,670	5,751	5,670	6,579
Wendlebury Road, E of M40	6.8	2,603	3,406	3,486	3,406	3,983
M40	14.5	62,048	73,113	73,113	73,113	73,113

Street Canyon Effect

1.11 Narrow streets with tall buildings on either side have the potential to create a confined space, which can interfere with the dispersion of traffic pollutants and may result in pollutant emissions accumulating in these streets. In an air quality model these narrow streets are described as street canyons.

1.12 ADMS-Roads includes a street canyon model to take account of the additional turbulent flow patterns occurring inside such a narrow street with relatively tall buildings on both sides. LAQM.TG(09) identifies a street canyon *"as narrow streets where the height of buildings on both sides of the road is greater than the road width."*

1.13 Following a review of the road network to be included within the model, it was considered that modelled roads are relatively wide and the majority of existing buildings along these roads are not considered to be tall. The proposed buildings within the Site would not cause any new canyons to be created. Therefore, no street canyons were included within the model for any of the scenarios considered.

Heating Plant

1.14 The proposed heating plant would comprise a combination of boilers; assumed for this assessment to comprise one gas-fired Combined Heat and Power (CHP) plant, four gas-fired boilers and a biomass boiler which would release emissions through flues at the top of proposed Energy Centre building. The stack parameters used within the ADMS-Roads model for the gas-fired CHP and boilers and biomass boiler, are presented in Table A1.2 below. A stack height of 20m is now proposed. However, a stack height of 16m was modelled. This is considered to represent a worst case scenario.

Table A1.2: Stack Parameters for the Heating Plant

Unit	Number	Grid Reference	Flue Diameter (m)	Release Rate (m/s)	Release Height (m)	Release Temperature (deg °C)	Total Emissions (g/s)
200kW Boiler	1		0.35	6	16	101	NOx: 0.004
1000kW Boiler	2		0.35	6	16	101	NOx: 0.044
2000kW Boiler	1	456054, 222956	0.45	6	16	93	NOx: 0.044
550kW Biomass Boiler	1		0.4	6	16	190	NOx: 0.0011 PM_{10}: 0.0004
2MW CHP	1		0.4	27.5	16	120	NOx: 0.36

Note: For gas-fired plants emission factors are not provided for PM_{10} because gas-fired plants do not emit any significant level of particulates therefore PM_{10} emission factors are only provided for the biomass boiler

Road Traffic Emission Factors

1.15 ADMS-Roads version 3.2 SP1 (September 2014) has been used. This includes a number of UK emission factor datasets. The UK Emission Factor Toolkit (EFT) version 6.0.1 published July 2014 and included with the ADMS-Roads model has been used in the assessment.

1.16 The EFT uses traffic flow, %HDV, speed and road type information as input data and calculates outputs as total emissions as g/km and g/km/s for the selected pollutant(s).

1.17 2030 is the latest forecast year available for road traffic emissions. It is assumed that the 2031 and 2046 road traffic emissions will remain at 2030 levels.

Background Pollutant Concentrations

1.18 The ADMS-Roads model requires background pollutant concentration data (i.e. concentrations due to the contribution of pollution sources not directly taken into account in the dispersion modelling), that correspond to the year of assessment, which is added to contributions from the modelled pollution sources.

1.19 Background monitoring is undertaken by CDC using two diffusion tubes, located at Villiers Road approximately 2.0km south east of the Site and at Tarnarisk Gardens approximately 2.7km northeast. Table A1.3 shows the annual mean NO_2 concentrations measured at these locations.

Table A1.3: Annual Mean NO_2 Concentrations at the CDC Urban Background Diffusion Tubes (µg/m^3)

Pollutant	2010	2011	2012	2013
Villiers Road	26.8	19.0	20.5	19.8
Tarnarisk Gardens	22.3	22.3	17.6	17.4

Source: CDC Progress Report 2014

1.20 Table A1.3 shows that at the annual mean NO_2 concentrations are below the annual mean objective of 40µg/m^3 at both diffusion tube locations between 2010 and 2013.

1.21 In addition to the urban background monitoring at the two diffusion tube locations, background concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ are available from the Defra Air Quality Archive for 1x1km grid squares for assessment years between 2011 and 2030. Table A1.4 presents the Defra background concentrations for the year 2013 for the grid square the Site is located within (455500, 223500).

Table A1.4: Defra Background Maps in 2013 for the Grid Squares at the Location of the Site

Pollutant	Annual Mean Concentration (µg/m^3)
NO_x	18.3
NO_2	13.2
PM_{10}	18.0
$PM_{2.5}$	11.9

1.22 The data in Table A1.3 and A1.4 shows that the 2013 monitored urban background NO_2 concentrations at the Villiers Road diffusion tube (19.8µg/m^3) and Tarnarisk Gardens diffusion tube (17.4µg/m^3) are higher than the total Defra background map (13.2µg/m^3). For a conservative assessment, background annual mean NO_2 concentrations have been obtained from the Villiers Road diffusion tube, this was agreed with the EHO at CDC.

1.23 Background concentrations data used within the assessment are presented in Table A1.5.

Table A1.5: Background Concentrations (μg/m^3) Used within the Assessment

Pollutant	Source	2013	2031/2046^
NO_x	Defra background maps	18.3	11.4
NO_2	CDC Diffusion Tube	19.8	12.8*
PM_{10}	Defra background maps	18.0	16.6
$PM_{2.5}$	Defra background maps	11.9	10.6

Notes: ^ 2030 is the latest forecast year available for background projections. It is assumed that 2031 and 2046 background concentrations will remain at 2030 levels.

* 2013 concentration multiplied by 0.647 (ratio obtained from the Defra background map)

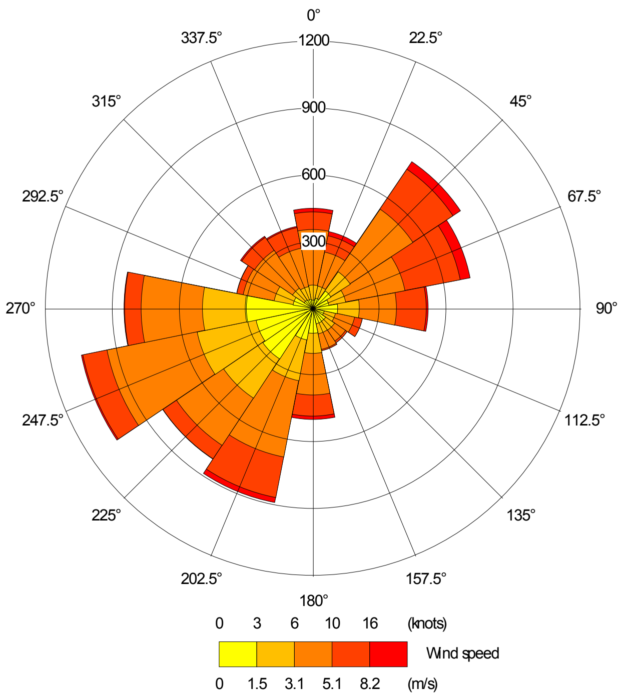
Meteorological Data

1.24 Local meteorological conditions strongly influence the dispersal of pollutants. Key meteorological data for dispersion modelling include hourly sequential data for wind direction, wind speed, temperature, precipitation and the extent of cloud cover for each hour of a given year. As a minimum ADMS-Roads requires wind speed, wind direction, and cloud cover.

1.25 Meteorological data to input into the model were obtained from the Brize Norton Meteorological Station, which is the closest to the Site and considered to be the most representative. The 2013 data were used to be consistent with the base traffic year and model verification year. It was also used for the 2031 scenarios and the 2046 cumulative scenarios for the air quality assessment. Figure A1.2 presents the wind-rose for the meteorological data.

1.26 Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75 m/s. It is recommended in Technical Guidance LAQM.TG(09) that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedences. Technical Guidance LAQM.TG(09) recommends that meteorological data should only be used if the percentage of usable hours is greater than 75%, and preferably 90%. 2013 meteorological data from Brize Norton include 8,728 lines of usable hourly data out of the total 8,760 for the year, i.e. 99.6% of usable data. This is above the 75% threshold, and is therefore adequate for the dispersion modelling.

Figure A1.2: 2013 Wind Rose for the Brize Norton Meteorological Site



Model Data Processing

1.27 The modelling results were processed to calculate the averaging periods required for comparison with the AQS objectives.

1.28 NO_x emissions from combustion sources (including vehicle exhausts) comprise principally nitric oxide (NO) and nitrogen dioxide (NO_2). The emitted nitric oxide reacts with oxidants in the air (mainly ozone (O_3)) to form more NO_2. Since only NO_2 is associated with effects on human health, the air quality standards for the protection of human health are based on NO_2 and not total NO_x or NO.

1.29 The ADMS-Roads model was run without the Chemistry Reaction option to allow verification (see below). Therefore, a suitable NO_X:NO_2 conversion needed to be applied to the modelled NO_X concentrations. There are a variety of different approaches to dealing with NO_X:NO_2 relationships, a number of which are widely recognised as being acceptable. However, the current approach was developed for roadside sites, and is detailed within Technical Guidance LAQM.TG(09).

1.30 The LAQM Support website provides a spreadsheet calculator[4] to allow the calculation of NO_2 from NO_x concentrations, accounting for the difference between primary emissions of NO_x and background NO_x, the concentration of O_3, and the different proportions of primary NO_2 emissions, in different years. This approach is only applicable to annual mean concentrations.

1.31 LAQM.TG(09) paragraph 2.29 states that where stacks are included within models representing wider urban areas and where the annual mean concentrations are the main focus (as is the case in this assessment) then the spreadsheet calculator, described above, can be used for the conversion of total annual mean NO_X to annual average NO_2 concentrations. This guidance was followed for the assessment NO_x concentrations due to the heating plant emissions.

1.32 Research[5] undertaken in support of LAQM.TG(09) has indicated that the 1-hour mean AQS objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60µg/m^3. The 1-hour mean objective is, therefore, not considered further within this assessment where the annual mean NO_2 concentration is predicted to be less than 60µg/m^3.

1.33 In order to calculate the number of PM_{10} 24-hour means exceeding 50µg/m^3 the relationship between the number of 24-hour mean exceedences and the annual mean PM_{10} concentration from LAQM.TG (09)[1] was applied as follows:

$$\textbf{Number of Exceedances} = -18.5 + 0.00145 \times (\text{annual mean}^3) + \frac{206}{\text{annual mean}}.$$

Other Model Parameters

1.34 There are a number of other parameters that are used within the ADMS-Roads model which are described here for completeness and transparency:

- The model requires a surface roughness value to be inputted. A value of 1.0 was used, which is representative of the study area;
- The model requires the Monin-Obukov length (a measure of the stability of the atmosphere) to be inputted. A value of 30m (representative of mixed urban) was used for the modelling.

Model Verification

1.35 Model verification is the process of comparing monitored and modelled pollutant concentrations for the same year, at the same locations, and adjusting modelled concentrations if necessary to be consistent with monitoring data. This increases the robustness of modelling results.

1.36 Discrepancies between modelled and measured concentrations can arise for a number of reasons, for example:

- Traffic data uncertainties;
- Background concentration estimates;
- Meteorological data uncertainties;
- Sources not explicitly included within the model (e.g. car parks and bus stops);
- Overall model limitations (e.g. treatment of roughness and meteorological data, treatment of speeds); and
- Uncertainty in monitoring data, particularly diffusion tubes.

1.37 Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of all of these aspects.

Nitrogen Dioxide

1.38 The ADMS-Roads model was run to predict annual mean NO_x concentrations at five roadside CDC diffusion tube locations.

1.39 As highlighted above, the NO_2 concentrations are a function of NO_x concentrations. Therefore, the roadside NO_x concentration predicted by the model was converted to NO_2 using the NO_x to NO_2 calculator provided by Defra on the air quality archive. The background data for 2013, as presented in Table A1.5 were used.

1.40 The modelled and equivalent measured roadside NO_2 concentrations at the diffusion tube sites were compared as shown in Table A1.6 below.

Table A1.6: 2013 Annual Mean NO_2 Modelled and Monitored Concentrations

Site ID	Monitored Annual Mean NO_2 ($\mu g/m^3$)	Modelled Total Annual Mean NO_2 ($\mu g/m^3$)	% Difference (modelled – monitored)
DT3 Kings End South	48.5	32.0	-34.1
DT4 Kings End North	35.8	26.5	-26.0
DT5 Field Street	38.6	35.0	-9.3
DT6 North Street	42.7	34.2	-19.9
DT7 Queens Avenue	41.0	30.5	-25.7

1.41 Table A1.6 indicates that the model under predicts annual mean NO_2 concentrations at the five diffusion tube locations. Technical Guidance LAQM.TG(09) suggests that where there is disparity between modelled and monitored results, particularly if this is by more than 25%, appropriate adjustment should be undertaken.

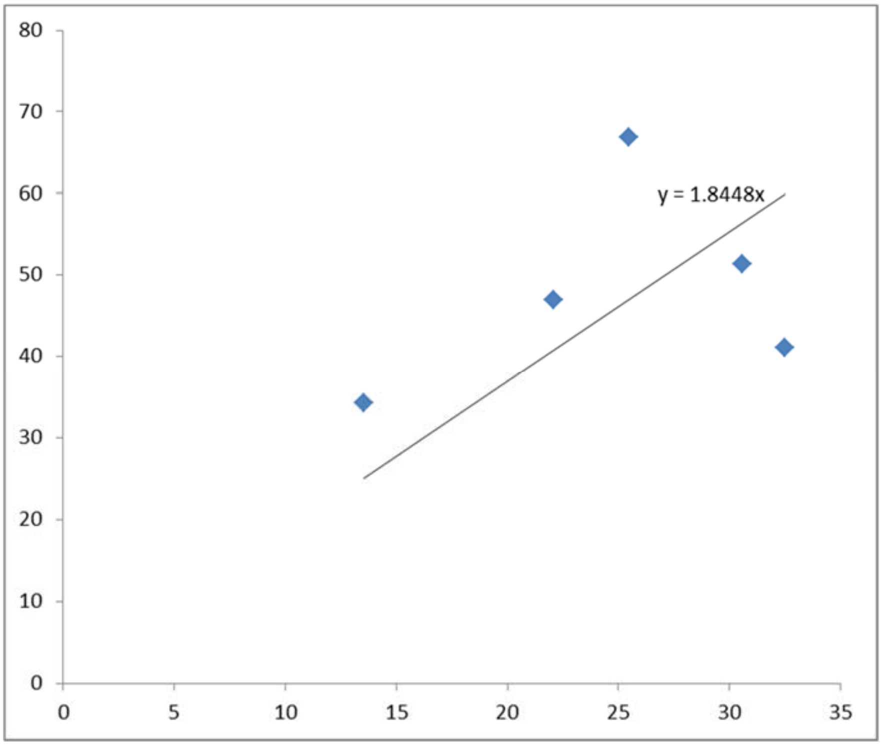
1.42 LAQM.TG(09) presents a number of methods for approaching model verification and adjustment. Example 2, of Annex 3 in the LAQM.TG (09) guidance document, indicates a method based on adjusting NO_2 road contribution and calculating a single adjustment factor. This method refers to modelling based on road traffic sources and can be applied to either a single diffusion tube location, or where numerous diffusion tube monitoring locations are sited within the modelled area. This requires the roadside NO_x contribution to be calculated. In addition, monitored NO_x concentrations are required, which have been calculated from the annual mean NO_2 concentration at the diffusion tube site using the NO_x to NO_2 spreadsheet calculator as described above. The steps involved in the adjustment process are presented in Table A1.7.

Table A1.7: Model Verification Result for Adjustment NO_x Emissions ($\mu g/m^3$)

Site ID	Monitored NO_2	Monitored NO_x	Monitored Road NO_2	Monitored Road NO_x	Modelled Road NO_x	Ratio of Monitored Road Contribution NO_x/Modelled Road Contribution NO_x
DT3	48.5	85.4	28.7	66.9	25.5	2.6
DT4	35.8	52.8	16.0	34.3	13.6	2.5
DT5	38.6	59.5	18.8	41.0	32.5	1.3
DT6	42.7	69.8	22.9	51.3	30.6	1.7
DT7	41.0	65.5	21.2	47.0	22.1	2.1
					Adjustment Factor	**1.8448**

1.43 Figure A1.3 shows the mathematical relationship between modelled and monitored roadside NO_x (i.e. total NO_x minus background NO_x) in a scatter graph (data taken from Table A1.7), with a trendline passing through zero and its derived equation.

Figure A1.3: Unadjusted Modelled versus Monitored Annual Mean Roadside NO_x at the Monitoring Sites (µg/m³)



1.44 Consequently in Table A1.8 the adjustment factor (1.8448) obtained from Figure A1.3 is applied to the modelled NO_x Roadside concentrations to obtain improved agreement between monitored and modelled annual mean NO_x. This has been converted to annual mean NO_2 using the NO_x:NO_2 spreadsheet calculator.

Table A1.8: Final Adjusted Annual Average NO_2 Concentrations Compared to Monitored Annual Mean NO_2 Concentrations (µg/m³)

Site ID	Adjusted Modelled Road NO_x	Adjusted Modelled Total NO_x	Modelled Total NO_2	Monitored Total NO_2	% Difference
DT3	47.0	65.5	41.0	48.5	-15.5
DT4	25.0	43.5	31.8	35.8	-11.3
DT5	59.9	78.4	46.0	38.6	19.1
DT6	56.5	75.0	44.7	42.7	4.6
DT7	40.8	59.3	38.5	41.0	-6.1

1.45 The data in Table A1.8 indicates an improved agreement between monitored and modelled annual mean NO_2 results compared to the unadjusted/unverified model.

1.46 The NO_x adjustment process was subsequently applied to all of roadside NO_x modelling for 2013 and 2031 ‘without’ and ‘with’ the Development in place, at the specific receptors locations assessed, before heating plant concentrations were added and before the predicted concentrations were converted to NO_2.

Particulate Matter (PM_{10} and $PM_{2.5}$)

1.47 PM_{10} and $PM_{2.5}$ monitoring data is not available for the Site area. Therefore, the roadside modelled NO_x adjustment factor of 1.8448 was applied to all the roadside PM_{10} and $PM_{2.5}$ modelling results, before adding on the background concentrations, for the study area for 2013 and each of the 2031 scenarios, at the specific receptors locations assessed, and before the number of daily exceedences was calculated.

Verification Summary

1.48 Any atmospheric dispersion model study will always have a degree of inaccuracy due to a variety of factors. These include uncertainties in traffic emissions data, in the differences between available meteorological data and the specific microclimate at each receptor location, simplifications made in the model algorithms that describe the atmospheric dispersion and chemical processes. There will also be uncertainty in the comparison of predicted concentrations with monitored data, given the potential for errors and uncertainty in sampling methodology (technique, location, handling, and analysis) as well as processing of any monitoring data.

1.49 Whilst systematic under or over prediction can be taken in to account through the model verification / adjustment process, random errors will inevitably occur and a level of uncertainty will still exist in corrected / adjusted data.

1.50 Model uncertainties arise because of limited scientific knowledge, limited ability to assess the uncertainty of model inputs, for example, emissions from vehicles, poor understanding of the interaction between model and / or emissions inventory parameters, sampling and measurement error associated with monitoring sites and whether the model itself completely describes all the necessary atmospheric processes.

1.51 Overall, it is concluded that with the adjustment factors applied to the ADMS-Roads model, it is performing well and modelled results are considered to be suitable to determine the effects of the Development on local air quality.

NO_2 Sensitivity Test

1.52 Whilst this air quality assessment was based on current guidance, i.e., with reduced emission rates and background concentration for the completion year of 2031, to take into account the trend that NO_x and NO_2 concentrations are not declining as expected[1], a sensitivity test has been carried out, on the basis of no future reductions in road traffic emission rates and background concentrations (i.e. considering the potential effect of the Himley Village Development against the current baseline, 2013, conditions). Modelled results of this additional scenario are presented in Table A1.9.

Table A1.9: Results of the ADMS-Roads Modelling at Sensitive Receptors, Assuming No Improvement in NO_x and NO_2

Receptor ID	2031 Without Development	2031 With Development	2031 Change
1	24.2	24.5	0.3
2	24.2	25.2	1.0
3	23.4	24.5	1.1
4	28.0	28.6	0.6
5	24.8	25.0	0.3

Receptor ID	2031 Without Development	2031 With Development	2031 Change
6	27.5	27.7	0.2
7	28.1	28.3	0.2
8	22.4	22.4	0.1
9	22.8	22.9	0.1
10	28.2	28.4	0.2
11	25.9	26.0	0.1
12	30.4	30.7	0.3
13	30.9	31.2	0.2
14	26.4	26.5	0.2
15	26.5	26.5	0.0
16	28.2	28.4	0.2
17	31.8	32.1	0.2
18	22.6	22.9	0.2
19	29.4	29.4	-0.1
20	28.6	28.9	0.3
21	28.3	29.2	0.9
22	26.9	27.1	0.2
23	**43.7**	**44.4**	0.6
24	23.3	23.5	0.2
25	**52.8**	**53.8**	1.0
26	24.7	24.7	0.0
27	**43.4**	**44.1**	0.7
28	38.3	38.8	0.5
29	**42.2**	**42.8**	0.6
30	34.5	34.8	0.3
31	26.4	26.6	0.2
32	25.7	25.8	0.1
33	26.4	26.5	0.0
34	-	25.0	-
35	-	24.4	-

Note: Exceedences of the AQS objective highlighted in **Bold**

1.53 Table A1.10 summarises the magnitude of change (as outlined in Table 9.6 of the ES chapter) and the significance of effects (as outlined in Table 9.7 of the ES chapter) for annual mean NO_2 concentrations 'with' the Development, assuming no improvements to NO_x and NO_2. The changes in pollutant concentrations, and absolute pollutant concentrations, presented in this sensitivity analysis, and therefore the effect significance criteria, will be less than those presented as the Euro 6 emission standards will take effect post 2015.

Table A1.10: Magnitude of Change and Significant of Effects for Annual Mean NO_2 Concentrations with the Development in 2031, Assuming No Improvement in NO_x and NO_2

ID	Receptor Location	Magnitude of Change (see Table9.6 of the ES chapter)	Significance (dependent on magnitude of change and magnitude of concentration see Table 9.7 of the ES chapter)
1		Imperceptible	Negligible
2		Small	Negligible
3		Small	Negligible
4		Small	Negligible
5		Imperceptible	Negligible
6		Imperceptible	Negligible
7		Imperceptible	Negligible
8		Imperceptible	Negligible
9		Imperceptible	Negligible
10		Imperceptible	Negligible
11		Imperceptible	Negligible
12		Imperceptible	Negligible
13		Imperceptible	Negligible
14		Imperceptible	Negligible
15		Imperceptible	Negligible
16		Imperceptible	Negligible
17		Imperceptible	Negligible
18		Imperceptible	Negligible
19		Imperceptible	Negligible
20		Imperceptible	Negligible
21		Small	Negligible
22		Imperceptible	Negligible
23		Small	Minor Adverse
24		Imperceptible	Negligible
25		Small	Minor Adverse
26		Imperceptible	Negligible
27		Small	Minor Adverse
28		Small	Minor Adverse
29		Small	Minor Adverse
30		Imperceptible	Negligible
31		Imperceptible	Negligible
32		Imperceptible	Negligible
33		Imperceptible	Negligible

References

1 http://laqm.defra.gov.uk/faqs/faqs.html: Measured nitrogen oxides (NO_x) and/or nitrogen dioxide (NO_2) concentrations in my local authority area do not appear to be declining in line with national forecasts.

2 Defra, 2009, Local Air Quality Management Technical Guidance LAQM.TG(09)

3 Department for Transport (DfT) Statistics, www.dft.gov.uk/statistics/series/traffic

4 AEA, NO_X to NO_2 Calculator, http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php Version 4.1, 19 June 2014

5 AEA, 'Analysis of the relationship between annual-mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective', 2008.