Appendix 8A - Dispersion Modelling Inputs

Road Traffic Assessment Inputs

Additional vehicle trips associated with the development have the potential to result in air quality impacts as a result of increased traffic exhaust emissions. Dispersion modelling using ADMS Roads was therefore undertaken to predict pollutant concentrations at sensitive locations both with and without the development in order to consider potential changes as a result of the proposals.

The dispersion model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and,
- Monin-Obukhov length.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS Roads dispersion model (version 3.2). ADMS Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the area NGR: 454500, 221000 to 460500, 226500. A Cartesian grid with a height of 1.5m, to represent exposure at ground level, was used within the model to produce data suitable for contour plotting using the Surfer software package.

Reference should be made to Figure 8-12 for a graphical representation of the assessment extents.

Traffic Flow Data

Traffic data for use in the assessment was provided by Hyder Consulting (UK) Ltd, the Transport Consultants for the development. This included the following scenarios:

- 2012 Baseline;
- 2031 Do Minimum (DM) - anticipated traffic flows without the Development;

- 2031 Do Something (DS) - anticipated traffic flows including predicted variations as a result of the Development; and,
- 2031 Cumulative - anticipated traffic flows including predicted variations as a result of the Development and other committed and proposed developments.

Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the baseline traffic data used in the assessment is provided in Table 8A-1.

Table 8A-1 Baseline Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Speed (km/h)
1	A41 Northbound, N of M40 J9	7.3	13,446	6.8	90
2	A41 Southbound, N of M40 J9	8.0	11,511	6.8	90
3A1	A41 Oxford Road Northbound, S of A41 Junction	7.8	12,565	6.8	60
3A2	A41 Oxford Road Northbound, A41 Junction	10.4	12,565	6.8	20
3B1	A41 Oxford Road Southbound, S of A41 Junction	7.6	12,565	6.8	60
3B2	A41 Oxford Road Southbound, A41 Junction	9.9	12,565	6.8	20
4A	Vendee Drive	5.0	2,995	6.8	40
4B	Vendee Drive Junction at A41	5.0	2,995	6.8	10
4C	Vendee Drive Junction at A4095	5.0	2,995	6.8	10
5A	A41 Northbound between Pringle Drive and Middleton Stoney Road	7.9	7,894	6.8	20
5B	A41 Southbound between Pringle Drive and Middleton Stoney Road	7.3	7,894	6.8	20
5C	A41 Junction from Pringle Drive Roundabout Northbound	8.0	7,894	6.8	10
5D	A41 Junction from Pringle Drive Roundabout Southbound	9.1	7,894	6.8	10
5E	A41 between Pringle Drive and Middleton Stoney Road	8.8	15,789	6.8	30
5F	A41 between Pringle Drive and Middleton Stoney Road Junction	10.3	15,789	6.8	10
6A	Middleton Stoney Road, W of Kings End	9.5	9,033	6.8	80
6B	Middleton Stoney Road, W of Kings End Junction	9.6	9,033	6.8	20
7	Middleton Stoney Road, W of Howes Lane	7.0	6,024	6.8	80
8A	Howes Lane	7.0	7,949	6.8	80

8B	Howes Lane Junction at Middleton Stoney Road	11.9	7,949	6.8	20
8C	Howes Lane Junction at Bucknell Road	14.8	7,949	6.8	20
9A	Lords Lane	10.2	11,555	6.8	80
9B	Lords Lane Junction at Bucknell Road	13.8	11,555	6.8	20
9C	Lords Lane Junction at Banbury Road	12.9	11,555	6.8	20
10A	Bucknell Road, N of Lords Lane	5.5	2,184	6.8	90
10B	Bucknell Road, N of Lords Lane Junction	17.1	2,184	6.8	20
11A	Bucknell Road, S of Howes Lane	10.7	6,830	6.8	30
11B	Bucknell Road, S of Howes Lane Junction at Lords Lane	12.1	6,830	6.8	10
11C	Bucknell Road, S of Howes Lane Junction at Queens Road	9.6	6,830	6.8	10
12A	Banbury Road, N of Lords Lane	5.8	11,456	6.8	80
12B	Banbury Road, N of Lords Lane Junction	15.3	11,456	6.8	20
13A	A4095 E of Banbury Road between B4100 and Buckingham Road	8.9	18,758	6.8	80
13B	A4095 E of Banbury Road Junction at B4100	15.3	18,758	6.8	20
13C	A4095 E of Banbury Road Junction W of Buckingham Road	18.7	18,758	6.8	20
13D	A4095 E of Banbury Road between Buckingham Road and Lauton Road	8.7	18,758	6.8	80
13E	A4095 E of Banbury Road Junction E of Buckingham Road	14.1	18,758	6.8	20
13F	A4095 E of Banbury Road Junction W of Lauton Road	12.1	18,758	6.8	20
13G	A4095 E of Banbury Road between Lauton Road and Charbridge Lane	6.8	18,758	6.8	50
13H	A4095 E of Banbury Road Junction E of Lauton Road	9.6	18,758	6.8	20
13I	A4095 E of Banbury Road Junction at Charbridge Lane	7.9	18,758	6.8	20
14A	Banbury Road, S of A4095	7.6	5,427	6.8	60
14B	Banbury Road, S of A4095 Junction at A4095	13.8	5,427	6.8	20
14C	Banbury Road, S of A4095 Junction at Queens Road	11.6	5,427	6.8	20
15A	Buckingham Road, S of Skimmingdish Lane	8.4	7,755	6.8	60
15B	Buckingham Road Junction at Skimmingdish	15.6	7,755	6.8	20

	Lane				
15C	Buckingham Road Junction at Queens Road	8.5	7,755	6.8	20
16A	Queens Road	7.8	12,381	6.8	20
16B	Queens Road Junction at B4100	11.8	12,381	6.8	10
16C	Queens Road Junction at B4030	11.7	12,381	6.8	10
17A	A41 E of A41 Oxford Road	9.3	21,857	6.8	90
17B	A41 E of A41 Oxford Road Junction at Oxford Road	15.8	21,857	6.8	20
17C	A41 E of A41 Oxford Road Junction at B4100	18.9	21,857	6.8	20
18A	A4421 Nuenkirchen Way	17.8	15,077	6.8	80
18B	A4421 Nuenkirchen Way Junction at B4100	17.1	15,077	6.8	20
18C	A4421 Nuenkirchen Way Junction at Peregrine Way	20.8	15,077	6.8	20
19A	A41, E of London Road Roundabout	10.5	23,325	6.8	80
19B	A41, E of London Road Roundabout Junction	18.0	23,325	6.8	20
20A	A4421, E of Skimmingdish Lane	9.7	15,714	6.8	80
20B	A4421, E of Skimmingdish Lane Junction at Peregrine Way	15.4	15,714	6.8	20
20C	A4421, E of Skimmingdish Lane Junction at A4421	12.1	15,714	6.8	20
21A	Shakespeare Drive	7.1	1,462	6.8	30
21B	Shakespeare Drive Junction at Howes Lane	9.8	1,462	6.8	10
21C	Shakespeare Drive Junction at Middleton Stoney Road	16.1	1,462	6.8	10
22	M40 J10 Northbound off sliproad	5.7	5,377	14.5	50
23A	Ardley Road E of B430	6.7	2,000	6.8	70
23B	Ardley Road E of B430 Junction	11.1	2,000	6.8	20
24	M40 J20 Southbound on sliproad	4.5	5,034	14.5	50
25A	B430 M40 Overbridge Eastbound	7.5	10,829	6.8	30
25B	B430 M40 Overbridge Westbound	6.8	10,829	6.8	30
26A	A4095 North of Chesterton	5.9	5,745	6.8	90
26B	A4095 North of Chesterton Junction	9.1	5,745	6.8	20
27	A41 E of Pioneer Road	6.9	22,479	6.8	90
28A	Bicester Road, E of A4421	5.1	6,367	6.8	30
28B	Bicester Road, E of A4421 Junction	10.6	6,367	6.8	10
29A	A4421 N of Skimmingdish Lane	7.1	12,152	6.8	80

29B	A4421 N of Skimmingdish Lane Junction	9.8	12,152	6.8	20
30A	Fringford Road	7.8	925	6.8	60
30B	Fringford Road Junction	10.2	925	6.8	10
31	B4100 banbury Road, N of Bainton Road	7.1	11,456	6.8	80
32A	Middleton Road, W of Bucknell	3.7	194	6.8	70
32B	Middleton Road, W of Bucknell Junction	8.4	194	6.8	10
33A	Green Lane W of Chesterton	5.7	3,815	6.8	80
33B	Green Lane W of Chesterton Junction	7.6	3,815	6.8	20
34A	Wendlebury Road E of M40	6.1	2,676	6.8	50
34B	Wendlebury Road E of M40	14.7	2,676	6.8	20
35	M40 Northbound, S of J10/ N of J9	10.1	85,545	14.5	100
36	M40 Southbound, S of J10/ N of J9	10.4	76,957	14.5	100
37	M40 Northbound, N of J10	10.9	80,638	14.5	100
38	M40 Southbound, N of J10	10.3	72,188	14.5	100

The 2031 traffic data is shown in Table 8A-2.

Table 8A-2 2031 Traffic Data

Road Link		24-hour AADT Traffic Flow			HDV Prop. (%)
		DM	DS	Cumulative	
1	A41 Northbound, N of M40 J9	15,178	15,166	15,173	6.8
2	A41 Southbound, N of M40 J9	12,354	12,434	12,541	6.8
3A1	A41 Oxford Road Northbound, S of A41 Junction	20,516	21,140	22,085	6.8
3A2	A41 Oxford Road Northbound, A41 Junction	20,516	21,140	22,085	6.8
3B1	A41 Oxford Road Southbound, S of A41 Junction	20,516	21,140	22,085	6.8
3B2	A41 Oxford Road Southbound, A41 Junction	20,516	21,140	22,085	6.8
4A	Vendee Drive	8,590	9,145	9,953	6.8
4B	Vendee Drive Junction at A41	8,590	9,145	9,953	6.8
4C	Vendee Drive Junction at A4095	8,590	9,145	9,953	6.8
5A	A41 Northbound between Pringle Drive and Middleton Stoney Road	10,981	11,435	12,122	6.8
5B	A41 Southbound between Pringle Drive and Middleton Stoney Road	10,981	11,435	12,122	6.8

5C	A41 Junction from Pringle Drive Roundabout Northbound	10,981	11,435	12,122	6.8
5D	A41 Junction from Pringle Drive Roundabout Southbound	10,981	11,435	12,122	6.8
5E	A41 between Pringle Drive and Middleton Stoney Road	21,962	22,870	24,245	6.8
5F	A41 between Pringle Drive and Middleton Stoney Road Junction	21,962	22,870	24,245	6.8
6A	Middleton Stoney Road, W of Kings End	10,450	10,934	11,640	6.8
6B	Middleton Stoney Road, W of Kings End Junction	10,450	10,934	11,640	6.8
7	Middleton Stoney Road, W of Howes Lane	10,450	9,425	15,025	6.8
8A	Howes Lane	11,183	10,304	9,008	6.8
8B	Howes Lane Junction at Middleton Stoney Road	11,183	10,304	9,008	6.8
8C	Howes Lane Junction at Bucknell Road	11,183	10,304	9,008	6.8
9A	Lords Lane	13,933	12,812	11,138	6.8
9B	Lords Lane Junction at Bucknell Road	13,933	12,812	11,138	6.8
9C	Lords Lane Junction at Banbury Road	13,933	12,812	11,138	6.8
10A	Bucknell Road, N of Lords Lane	3,390	2,615	1,476	6.8
10B	Bucknell Road, N of Lords Lane Junction	3,390	2,615	1,476	6.8
11A	Bucknell Road, S of Howes Lane	7,124	7,664	8,506	6.8
11B	Bucknell Road, S of Howes Lane Junction at Lords Lane	7,124	7,664	8,506	6.8
11C	Bucknell Road, S of Howes Lane Junction at Queens Road	7,124	7,664	8,506	6.8
12A	Banbury Road, N of Lords Lane	16,122	17,356	19,148	6.8
12B	Banbury Road, N of Lords Lane Junction	16,122	17,356	19,148	6.8
13A	A4095 E of Banbury Road between B4100 and Buckingham Road	21,003	21,305	21,741	6.8
13B	A4095 E of Banbury Road Junction at B4100	21,003	21,305	21,741	6.8
13C	A4095 E of Banbury Road Junction W of Buckingham Road	21,003	21,305	21,741	6.8
13D	A4095 E of Banbury Road between Buckingham Road and Lauton Road	21,003	21,305	21,741	6.8

13E	A4095 E of Banbury Road Junction E of Buckingham Road	21,003	21,305	21,741	6.8
13F	A4095 E of Banbury Road Junction W of Lauton Road	21,003	21,305	21,741	6.8
13G	A4095 E of Banbury Road between Lauton Road and Charbridge Lane	21,003	21,305	21,741	6.8
13H	A4095 E of Banbury Road Junction E of Lauton Road	21,003	21,305	21,741	6.8
13I	A4095 E of Banbury Road Junction at Charbridge Lane	21,003	21,305	21,741	6.8
14A	Banbury Road, S of A4095	8,329	9,485	11,247	6.8
14B	Banbury Road, S of A4095 Junction at A4095	8,329	9,485	11,247	6.8
14C	Banbury Road, S of A4095 Junction at Queens Road	8,329	9,485	11,247	6.8
15A	Buckingham Road, S of Skimmingdish Lane	12,349	13,642	15,620	6.8
15B	Buckingham Road Junction at Skimmingdish Lane	12,349	13,642	15,620	6.8
15C	Buckingham Road Junction at Queens Road	12,349	13,642	15,620	6.8
16A	Queens Road	20,206	21,000	22,169	6.8
16B	Queens Road Junction at B4100	20,206	21,000	22,169	6.8
16C	Queens Road Junction at B4030	20,206	21,000	22,169	6.8
17A	A41 E of A41 Oxford Road	34,202	35,238	36,800	6.8
17B	A41 E of A41 Oxford Road Junction at Oxford Road	34,202	35,238	36,800	6.8
17C	A41 E of A41 Oxford Road Junction at B4100	34,202	35,238	36,800	6.8
18A	A4421 Nuenkirchen Way	18,631	19,355	20,437	6.8
18B	A4421 Nuenkirchen Way Junction at B4100	18,631	19,355	20,437	6.8
18C	A4421 Nuenkirchen Way Junction at Peregrine Way	18,631	19,355	20,437	6.8
19A	A41, E of London Road Roundabout	17,716	17,966	18,341	6.8
19B	A41, E of London Road Roundabout Junction	17,716	17,966	18,341	6.8
20A	A4421, E of Skimmingdish Lane	22,666	23,610	25,002	6.8
20B	A4421, E of Skimmingdish Lane Junction at Peregrine Way	22,666	23,610	25,002	6.8
20C	A4421, E of Skimmingdish Lane	22,666	23,610	25,002	6.8

	Junction at A4421				
21A	Shakespeare Drive	1,097	1,623	2,421	6.8
21B	Shakespeare Drive Junction at Howes Lane	1,097	1,623	2,421	6.8
21C	Shakespeare Drive Junction at Middleton Stoney Road	1,097	1,623	2,421	6.8
22	M40 J10 Northbound off sliproad	6,307	7,223	8,634	14.54
23A	Ardley Road E of B430	4,408	4,691	5,141	6.8
23B	Ardley Road E of B430 Junction	4,408	4,691	5,141	6.8
24	M40 J20 Southbound on sliproad	3,960	7,223	4,088	14.5
25A	B430 M40 Overbridge Eastbound	12,189	12,410	12,728	6.8
25B	B430 M40 Overbridge Westbound	12,189	12,410	12,728	6.8
26A	A4095 North of Chesterton	10,095	10,463	11,025	6.8
26B	A4095 North of Chesterton Junction	10,095	10,463	11,025	6.8
27	A41 E of Pioneer Road	29,932	30,073	30,276	6.8
28A	Bicester Road, E of A4421	4,925	4,916	4,890	6.8
28B	Bicester Road, E of A4421 Junction	4,925	4,916	4,890	6.8
29A	A4421 N of Skimmingdish Lane	16,831	17,242	17,893	6.8
29B	A4421 N of Skimmingdish Lane Junction	16,831	17,242	17,893	6.8
30A	Fringford Road	1,412	1,432	1,461	6.8
30B	Fringford Road Junction	1,412	1,432	1,461	6.8
31	B4100 banbury Road, N of Bainton Road	14,523	14,846	15,355	6.8
32A	Middleton Road, W of Bucknell	305	1,734	3,862	6.8
32B	Middleton Road, W of Bucknell Junction	305	1,734	3,862	6.8
33A	Green Lane W of Chesterton	5,766	5,886	6,066	6.8
33B	Green Lane W of Chesterton Junction	5,766	5,886	6,066	6.8
34A	Wendlebury Road E of M40	3,464	3,580	3,778	6.8
34B	Wendlebury Road E of M40	3,464	3,580	3,778	6.8
35	M40 Northbound, S of J10/ N of J9	86,553	87,863	89,892	14.5
36	M40 Southbound, S of J10/ N of J9	72,452	72,552	72,718	14.5
37	M40 Northbound, N of J10	81,104	81,186	81,319	14.5
38	M40 Southbound, N of J10	79,050	79,130	79,251	14.5

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 6.0.1) released in July 2014, which incorporates updated COPERT4v10 vehicle emissions factors for NO_x and vehicle fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. A review of the Highways Agency Interim Advice Note 170/12 (Ref 8-10) proposes that currently published future NO_x and NO_2 projections may be too pessimistic and advises a Gap Analysis Method for the prediction of future year conditions. As such, the relevant spreadsheet was utilised within information from DEFRA and model outputs to represent future year NO_2 concentrations.

A summary of the traffic emission, traffic data and background pollutant concentrations utilised for each scenario is shown in Table 8A-3.

Table 8A-3 Data Requirements for Each Assessment Scenario

Scenario	Traffic Data (Year)	Vehicle Emission (Year)	NO_2 Background Concentration ($\mu g/m^3$)	PM_{10} Background Concentration ($\mu g/m^3$)
Base Year (2013)	2013	2013	19.80 (2013)	18.15 (2013)
Projected Base Year (2031)	2013	2031	13.78 (2031)	16.80 (2031)
Do-Minimum	2031	2031	13.78 (2031)	16.80 (2031)
Do-Something	2031	2031	13.78 (2031)	16.80 (2031)

Meteorological Data

Meteorological data used in the assessment was taken from Brize Norton meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive). Brize Norton meteorological station is located at NGR: 42881, 205734 which is approximately 32km north-west of the proposed development.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 8-11 for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 1m was used in this dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the dispersion modelling assessment area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the nature of the assessment area and is suggested within ADMS-Roads as being suitable for 'mixed urban/industrial'.

Background Concentrations

An annual mean NO_2 concentration of 19.80µg/m^3, as measured at the Villiers Road diffusion tube in 2013, was used to represent background levels in the vicinity of the site during the verification process. This monitoring location is distanced from major road sources and as such is considered to provide a reasonable estimation of background pollutant concentrations for an assessment of this nature.

An annual mean PM_{10} concentration of 18.15µg/m^3, as predicted by DEFRA, was used to represent background levels in the vicinity of this site for the verification process.

Background concentration estimates for 2013 were utilised for the future year scenarios in accordance with the Highways Agency Interim Advice Note (Ref-8-9). This was calculated by factoring the measured NO_2 concentration from the Villiers Road diffusion tube to 2031 using the relationship between the predicted 2013 and 2031 background concentrations provided by DEFRA. Therefore, an annual mean NO_2 concentration of 13.78µg/m^3 and an annual mean PM_{10} concentration of 16.80µg/m^3 were used to represent background levels in the vicinity of the site during 2031.

Reference should be made to Table 8A-3 for a summary of background pollutant concentrations for each scenario.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM.TG(09).

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2013 using traffic data, meteorological data and monitoring results from this year.

CDC undertakes diffusion tube monitoring of NO_2 concentrations at five suitable locations within the modelling extents. Monitoring results for these locations were obtained from the most recent LAQM Progress Report for the purpose of this assessment. The road contribution to total NO_x concentration at the monitoring locations was calculated following the methodology contained within DEFRA guidance LAQM.TG(09). The monitored annual mean NO_2 concentrations and calculated roadside NO_x concentrations are summarised in Table 8A-4.

Table 8A-4 Monitoring Results

Location		2013 Monitored NO_2 Concentration (µg/m^3)	Calculated Roadside NO_x Concentration (µg/m^3)
3	Kings End South	48.5	66.91
4	Kings End North	35.8	34.29
5	Field Street	38.6	41.02
6	North Street	42.7	51.33
7	Queens Avenue	41.0	46.98

The dispersion model was run with the traffic input data previously detailed to predict NO_x concentrations at the monitoring locations. The results are shown in Table 8A-5.

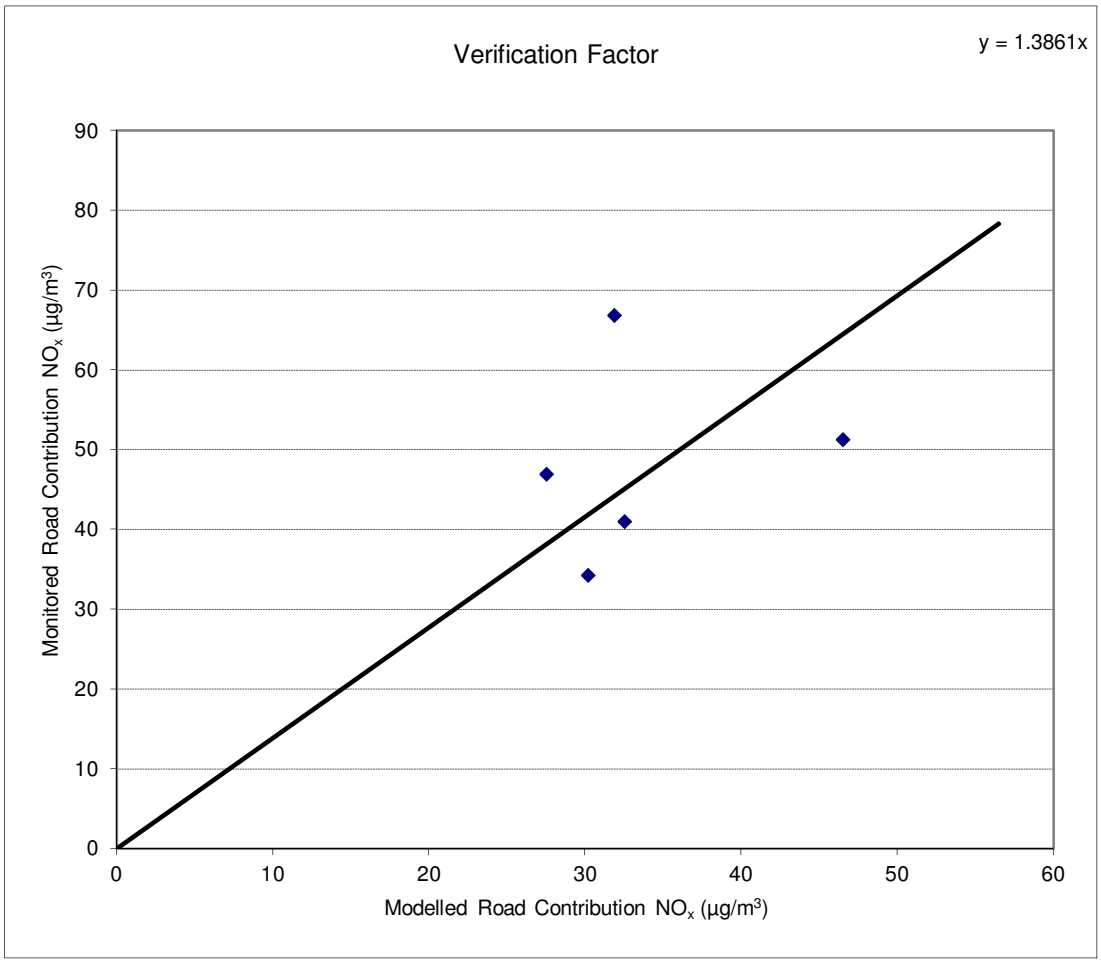
Table 8A-5 Modelled Concentrations

Location		Modelled Roadside NO_x Concentration (µg/m^3)
3	Kings End South	31.86
4	Kings End North	30.17
5	Field Street	32.51
6	North Street	46.50
7	Queens Avenue	27.50

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of this trendline based on the linear progression through zero calculated, as shown in Graph 1. This indicated a verification factor of 1.3861 was required to be applied to all modelling results.

As PM_{10} monitoring is not undertaken within the assessment extents, a verification factor of 1.3861 was also used to adjust model predictions of this pollutant in accordance with the guidance provided within LAQM.TG(09).

Graph 1 Verification Factor



Energy Centre Assessment Inputs

Atmospheric emissions from the Energy Centre have the potential to result in air quality impacts in the vicinity of the Development. Dispersion modelling using ADMS 5 was therefore undertaken in order to consider potential changes as a result of the proposals. This included modelling of both Energy Centre 2 (EC2) (associated with Application 1 (North of Railway)) and Energy Centre 3 (EC3) (associated with Application 2 (South of Railway)). Concentrations were apportioned between the relevant sources to ensure both individual and cumulative impacts could be determined.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using ADMS 5 (v5.0.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS 5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a

skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology, and calculates user-selected long-term and short-term averages.

Source Locations

The relevant Energy Centre and stack locations are summarised in Table 8A-6.

Table 8A-6 Source Locations

Building	Building Location (NGR)		Stack	Stack Location (NGR)	
	X	Y		X	Y
EC2	457192	224241	EC2-1	457185	224250
			EC2-2	457185	224249
			EC2-3	457184	224250
			EC2-4	457184	224249
EC3	456641	223440	EC3-1	456640	223451
			EC3-2	456639	223451

Process Conditions

It is currently anticipated that EC2 will comprise four Ener-G E425 CHP engines and EC3 will comprise two Ener-G E425 CHP engines. The relevant process conditions for this plant were obtained by the relevant technical data sheet and are summarised in Table 8A-7.

Table 8A-7 Process Conditions

Parameter	Unit	CHP
Stack height	m	18
Emission point diameter (internal)	m	0.25
Flue gas emission velocity	m/s	15.58
Temperature	˚C	120

Emissions

Emissions for the proposed CHP plant were obtained from Ener-G. These are summarised in Table 8A-8.

Table 8A-8 Process Conditions

CHP Engine	NO_x Exhaust Gas Concentration (mg/Nm^3)	NO_x Emission Rate (g/s)
E425	480	0.2551

Emissions of NO_x from combustion processes are predominantly in the form of nitrogen oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Comparisons of ambient NO and NO_2 concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that that more than 30% of the NO_x is present at ground level as NO_2.

Ground level NO_x concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NO_x to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon Environment Agency methodology (Ref 8-15).

The model considered all CHP engines operating at maximum load 24-hours per day, 365-days per year in order to provide a worst-case scenario.

Meteorological Data

Meteorological data used in this assessment was taken from Brize Norton meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive), as described previously.

Assessment Extents

Ambient concentrations were predicted over the area NGR: 454500, 221250 to 459750, 226500. One Cartesian at a height of 1.5m was used within the model to produce data suitable for contour plotting.

Discrete receptor locations were included in the model as detailed in Chapter 8.

Roughness Length

A roughness length (z_0) of 1m was used in this dispersion modelling study, as described previously.

Monin-Obukhov Length

A Monin-Obukhov length of 30m was used in this dispersion modelling study, as described previously.

Modelling Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emissions estimates, background estimated and meteorology; and,
- Variability - randomness of measurements used.

Potential uncertainties in model results have been minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS 5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Plant operating parameters - Operational parameters were supplied by Ener-G, the anticipated CHP engine manufacturer;
- Emission rates - Emission rates were supplied by Ener-G. These are based on the design specification and are therefore considered to represent suitable input parameters;
- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered where necessary in order to ensure a robust assessment of potential pollutant concentrations.