

## DMRB Screening Air Quality Assessment for Vehicle Emissions Associated with the Operation of the Proposed REGF at Pebble Hall, Theddingworth

### Introduction

GF Environmental Ltd (GFE) was commissioned by Carbonarius Ltd to undertake a screening air quality assessment for vehicular emissions associated with the operation of the proposed Renewable Energy Generation Facility (REGF) at Pebble Hall, Theddingworth. Information on vehicle movements associated with the operation of the REGF were taken from the Transport Statement prepared by Origin Transport Consultants<sup>1</sup> in support of the planning application.

Volume 11, Section 3 of the Design Manual for Roads and Bridges (DMRB) gives guidance on the assessment of the impact that road projects may have on local air quality. It includes a calculation method to estimate local pollutant concentrations. The calculations have been incorporated into a spreadsheet that is made available by the Highways Agency<sup>2</sup>. The latest version of the DMRB Screening Method (Version 1.03c) was issued in July 2007, and was used to undertake the screening assessment of the potential impact on local air quality of pollutant emissions from vehicles associated with the operation of the proposed REGF.

In line with official guidance<sup>3</sup> the background concentrations of NO<sub>x</sub> and NO<sub>2</sub> were set to zero, and the DMRB spreadsheet was set to calculate the “Road Increment NO<sub>x</sub>” value. This value was then entered into the DEFRA “NO<sub>x</sub> to NO<sub>2</sub> Calculator” spreadsheet<sup>4</sup> to calculate the total NO<sub>2</sub> value, as per the guidance below.

**Box 1: Instructions for taking account of recent changes in NO<sub>2</sub>/NO<sub>x</sub> ratios using the DMRB Screening Model (v1.03c).**

**Step 1:** Run the DMRB model as usual, but enter a value of zero as the background for both NO<sub>x</sub> and NO<sub>2</sub>.

**Step 2:** Take the NO<sub>x</sub> concentration predicted by the DMRB model and paste it into the “Road increment NO<sub>x</sub>” column of the NO<sub>x</sub> to NO<sub>2</sub> calculator (see paragraph 1.07) (the background is added at this stage).

**Step 3:** Run the NO<sub>x</sub> to NO<sub>2</sub> calculator to calculate total-NO<sub>2</sub>.

### Off-Site Vehicle Movements

Emissions from off-site vehicle movements will be associated with deliveries of waste and raw materials to and from the proposed REGF. Estimates of vehicle movements associated with the operational phase of the REGF development were taken from the Transport Assessment prepared to support the planning application. The DMRB Screening Method requires an input of traffic flow figures for the stretch of road (link) expressed as an annual average daily traffic (AADT) flow, and the input parameters are summarised in the table below.

Table 1 Vehicle Data Input into the DMRB Model

Phase of the Development	Annual Average Daily Total (AADT)*	Percentage LDVs (<3.5t GVW)	Percentage HDVs (>3.5t GVW)	Average Speed (km h <sup>-1</sup> )
Operation	80	37.5	62.5	48 **

\* Total vehicle movements into and out of the proposed REGF facility.

\*\* Average speed of all vehicles

<sup>1</sup> Carbonarius Ltd. Pebble Hall Farm, Theddingworth Road, Marston Trussell, Northamptonshire, LE17 6NJ. Proposed modification

<sup>2</sup> [http://www.dft.gov.uk/ha/standards/tech\\_info/files/DMRB\\_Screening\\_Method\\_V1.03c\\_\(12-07-07\)\\_locked.zip](http://www.dft.gov.uk/ha/standards/tech_info/files/DMRB_Screening_Method_V1.03c_(12-07-07)_locked.zip)

<sup>3</sup> [http://www.airquality.co.uk/archive/laqm/documents/DMRB\\_text\\_130309.pdf](http://www.airquality.co.uk/archive/laqm/documents/DMRB_text_130309.pdf)

<sup>4</sup> <http://laqm.defra.gov.uk/documents/NOx-NO2-Calculator-v3.2.xls>

## Background Air Quality

The DMRB Screening Method requires the user to input a value for background pollutant concentrations. Air quality data were taken from the DEFRA 2010 Background Maps website<sup>5</sup> for the area in the vicinity of the REGF development site, and are summarised in the table below.

Table 2 Background Air Quality Data for the Theddingworth Area

Pollutant	Annual Average Concentration ( $\mu\text{g}/\text{m}^3$ )*
NO <sub>2</sub>	10.4
NO <sub>x</sub>	14.2
PM <sub>10</sub>	15.2
PM <sub>2.5</sub>	10.0

\* Average of concentrations at grid points 465500,285500 466500,285500 and 465500,284500

## Results for Nitrogen Dioxide – Operational Phase

The results from the DMRB assessment of the impact on background NO<sub>2</sub> concentrations of emissions of NO<sub>x</sub> from all vehicles travelling to and from the proposed REGF are presented below.

Table 3 Results from DMRB Screening Method for Nitrogen Dioxide – Operational Phase

Distance from Centre of Carriageway (metres)	Road NO <sub>x</sub> ( $\mu\text{g m}^{-3}$ )	Background NO <sub>x</sub> ( $\mu\text{g m}^{-3}$ )	Total NO <sub>x</sub> ( $\mu\text{g m}^{-3}$ )	Road NO <sub>2</sub> ( $\mu\text{g m}^{-3}$ )	Background NO <sub>2</sub> ( $\mu\text{g m}^{-3}$ )	Total NO <sub>2</sub> ( $\mu\text{g m}^{-3}$ )
5	0.40	14.2	14.6	0.22	10.4	10.62
10	0.36	14.2	14.6	0.20	10.4	10.60
15	0.32	14.2	14.5	0.17	10.4	10.57
20	0.28	14.2	14.5	0.15	10.4	10.55
25	0.24	14.2	14.4	0.13	10.4	10.53
30	0.21	14.2	14.4	0.12	10.4	10.52
35	0.19	14.2	14.4	0.10	10.4	10.50
40	0.17	14.2	14.4	0.09	10.4	10.49
45	0.15	14.2	14.3	0.08	10.4	10.48
50	0.13	14.2	14.3	0.07	10.4	10.47
55	0.12	14.2	14.3	0.06	10.4	10.46
60	0.10	14.2	14.3	0.06	10.4	10.46
65	0.09	14.2	14.3	0.05	10.4	10.45
70	0.08	14.2	14.3	0.04	10.4	10.44
75	0.07	14.2	14.3	0.04	10.4	10.44
80	0.06	14.2	14.3	0.03	10.4	10.43
85	0.06	14.2	14.3	0.03	10.4	10.43
90	0.05	14.2	14.2	0.03	10.4	10.43
95	0.04	14.2	14.2	0.02	10.4	10.42
100	0.04	14.2	14.2	0.02	10.4	10.42

The results show that at the kerbside of the carriageway (5 metres), annual average NO<sub>2</sub> concentrations may increase by about 0.2  $\mu\text{g m}^{-3}$  which represents a value of ~0.5% of the annual Objective Value of 40  $\mu\text{g m}^{-3}$ . In line with Environment Agency guidance for long term assessment<sup>6</sup>, a process contribution of this magnitude can be screened out as insignificant.

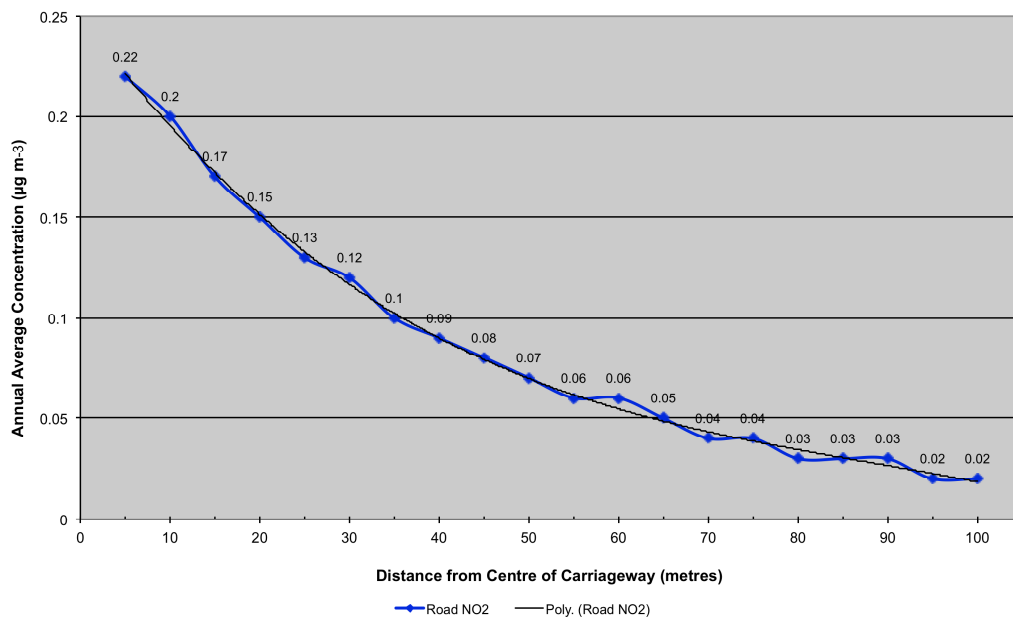
The facades of residential properties in Theddingworth are typically about 15 to 20 metres from the centre of the carriageway of the A4304 at their nearest point. On that basis the increase in annual average NO<sub>2</sub> concentrations that people living in these properties might experience is likely to be ~0.15  $\mu\text{g m}^{-3}$ , or about 0.4% of the AQS objective value. This **imperceptible** increase will not have a significant impact on the health of people living along the main transport route leading to the REGF development site.

When the results for Road-NO<sub>2</sub> are presented graphically, the following trend is observed.

<sup>5</sup> <http://laqm.defra.gov.uk/maps/maps2010.html>

<sup>6</sup> Horizontal Guidance Note H1 Annex F, Version 2.2, December 2011

Figure 1 Variation in Road-NO<sub>2</sub> with Distance from the Centre of the Carriageway – Operational Phase



As can be seen, the Road-NO<sub>2</sub> value (Process Contribution to background NO<sub>2</sub>) decreases with distance from the centre of the carriageway, with values falling to about 0.1 µg m<sup>-3</sup> (~0.25% of the Annual Objective Value) at a distance of about 35 metres from the centre of the carriageway. In terms of the Environmental Protection UK impact descriptors, the increase in annual average NO<sub>2</sub> concentrations, due to vehicular emissions associated with the operation of the REGF, can be considered to be **imperceptible** and likely to have a **negligible** impact at residential properties along the route to the development site.

**Results for Other Pollutants – Operational Phase**

The DMRB methodology also provides estimates of the potential increase in background concentrations of other pollutants including carbon monoxide, particles (PM<sub>10</sub>), benzene and 1,3-butadiene. The following results were obtained for a receptor situated ~10 metres from the carriageway.

Table 4 Results from DMRB Screening Method for Other Pollutants – Construction Phase

Receptor Location	Particles (PM <sub>10</sub> ) (µg m <sup>-3</sup> )	Carbon Monoxide (µg m <sup>-3</sup> )	Benzene (µg m <sup>-3</sup> )	1,3-Butadiene (µg m <sup>-3</sup> )
10 metres from carriageway	0.02	0.00039	0.00018	0.0017

The results show that for receptors located ~10 metres from the centre of the carriageway, the increase in annual average concentrations of Particles (PM<sub>10</sub>) represents an imperceptible increase, with a value that is <0.1% of the annual objective value of 40 µg m<sup>-3</sup> and can be screened out as insignificant in terms of the Environment Agency’s significance criteria.

In terms of the Environmental Protection UK impact descriptors, the increase in annual average PM<sub>10</sub> concentrations due to vehicles travelling to and from the proposed REGF site can be considered to be **imperceptible** at nearby residential properties, and have a **negligible** impact on air quality.

Process contributions to annual average concentrations of carbon monoxide, benzene and 1,3-butadiene are <0.01% of their respective annual objective values, and are also considered to be insignificant.

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 3<sup>rd</sup> December 2013