

## Herbert Road, Newport

### Appendix 13.2: Air Quality Model Verification

The DMRB Screening Model has been used to predict pollutant concentrations in relation to the proposed Development at Herbert Road, which is located within the Newport City Council (NCC) administrative boundary.

The DMRB is not always 'conservative'. It is therefore important to compare the results from the DMRB model against local monitoring data. This would verify the performance of the model, reducing uncertainties and improving confidence in the modelling.

#### NO<sub>2</sub>

This verification method requires the roadside NO<sub>x</sub> contribution to be calculated, which is extracted from the total NO<sub>x</sub> modelled by DMRB model at selected location.

In this study, the DMRB was used to predict the annual mean NO<sub>2</sub> concentration at the nearest NCT NO<sub>2</sub> diffusion tube monitoring site NCC11A at 169 Caerleon Road. This allows a comparison between the predicted and monitored data in order to verify the performance of the model. The use of this monitoring site for verification was agreed with NCC.

The latest year of monitoring data available from NCC is for the year 2011 and therefore the verification process was undertaken for 2011.

Table 1 shows the 2011 monitored and modelled concentrations at NCC11A diffusion tube location. The modelled annual mean NO<sub>2</sub> concentration has been calculated using the Air Quality Archive NO<sub>x</sub> to NO<sub>2</sub> spreadsheet<sup>1</sup> using the 2011 backgrounds presented in Table 2 from the UK Air Quality Archive for the grid square that the monitor is located within (grid reference 331500, 188500).

**Table 1: 2009 Annual Mean NO<sub>2</sub> Modelled and Monitored Concentrations**

Year	Location	Monitored Annual Mean NO <sub>2</sub> [µg/m <sup>3</sup> ]	Modelled Annual Mean NO <sub>2</sub> [µg/m <sup>3</sup> ]	% Difference
2011	NCC11A	37.9	31.6	16.6%

\* calculated from the modelled annual mean NO<sub>x</sub> using the Air Quality Archive NO<sub>x</sub>:NO<sub>2</sub> spreadsheet calculator.

**Table 2 Pollutant Background Concentrations (µg/m<sup>3</sup>) for validation purposes, Grid Reference (502500, 222500)**

Pollutant	2011
NO <sub>x</sub> (µg/m <sup>3</sup> )	46.95
NO <sub>2</sub> (µg/m <sup>3</sup> )	28.98

The results in Table 1 show that the DMRB, with the input data provided, is underperforming in this area with the magnitude of 16.6%.

Technical Guidance LAQM.TG (09)<sup>2</sup> suggests that where there is disparity between modelled and monitored results, appropriate adjustment should be undertaken.

LAQM.TG (09) presents a number of methods for approaching model verification and adjustment. One of these (Example 2) indicates a method based on adjusting the NO<sub>2</sub> road contribution and calculating a single adjustment factor. This method refers to modelling based on road traffic sources only and can be applied to a single diffusion tube location.

An adjustment of the road NO<sub>x</sub> component has therefore been undertaken following the guidance above in order to predict reliable results for the future scenarios. This is shown in Table 3.

**Table 3: Calculating Adjustment Factor**

	A1	A2	A3	A4
Monitoring Site	Total Monitored NO <sub>x</sub> *	Monitored NO <sub>x</sub> from Road Emissions (=A1 – Background NO <sub>x</sub> )	Modelled NO <sub>x</sub> from Road Emissions (= [NO <sub>x</sub> ] TotalMod – Background NO <sub>x</sub> )	Adjustment Factor (=A2/A3)
NCC11A	66.96	20.01	5.58	3.59

\* calculated from the monitored annual mean NO<sub>2</sub> using the Air Quality Archive NO<sub>x</sub>: NO<sub>2</sub> spreadsheet calculator.

Consequently, in Table 4, the adjustment factor (3.59) obtained in Table 3 is applied to the modelled NO<sub>x</sub> roadside concentrations from the DMRB to obtain improved agreement between monitored and modelled annual mean NO<sub>x</sub>. This has then been converted to annual mean NO<sub>2</sub> using the Air Quality Archive NO<sub>x</sub>: NO<sub>2</sub> spreadsheet calculator.

**Table 4: Adjusted Annual Average NO<sub>2</sub> Concentrations Compared to Measured Annual Mean NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**

	A5	A6	A7	A8	A9
Location	Corrected Road Emissions NO <sub>x</sub> (=A3 * A4)	Total Corrected NO <sub>x</sub> (=A5+background NO <sub>x</sub> )	Measured Annual Mean NO <sub>2</sub> (µg/m <sup>3</sup> )	Adjusted Modelled Annual Mean NO <sub>2</sub> (µg/m <sup>3</sup> )	% Difference (modelled adjusted-measured)
NCC11A	20.01	66.96	37.9	37.9	-

The data in Table 4 indicate an overall improved agreement between monitored and modelled annual mean NO<sub>2</sub> results compared to the unadjusted/unverified model.

The adjustment process was subsequently applied to all of the roadside NO<sub>x</sub> modelling results for 2011, which was modelled as the baseline year for the assessment, and 2014 and 2029 'with' and 'without' the proposed Development in place to predict the concentrations at the selected receptors.

It is noted that the modelled receptor 5 (Kwik Fit Garage at 60 Clarence Place) also shows good correlation with the nearby monitoring sites within the Chepstow Road AQMA. This correlation is shown in Table 5 below. The results in Table 5 provide further confidence in the accuracy of the base models.

**Table 5: Comparison of base (2011) modelling results at Receptor 5 with nearby diffusion tubes within the Chepstow Road AQMA**

Modelled Annual Mean NO <sub>2</sub> (µg/m <sup>3</sup> ) – Receptor 5	Monitored Annual Mean NO <sub>2</sub> (µg/m <sup>3</sup> ) – NCC50 (9 Caerleon Road)	Monitored Annual Mean NO <sub>2</sub> (µg/m <sup>3</sup> ) – NCC24B (21 Caerleon Road)
44.6	45.5	44.4

### PM<sub>10</sub>,

No PM<sub>10</sub> monitoring data is available to compare to the model output. Therefore, the adjustment factor (3.59) was subsequently applied to all the roadside PM<sub>10</sub> modelled concentration, before backgrounds were added, at the assessed locations.

In addition, in order to calculate the number of daily exceedences of 50µg/m<sup>3</sup> PM<sub>10</sub> the relationship between the number of 24-hour exceedences of 50µg/m<sup>3</sup> and the annual mean PM<sub>10</sub> concentration from LAQM.TG (09)<sup>2</sup> has been applied as follows:

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

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1 Air Quality Archive NOx : NO<sub>2</sub> calculator, Version 2.1, January 2010

(<http://www.airquality.co.uk/laqm/tools.php>)

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