

APPENDIX 8.3

MODEL VERIFICATION

Appendix 8.3: Model Verification

8.3.1 The approach to model verification that LAQM.TG22 recommends for local authorities when they carry out their LAQM duties has been applied within this study. For the verification and adjustment of NO_x /NO₂ concentrations, the guidance recommends that the comparison considers a broad spread of automatic and diffusion-tube monitoring. Horsham District Council and Crawley Borough Council monitor roadside NO₂ concentrations passively using diffusion tubes at four locations in the vicinity of the Application Site.

8.3.2 The concentrations monitored over recent years are provided in Table 8.3.1.

Table 8.3.1 Measured Annual-mean NO₂ Concentrations (µg.m⁻³)

Monitoring Site	Measured Annual-mean NO ₂ Concentrations (µg.m ⁻³)	
	2023	2024
CR102	23.0	22.2
CR88	18.0	15.5
CR104	17.0	15.6
N Horsham 3N	26.2	21.7

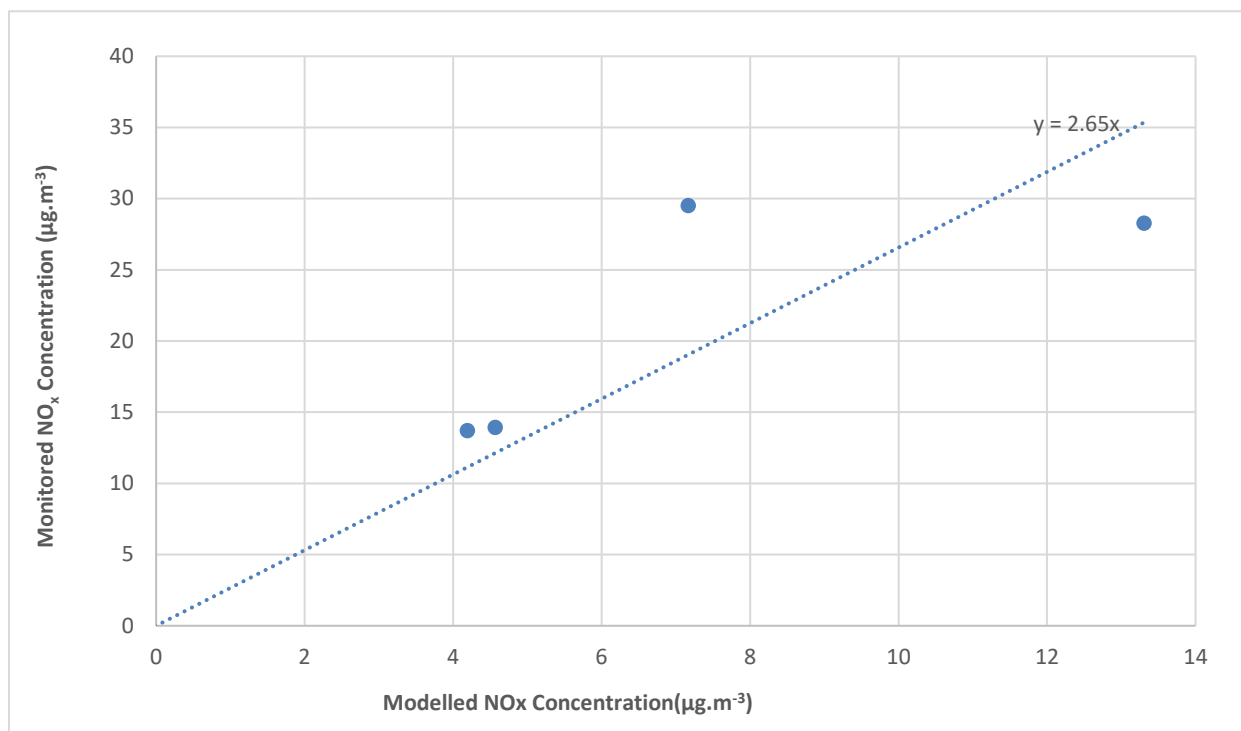
8.3.3 The data from 2024 has been used throughout the model verification. The monitored annual-mean NO_x road contributions have been derived from the monitored annual-mean NO₂ concentrations using the LAQM.TG22 calculator. The monitored annual-mean NO_x road contributions have then been compared with the modelled annual-mean NO_x road contributions. This comparison is provided in Table 8.3.2 below.

Table 8.3.2 Comparison of Monitored and Modelled Annual-Mean Road NO_x Contribution (µg.m⁻³)

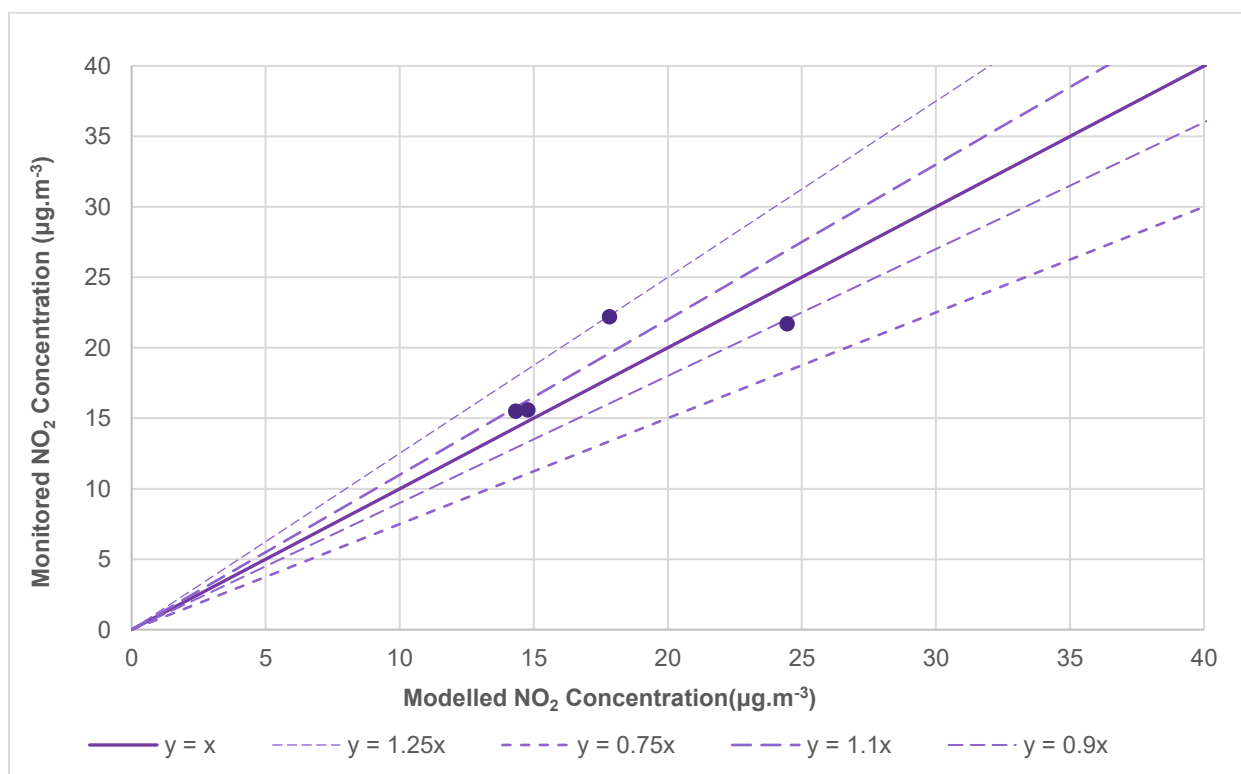
Monitoring Site	Annual-mean Road NO _x Contribution (µg.m ⁻³)	
	Monitored	Modelled
CR102	29.5	7.2
CR88	13.7	4.2
CR104	13.9	4.6
N Horsham 3N	28.3	13.3

8.3.4 It should be borne in mind that the monitored concentrations are themselves only estimates to the true concentrations at each point; the EU Directive on air quality [i] designates passive NO₂ samplers indicative measures with a potential uncertainty of +/-30 %. Ignoring any uncertainty errors in the monitoring results, the table above indicates that the model is under-predicting.

8.3.5 The modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 8.3.1.

Graph 8.3.1 Road Contribution NO_x

8.3.6 The modelled NO_x contributions have been multiplied by the gradient of the trend line (2.65) to determine the corrected NO_x contributions. Modelled annual-mean NO₂ concentrations have been derived from the corrected modelled annual-mean NO_x road contributions. The corrected modelled annual-mean NO₂ concentrations have been plotted against the monitored annual-mean NO₂ concentrations in Graph 8.3.2.

Graph 8.3.2 Corrected NO₂ Concentrations

8.3.7 The corrected modelled annual-mean NO₂ concentrations are within 25% of the monitored annual-mean NO₂ concentrations. The correction factor therefore improves the modelled concentrations and has been applied to all predictions used within the assessment.

8.3.8 The fractional bias can also be used to determine whether the corrected model has a tendency to over or under-predict. The fractional bias is calculated as:

$$\frac{(\text{Average Monitored NO}_x \text{ Concentration} - \text{Average Predicted NO}_x \text{ Concentration})}{0.5 \times (\text{Average Monitored NO}_x + \text{Average Predicted NO}_x \text{ Concentration})}$$

8.3.9 Fractional bias values vary between +2 and -2 and has an ideal value of zero. A negative value suggests a model over-prediction and a positive value suggests a model under-prediction.

8.3.10 Table 8.3.3 sets out the average monitored concentration and the average predicted concentration.

Table 8.3.3 Comparison of Monitored and Adjusted Modelled Annual-mean Road NO_x Contribution (µg.m⁻³)

Monitoring Site	Annual-mean Road NO _x Contribution (µg.m ⁻³)	
	Monitored	Corrected Modelled
CR102	29.5	19.0
CR88	13.7	11.1
CR104	13.9	12.1
N Horsham 3N	28.3	35.3
Average	21.4	19.4

8.3.11 The fractional bias for this study is therefore $(21.4 - 19.4) / (0.5 \times (21.4 + 19.4)) = 0.098$. As the fractional bias is close to zero, the adjusted model is working well.