

Growing Baldock

Environmental Statement Volume 2: Figures & Appendices

Chapter 6: Air Quality

Appendix 6.4 Model Verification

APPENDIX 6.4: MODEL VERIFICATION

1.1.1 The approach to model verification that LAQM.TG22 recommends for local authorities when they carry out their LAQM duties is summarised in Section 6.3 of Chapter 6. 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. RPS undertook a monitoring scheme to obtain NO₂ concentrations passively using diffusion tubes in the vicinity of the Application Site. Monitoring was undertaken at 18 locations; six of which were background locations and 12 in a roadside location. Four of the roadside monitoring locations could not be used in this model verification as there is no traffic data available for the nearest road.

1.1.2 The concentrations monitored are provided in Table 6.4.1.

Table 6.4.1 Measured Annual-mean NO₂ Concentrations (µg.m⁻³)

Monitoring Site	Measured Annual-mean NO ₂ Concentrations (µg.m ⁻³)
RPS3	13.8
RPS5	11.7
RPS10	16.5
RPS12	14.5
RPS13	12.8
RPS14	13.2
RPS16	10.2
RPS17	13.8

1.1.3 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 6.4.2 below.

Table 6.4.2 Comparison of Monitored and Modelled Annual-mean Road NO_x Contribution (µg.m⁻³)

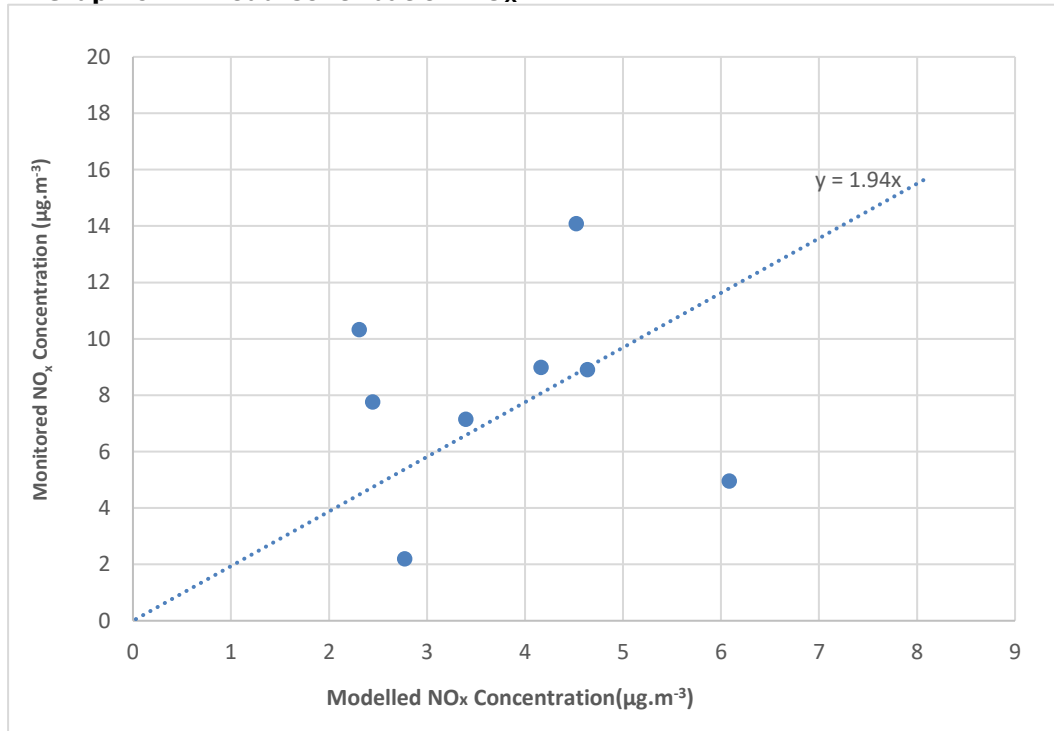
Monitoring Site	Annual-mean Road Nox Concentration (µg.m ⁻³)	
	Monitored	Modelled
RPS3	8.9	4.6
RPS5	5.0	6.1
RPS10	14.1	4.5
RPS12	10.3	2.3
RPS13	7.2	3.4

RPS14	7.8	2.4
RPS16	2.2	2.8
RPS17	9.0	4.2

1.1.4 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.

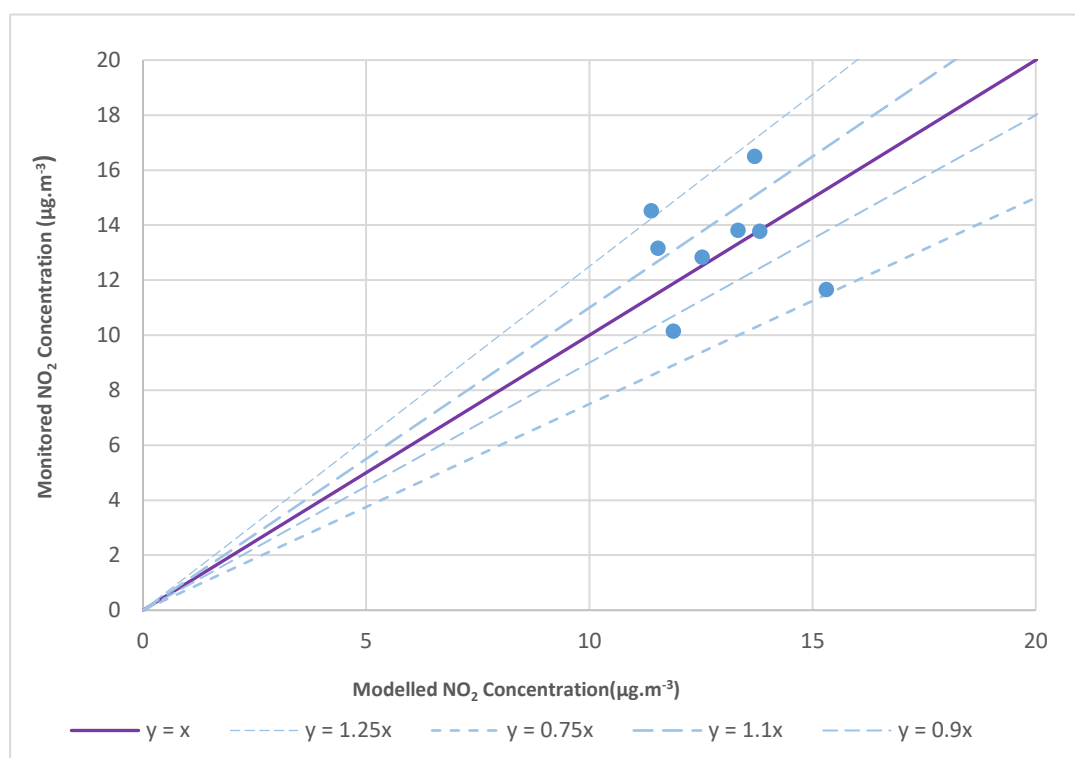
1.1.5 The modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 6.4.1.

Graph 6.4.1 Road Contribution NO_x



1.1.6 The modelled NO_x contributions have been multiplied by the gradient of the trend line (1.94) 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 6.4.2.

Graph 6.2.2 Corrected NO₂



- 1.1.7 The corrected modelled annual-mean NO₂ concentrations are all within 25% or greater than 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.
- 1.1.8 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:
- $$\frac{(\text{Average Monitored NO}_x \text{ Concentration} - \text{Average Predicted NO}_x \text{ Concentration})}{0.5 \times (\text{Average Monitored NO}_x + \text{Average Predicted NO}_x \text{ Concentration})}$$
- 1.1.9 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.
- 1.1.10 Table 6.4.3 sets out the average monitored concentration and the average predicted concentration.

Table 6.4.3 Comparison of Monitored and Adjusted Modelled Annual-mean Road NOX Contribution ($\mu\text{g.m}^{-3}$)

Monitoring Site	Annual-mean Road Nox Concentration ($\mu\text{g.m}^{-3}$)	
	Monitored	Corrected Modelled
RPS3	8.9	9.0
RPS5	5.0	11.8
RPS10	14.1	8.8
RPS12	10.3	4.5
RPS13	7.2	6.6
RPS14	7.8	4.7
RPS16	2.2	5.4
RPS17	9.0	8.1
Average	8.0	7.3

1.1.11 The fractional bias for this study is therefore $(8.0 - 7.3) / (0.5 \times (8.0 + 7.3)) = 0.09$. As the fractional bias is close to zero, the adjusted model is working well.

i Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe