APPENDIX 12.4

MODEL VERIFICATION

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NOx = NO + NO2). The model has been run to predict the 2017 annual mean road-NOx contribution at two roadside monitoring locations in proximity to the Site (described in Tables 12.7 and 12.8). The table below describes the heights at which the monitoring locations were modelled.

Table 12.4.1: Modelled Heights of Monitoring Locations

ID	Site Type	Within AQMA	Model Height (m)
Chatham AURN	Roadside	Yes	2.5
DT09	Roadside	Yes	2.5
DT15	Roadside	Yes	2.5
DT16	Roadside	Yes	2.5

The model output of road-NOx has been compared with the 'measured' road-NOx, which was calculated from the measured NO_2 concentrations and the DEFRA 2017 background NO_2 concentrations within the NOx from NO_2 calculator published by Defra.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure 13.4.1). This factor was then applied to the modelled road-NOx concentration for each monitoring Site to provide adjusted modelled road-NOx concentrations. The total NO_2 concentrations were then determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure 13.4.2).

The following primary and secondary adjustment factors have been applied to all modelled NO_2 data:

- Primary adjustment factor: 3.1006
- Secondary adjustment factor: 0.989

The results imply that the model was under-predicting the road-NOx contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

Figure 12.4.3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line. All monitoring points lie within the ±10% line.
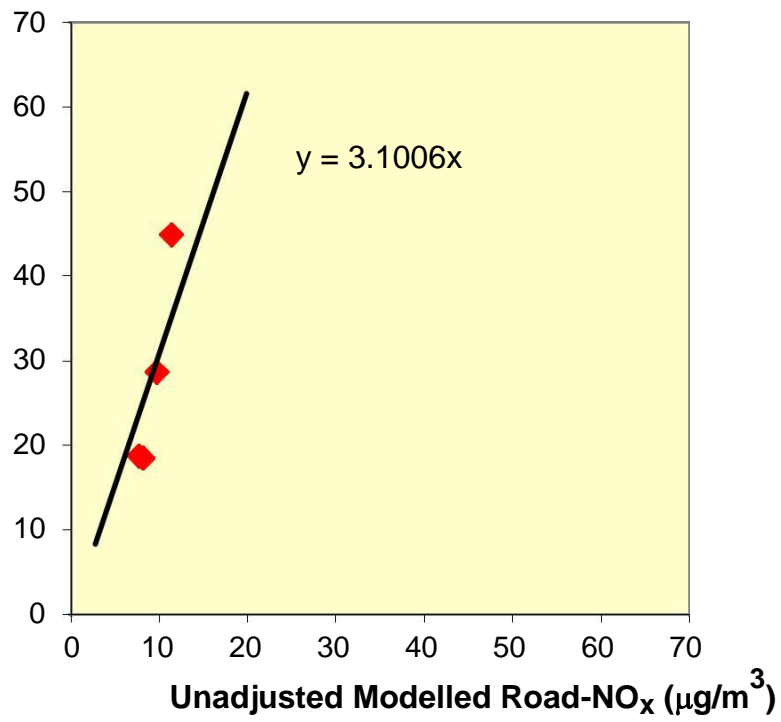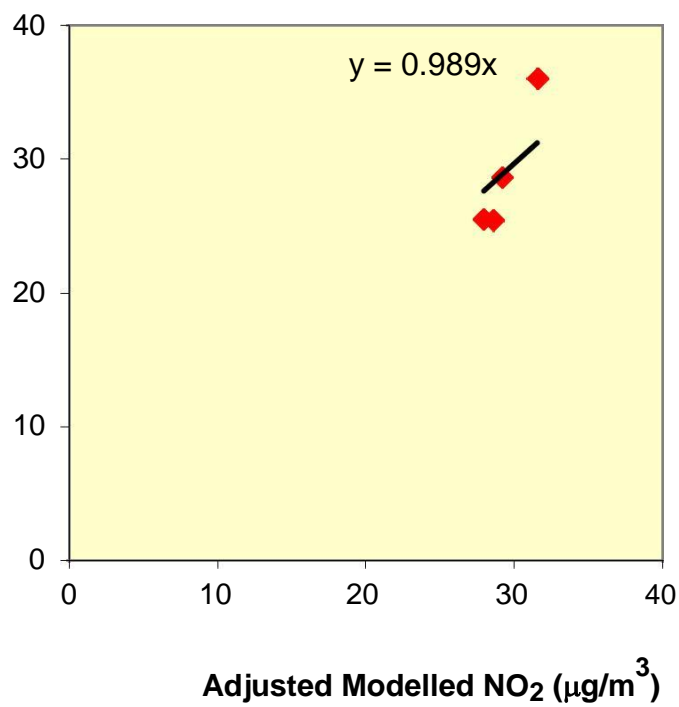
Figure 12.4.1: Comparison of Measured Road-NO_X with Unadjusted Modelled Road-NOx Concentrations

$$y = 3.1006x$$

Unadjusted Modelled Road-NO_X ($\mu g/m^3$)

Figure 12.4.2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO2 Concentrations

$$y = 0.989x$$

Adjusted Modelled NO_2 ($\mu g/m^3$)

Figure 12.4.3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO2 Concentrations

Adjusted Modelled NO_2 ($\mu g/m^3$)
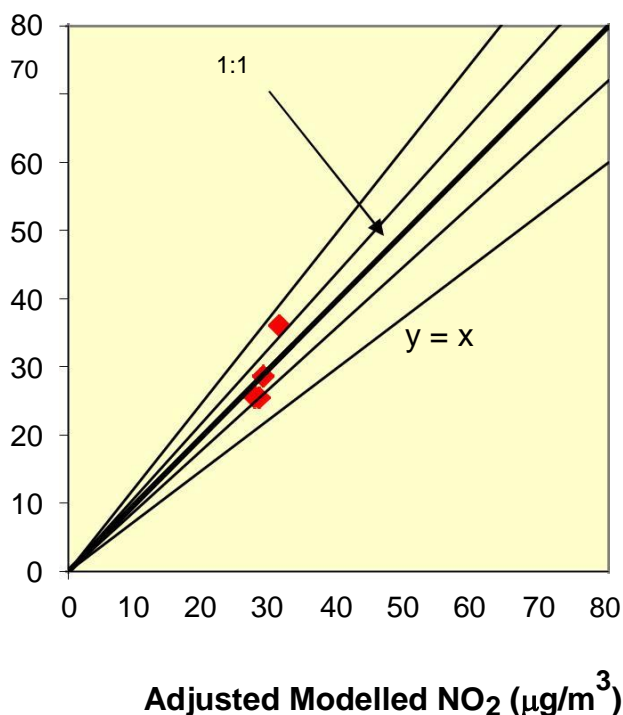
Particulate Matter (PM_{10})

PM_{10} concentrations predicted by the model were verified by predicting concentrations at the Chatham AURN site.

The model output of road-PM_{10} has been compared with the 'measured' road-PM_{10}, which was calculated from the measured PM_{10} concentrations and the DEFRA 2017 background PM_{10} concentrations.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure 13.4.4). This factor was then applied to the modelled road-PM_{10} concentration to provide adjusted modelled road-PM_{10} concentrations. The total PM_{10} concentrations were then determined by combining the adjusted modelled road-PM_{10} concentrations with the 2017 DEFRA background PM_{10} concentration. This adjustment resulted in a good correlation between monitored and predicted concentrations therefore no secondary adjustment was required (Figure 13.4.5).

An adjustment factor was determined as follows:

- Measured PM_{10}: 21.6 $\mu g/m^3$
- Measured Rd-PM_{10}: 5.5 $\mu g/m^3$
- Modelled Rd-PM_{10}: 23.5 $\mu g/m^3$
- Rd-PM_{10} adjustment factor: 7.4009

This factor implies that the model is under-predicting the road-PM_{10} contribution. This is a common experience with this and most other models.

Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ concentrations predicted by the model were verified by predicting concentrations at the Chatham AURN site.

The model output of road-$PM_{2.5}$ has been compared with the 'measured' road-$PM_{2.5}$, which was calculated from the measured $PM_{2.5}$ concentrations and the DEFRA 2017 background PM_{10} concentrations.

An adjustment factor was determined as follows:

- Measured $PM_{2.5}$: 14.1 µg/m^3
- Measured Rd-$PM_{2.5}$: 2.7 µg/m^3
- Modelled Rd-$PM_{2.5}$: 0.4 µg/m^3
- Rd-$PM_{2.5}$ adjustment factor: 6.2343