



Air Quality Review: West Midlands Interchange

January 2019



Experts in air quality
management & assessment

Document Control

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Job Number	J3582A
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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J3582A/1/F2	8 January 2019	Final Report	Stephen Moorcroft (Director)

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1 Introduction

1.1 Air Quality Consultants Ltd (AQC) has reviewed the information submitted in relation to air quality in support of the DCO application for the West Midlands Interchange.

1.2 This report reviews chapter 7 of the Environmental Statement and associated appendices (hereinafter referred to as the “assessment”). It also takes into consideration the following documents that were received in response to an initial review of the ES chapter:

- West Midlands Interchange: Response to South Staffordshire District Council Review (17th December 2018); and
- Ramboll Technical Note: Diffusion Tube Monitoring Study, West Midlands Interchange (18th December 2018).

1.3 This review has been carried out on behalf of South Staffordshire District Council (SSDC). It focuses on the potential impacts of the development on local residential properties and nearby designated ecological sites within South Staffordshire. This review covers the following issues:

- whether the scope of the assessment is sufficient;
- whether due consideration has been given to potential cumulative impacts with nearby existing and permitted developments;
- whether the air quality assessment is based on an appropriate methodology (i.e. is it ‘fit for purpose’);
- the identification of any errors or omissions within the assessment;
- whether the assessment of the overall significance of the proposed development is appropriate, and whether appropriate criteria have been adopted; and
- whether the mitigation measures proposed are appropriate.

1.4 Where methodological failings are identified, they are described as either a:

- **Minor Issue** – weaknesses have been identified but the professional experience of the reviewers suggests that the weaknesses are unlikely to affect the conclusions of the assessment;
- **Moderate Issue** – weaknesses have been identified which may or may not affect the conclusions¹; or
- **Major Issue** – in the opinion of the reviewers, the failings of the assessment are highly likely to invalidate the reported conclusions.

¹ An issue which is classified as moderate could thus move to being either a major or minor issue depending on specific unknown factors.

2 Issues Raised in Scoping

2.1 SSDC raised two issues in relation to air quality in the Scoping Opinion:

- The validity of the Penkrige automatic monitoring data in 2013 and 2014; and
- Impact of the proposals on the truck stop, and the resultant impact on air quality and residential amenity.

2.2 The first issue is addressed by acknowledging the low data capture for the monitoring site in the report.

2.3 No specific consideration appears to have been given to the impact of the proposed development upon the truck stop within the Air Quality chapter, although reference is made to consideration of traffic capacity within chapter 15 of the ES, which has not been reviewed.

3 Review

Consideration of Uncertainty in Future Vehicle Emissions Factors [Moderate Issue]

3.1 The assessment has utilised the emission factors published by Defra. However, no consideration has been given to the uncertainty associated with future vehicle emissions projections.

3.2 This could potentially alter the conclusions of the assessment.

West Midlands Interchange response:

3.3 Provided discussion about the factors affecting uncertainty and concluded that the latest version of the Defra Emission Factor Toolkit is sufficiently robust.

AQC response:

3.4 Although the latest version of the Defra toolkit has been used, there is still uncertainty associated with the projections within it. The impact that this uncertainty would have on the conclusions of the ES has not been considered, i.e whether any of the predictions are close to the objective and if the conclusions would change, if concentrations do not reduce as expected.

Baseline Year [Resolved]

3.5 The baseline year is identified as 2015. It would have been most appropriate to have used the most recent year for which monitoring data are available (2016).

West Midlands Interchange response:

3.6 *“When the modelling work was originally undertaken, 2015 data was the most recent data that was available and therefore the original model verification was undertaken with 2015 data. However, when 2016 data became available the verification was updated to 2016, but unfortunately the text in the ES chapter was not updated to reflect this. We can confirm that the model verification was undertaken with 2016 data.”*

AQC response:

3.7 Noted. However, this does raise concerns regarding the accuracy of other information provided within the ES chapter and accompanying appendices.

IAQM Impact Descriptors [Resolved]

3.8 The IAQM impact descriptors presented in Table 7.7 have been incorrectly represented. The first column should be labelled “1%”, not “<1%”. This would not have altered the conclusions as the results appear to have been correctly interpreted.

West Midlands Interchange response:

- 3.9 “The column heading should have read 1% and we can confirm that the results have been correctly interpreted and therefore the conclusions remain unaltered.”

AQC response:

- 3.10 Noted.

Model Verification [Major Issue]

- 3.11 The model has been verified separately for the receptors within each local authority. For receptors in South Staffordshire, the model results have been verified against measured data at nine monitoring sites. This indicated that the model was under-predicting concentrations and therefore an adjustment factor of 2.18 was applied to the modelled road-NO_x concentrations. Adjustment factors of this scale are fairly usual.
- 3.12 However, as shown in the Figure below (reproduced from the assessment), there is a large amount of scatter in the model results when they are compared with the measured values. At three of the sites, the final NO₂ concentrations fall outside the Defra guideline of +/-25%. In addition, the scatter suggests a very poor overall relationship between modelled and measured concentrations. As the actual predicted and measured values are not stated, it is not possible to evaluate the model performance against the criteria for R², RMSE and FB, as stated in LAQM.TG16; these data and calculations should be provided.
- 3.13 No model results are presented for the baseline year and it has not been possible to make a direct comparison with measurements and model predictions in the same year (other than the data points shown in the Figure). However, the results presented in Table 1 demonstrate that the predicted 2021 results at the monitoring sites (and therefore receptors) alongside the M6 are clearly too high. This is particularly apparent as 2021 concentrations would be expected to be lower than 2016 values, and in this instance they are higher.
- 3.14 As the 2015 baseline model results are not presented, it difficult to determine the extent of any under-prediction of the model at the other monitoring sites. This is particularly important for HA2 within the AQMA, which will be most sensitive to any changes in concentration as a result of the development. This may have resulted in the changes in concentrations being under-represented and could invalidate the reported conclusions.

Figure 7.2.7: Comparison of final modelled NO₂ with Measured NO₂ in South Staffordshire

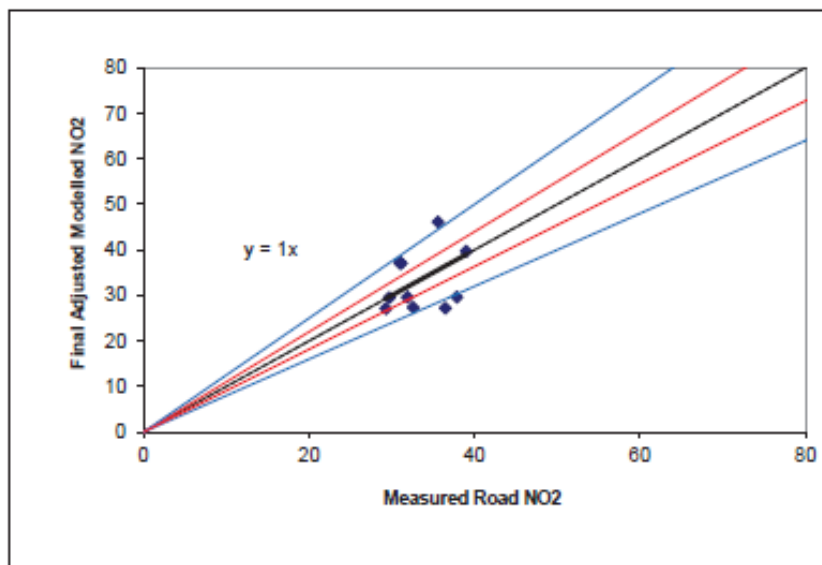


Table 1: Comparison of Measured Annual Mean Nitrogen Dioxide Concentrations with Model Results ($\mu\text{g}/\text{m}^3$)

Receptor	Measured 2016	Modelled 2021	Difference
PE2 – M6	31.1	Result not presented	N/A
PE11 – M6	31.4	42.9	11.5
ES4 – M6	35.6	38.9	3.3
ES5 – M6	32	44.1	12.1
ES6 – M6	31.4	39.5	8.1
HA2 – A5	37.9	21.6	-16.3
SA2 - Wedges Mills	32.6	23.7	-8.9
SA5- Wedges Mills	36.5	23.6	-12.9
SA6- Wedges Mills	29.3	23.6	-5.7

3.15 The predicted PM₁₀ results have been verified using the factors derived for NO_x and therefore the same issues apply as outlined above. This has led to exceedances of the 24-hour mean PM₁₀ objectives alongside the M6, where this is unlikely to occur.

West Midlands Interchange response:

“Whilst there is some scatter in the model verification, the primary verification factor is relatively low and is typical of this type of assessment where model variation is undertaken using 11 points. The results of the model verification at the receptors is presented in Technical Note TN-170000573-AQ, Issue: 4, which is issued with this response.

Defra Technical Guidance LAQM.TG16 provides a procedure for describing model uncertainty (Box 7.17), which is summarised in the table below along with the calculated values for the SSDC verification.

Statistical Parameter	Comments	Ideal Value	SSDC Value
Correlation Coefficient	The linear relationship between the predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.	1.00	0.24
Root Mean Square Error (RMSE)	RMSE is used to define the average error or uncertainty in the model. The units of RMSE are the same as the quantities compared.	0.0	6.1
Fractional Bias (FB)	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction	0.0	0.0

The statistical analysis indicates that there is a positive correlation between the predicted and monitored data, albeit not a strong one. The average error is also relatively large, but there is no overall tendency for the model to over or under predict.

The comparison of monitored and predicted data for the receptors adjacent to the M6 does suggest that the model is over-predicting concentrations at the receptors adjacent to the motorway. As the highest concentrations are predicted for receptors adjacent to the motorway, this suggests that the overall assessment is conservative. We would therefore agree that the moderate and substantial adverse effects predicted in the ES for daily mean PM₁₀ concentrations adjacent to the motorway at Darlaston Road, Walsall District are unlikely to occur.

For monitoring point HA2, the predicted concentration in 2016 is 29.6µg/m³ versus a monitored concentration of 37.9µg/m³. Whilst the model is underpredicting at this location, as noted in the AQC review, concentrations would be expected to be lower in 2021 (and in future years) compared to 2016 values. This is demonstrated in the modelling results at HA2 which show baseline NO2 concentrations of 21.6, 14.5 and 13.6µg/m³ in 2021, 2028 and 2036 respectively. The corresponding with development concentrations are 22.0, 14.9 and 14.0µg/m³ respectively. Even

allowing for model under-prediction at this location, there would be no exceedance of the annual mean NO₂ objective at this location and therefore no change to the reported conclusions.”

- 3.16 A separate Technical Note has been provided setting out monitoring results from a 6-month survey carried out at roadside sites near to the development in 2017/18. These measurements are broadly consistent with previous information presented and no exceedences of the annual mean nitrogen dioxide objective were identified at the monitoring locations.
- 3.17 The Technical Note includes measured and modelled concentrations used to derive the verification factor of 2.18 used in the assessment. It also presents measured and modelled concentrations for 2017 at the project specific monitoring sites and suggests that if these short-term monitoring data were used to verify the model, a lower verification factor of 1.44 would have been derived and thus it asserts that the predictions presented in the ES chapter can be considered worst-case.

AQC response:

- 3.18 The statistics and data provided are very useful to evaluate the model performance. However, contrary to the submitted response, they do not suggest the model is adequate and that there would be no change to the conclusions to the ES. The additional information provided supports reclassification of model verification from a ‘moderate’ to ‘major’ issue. The reasons for this conclusion are discussed below.
- 3.19 The correlation coefficient is reported as 0.24. The text in the table states that, “*a value of zero means no relationship and a value of 1 means absolute relationship.*” Therefore this result can be considered to demonstrate that there is only a weak relationship between the modelled and measured concentrations.
- 3.20 The RMSE is reported as 6.1 µg/m³. This means that there is a large deviation in the difference between the measured and modelled results. Ideally this value should be less than 4 µg/m³ (10% of the 40 µg/m³ objective).
- 3.21 Although the overall fractional bias is the ideal value of 0, this measure does not take into account the spread in values at specific sites. This value is just a result of large over-estimations at some sites being counteracted by equally large under-estimations at other sites.
- 3.22 The results presented in Table 1, clearly show that the over-predictions are occurring at motorway sites, and the under-predictions are alongside non-motorway roads. This is a common occurrence with the model used. The most appropriate way to address this would have been to carry out model verification separately for motorway and non-motorway roads. This would have resulted in a lower verification factor being applied to concentrations as a result of motorways, and a higher factor for other roads.

- 3.23 The data presented for monitoring site HA2, within the AQMA, confirms that the model results for 2016 were $8 \mu\text{g}/\text{m}^3$ lower than that actually measured at the same location, implying that the model has underestimated concentrations by a considerable margin within the AQMA. If the model were verified separately for non-motorway roads, a higher verification factor would be applied to achieve a better fit with the measured values. This would increase the predicted changes in annual mean concentrations and absolute values, and thus potentially increase the significance of impacts as a result of the proposed development. It is these locations, rather than those adjacent to motorways, where impacts are likely to be greatest due to proximity of receptors to the road and generally poorer dispersion. The scale of these differences needs to be evaluated by further modelling before a conclusion can be reached about the overall significance of the air quality impacts.
- 3.24 The lower verification factor derived from the short-term project specific monitoring data, does not take into consideration the long-term monitoring data from HA2 and if this were used, would lead to even greater under-predictions of concentrations and impacts within the AQMA.

Description of 24-hr PM₁₀ Impacts [Resolved]

- 3.25 The IAQM impact descriptors have been incorrectly applied to determine the significance of the predicted changes in relation to the 24-hour PM₁₀ objective. This has resulted in moderate and substantial adverse impacts being predicted that are unlikely to occur. This would not have altered the conclusions of the assessment.

West Midlands Interchange response:

- 3.26 A worked example is provided showing how the significance at a receptor was derived.

AQC response:

- 3.27 Noted.

Presentation of Results [Minor Issue]

- 3.28 The receptor names shown on the plans are different to those used in the tables where impacts are described. This makes it difficult to interpret the results, but would not alter the conclusions.
- 3.29 The existing baseline (2015) model results have not been presented, which it makes it difficult to determine how the model is performing at specific receptors. This would not alter the conclusions of the assessment but does make it difficult to review the validity of the results, as discussed in paragraphs 3.11 to 3.15.

West Midlands Interchange response:

"The receptor names are clearly set out and cross referenced in ES Appendices 7.2 and 7.4."

AQC response:

- 3.30 This approach does not allow for easy cross reference between the Figures and the impacts presented in Appendices 7.5 and 7.6

West Midlands Interchange response:

“The performance of the model is illustrated in the graphs in ES Appendix 7.2 and the statistical parameters described in Section 5 above. Some receptor locations will under-predict and some will over-predict which is inherent in the verification process and as the statistical parameters show, the model does not have any fractional bias”

AQC response:

- 3.31 Issues discussed above in relation to model verification.

Construction Dust Assessment [Minor Issue]

- 3.32 No plans of the receptors at risk of being affected by construction dust impacts are presented.

West Midlands Interchange response:

“Presentation of plans would not alter the dust risk assessment which is used to identify the appropriate mitigation to employ. The assessment conclusion was for High Risk mitigation to be employed, which is the highest category available. With the mitigation in place, the effects of construction dust are not significant.”

AQC response:

- 3.33 Noted.

Railway Emissions [Minor Issue]

- 3.34 Paragraph 7.167 makes reference to background concentrations, “*without a reduction in road traffic emissions*”. This is not mentioned anyway else in the report and does not actually appear to have been considered.

West Midlands Interchange response:

“It is not clear what the comment is actually referring to as railway emissions from moving locomotives have been considered in accordance with Defra LAQM.TG(16) criteria. Paragraph 7.166 and 7.167 refer to the assessment of the impact of additional train movements on local air quality. The West Coast Main Line is not one of the lines identified in LAQM.TG(16) as having a large number of diesel train movements and the development is only predicted to increase the number of movements by 10 per day. In addition, even without taking into account the predicted future reduction in background NO₂ concentrations, the existing background NO₂ concentration is

less than 25µg/m³. The development therefore does not meet either Defra criteria for the assessment of rail emissions from moving locomotives to be necessary”

AQC response:

- 3.35 The query related to the use of the specific phrase, “*without a reduction in road traffic emissions*” in the first sentence of para 7.167. There are no specific concerns about the assessment itself.

Table 7.17 [Resolved]

- 3.36 Final row states “EFT” where it should state the number of negligible impacts in WCC. It is not clear what this means.

West Midlands Interchange response:

“This is a typographic error, EFT in the negligible column should be ‘37’, and slight adverse should be ‘-’ per ES Appendix 7.6.”

AQC response:

- 3.37 Noted.

Idling Locomotives [Resolved]

- 3.38 No consideration has been given to the impact of idling locomotives on air quality.

West Midlands Interchange response:

“LAQM.TG(16) requires an assessment to be made where there is exposure within 15m of stationary locomotives. The only location where there would be large numbers of stationary locomotives would be within the freight terminal itself. As there is no public access to the freight terminal, this criterion is not met and therefore no assessment of the impact of idling locomotives is required”

AQC response:

- 3.39 Noted.

4 Summary

4.1 The air quality chapter of the ES has been reviewed. The conclusions and suitability of the assessment are set out in Table 2, along with any requirements for additional information.

Table 2: Summary of Air Quality Assessment

Impact	Conclusion of assessment	Suitability of assessment	Further information required?
Air quality impact of road traffic emissions	Not significant	Potentially under-estimated impacts in AQMA	Additional information provided has confirmed the poor model performance, with concentrations and impacts within the AQMAs being under-predicted. Further model results should be provided based on more appropriate verification of the model within the AQMAs.
Construction phase traffic impacts	Not significant	Potentially under-estimated impacts in AQMA	Construction traffic is considered in the modelling of road traffic impacts in 2021, however, further model results should be provided based on more appropriate verification of the model within the AQMAs.
Air quality impact of railway emissions	Not significant	Acceptable for moving and idling locomotives.	None
Construction phase dust impacts	Not significant	Acceptable	Commitment to dust mitigation measures commensurate with a High Risk site required (DCO requirement)
Ecological impacts	Potentially significant	Acceptable	States presented in Ecology chapter (not reviewed)

A1 Professional Experience

Penny Wilson, BSc (Hons) CSci MEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than seventeen years' relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is Member of the Institute of Air Quality Management and a Chartered Scientist.

Stephen Moorcroft, BSc (Hons) MSc DIC CEnv MEnvSc MIAQM

Mr Moorcroft is a Director of Air Quality Consultants, and has worked for the company since 2004. He has over thirty-five years' postgraduate experience in environmental sciences. Prior to joining Air Quality Consultants, he was the Managing Director of Casella Stanger, with responsibility for a business employing over 100 staff and a turnover of £12 million. He also acted as the Business Director for Air Quality services, with direct responsibility for a number of major Government projects. He has considerable project management experience associated with Environmental Assessments in relation to a variety of development projects, including power stations, incinerators, road developments and airports, with particular experience related to air quality assessment, monitoring and analysis. He has contributed to the development of air quality management in the UK, and has been closely involved with the LAQM process since its inception. He has given expert evidence to numerous public inquiries, and is frequently invited to present to conferences and seminars. He is a Member of the Institute of Air Quality Management.

Full CVs are available at www.aqconsultants.co.uk.