Review of Air Quality Submissions to the Wealden District Council Core Strategy Examination

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Experts in air quality management & assessment
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Review of Air Quality Submissions to the Wealden District Council Core Strategy Examination

1 Introduction

1.1 Air Quality Consultants Ltd has been commissioned by Wealden District Council to review documents by Jennifer Owen and Associates (JOA)¹ and Southdown Environmental Consultants (SEC)² submitted to the Wealden District Council Core Strategy Examination in relation to air pollution at European sites³. This review has identified a large number of failings, both with the methodology followed by SEC and with the presentation and interpretation of the results. These failings are sufficient that the conclusions of the SEC and JOA assessments cannot be relied upon. This current note summarises the key limitations with the SEC assessment. The professional experience of the consultants preparing this note is summarised in Appendix A1.

2 Review

Pollutants Considered

2.1 The SEC note considers impacts in relation to the annual mean nitrogen oxides (NOx) critical level and the nutrient nitrogen deposition critical load. It does not include an assessment against the 24-hour critical level for NOx⁴, or the acidity critical loads⁵. Neither is there any explanation for these omissions. In recent years, the acidity critical loads have, in many cases, been more stringent than the nutrient nitrogen critical loads and, since all nitrogen deposited is considered to have an acidifying potential⁶, it would be usual to consider both potential impacts of the depositing nitrogen⁷. Similarly, omitting any assessment of 24-hour NOx concentrations may miss potentially significant impacts.

Model Chosen

2.2 The SEC assessment uses the DMRB screening model to predict ambient concentrations of NOx and, (as far as can be seen from the results) nitrogen dioxide (NO₂). The local air quality

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¹ Wealden District Council Core Strategy Examination – Further Submission – Matter 14 / Pelham Holdings: The Environment, Climate Change, and Sustainable Construction.
² Memorandum dated 18th October 2011 – Air Pollution and Nitrogen Deposition at European Sites Relevant to the Housing Allocations in the Wealden Core Strategy.
³ The term ‘European sites’ is used here to refer to habitats designated as Special Areas of Conservation (SACs), Special Protection Areas (SPAs), or Ramsar sites.
⁴ http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788054
⁵ http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788053
⁶ Regardless of its oxygenation state when deposited. Each kg of nitrogen can be assumed to equal 0.071 keq of acidity.
⁷ While it does not affect the conclusions of the assessment, for the avoidance of confusion it should be noted that the equation describing nitrogen deposition given by SEC is incorrect. Very many other oxidised and reduced species also contribute to the total nitrogen deposition flux (e.g. Marner, B.B and Harrison, R.M. (2004) A spatially refined monitoring based study of atmospheric nitrogen deposition. Atmospheric Environment 38. 5045-5056.).
calculations in this model were last updated in 2003\(^8\). Since this time, there have been considerable developments including:

- the vehicle emission factors on which the model is based have been superseded;
- the NO\(_x\) to NO\(_2\) routine used by the model has been superseded; and
- it has been found that the model can under predict in many situations.

2.3 Defra’s air quality modelling helpdesk produced guidance on running the DMRB model in April 2009\(^9\). This explained that: “The DMRB Screening Model is not always ‘conservative’. It is therefore important to verify the results from the DMRB model against local monitoring data.” The guidance goes on to note that: “The method to convert roadside NO\(_x\) to NO\(_2\) within the DMRB model was based on measurements made between 1999 and 2001. Recent evidence shows that the proportion of primary NO\(_2\) in vehicle exhaust has increased. This means that the relationship between NO\(_x\) and NO\(_2\) at the roadside has changed from that currently used in the DMRB model.” The Defra guidance then presents an alternative method that should be followed.

2.4 A subsequent advice note from Defra, issued in March 2010\(^{10}\) gives a question and answer: Question: “Can screening models such as DMRB … be used for a Detailed Assessment?” Answer: “Generally no.” Although it does go on to note that “the DMRB model may be appropriate for use provided that the model results are sufficiently validated”.

2.5 Full details of how to verify or validate a model are given by Defra in its Technical Guidance for Local Air Quality Management (LAQM.TG(09))\(^{11}\). Without correct local verification, it is not possible to have any confidence in the model’s results. No such verification is reported by SEC, neither does SEC explain any attempt to use Defra’s current set of vehicle emission factors. It is thus concluded that the modelling carried out is not fit for purpose.

**Assessment Location**

2.6 The SEC assessment focuses on concentrations and deposition fluxes 20 m from the centre of the A26. In many places, the A26 is approximately 7 m wide (e.g. at Poundgate Hill), with the Ashdown Forest SAC extending right to the edge of the road. Nitrogen dioxide concentrations reduce rapidly with distance from roads\(^{12}\). Defra, in LAQM.TG(09) (Box 2.3) provides a method for predicting nitrogen dioxide concentrations at different distances from roads. This shows that the local road component of nitrogen dioxide is typically more than three times higher at the edge of a 7 m wide road than that 20 m from the centre of the road. Thus, if the assessment had considered

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\(^8\) The authors of this current report contributed to the development of this model.


\(^10\) http://laqm.defra.gov.uk/documents/Can_screening_models_DMRB_and_ADMS_be_used_for_a_DA.pdf


\(^12\) http://laqm.defra.gov.uk/documents/FallOffWithDistanceReptJuly08.pdf
impacts at worst-case locations within the European sites, the predicted impacts would have been more than three times higher.

**Future Year Predictions**

2.7 The SEC assessment considers predicted impacts in 2020 and 2021, but includes the impact of the full housing allocations up to 2030. Background NOx concentrations in 2020 are taken from Defra’s mapped predictions. Background nitrogen deposition fluxes were derived from the Centre for Ecology and Hydrology (CEH) maps published on the Air Pollution Information System (APIS) website. The background fluxes taken from APIS were reduced by 20% to account for anticipated reductions beyond 2010. No justification for this approach is provided. Historically, APIS only provided background deposition flux estimates for the year 2000. Prior to 2010, the Highways Agency considered model results between 2000 and 2010 and suggested that background fluxes could be reduced by 2% per year up until 2010. There is no clear justification for applying this reduction beyond 2010. APIS now provides background fluxes for 2005 and 2020 in any event, so a more appropriate method would be to use the values for 2020 to represent conditions in 2021, and also to include sensitivity tests as described in paragraph 2.9, below.

2.8 Impacts were predicted using the DMRB model’s estimates of traffic emissions in 2020. As noted above, this model was last updated in 2003 and these emission factors have since been superseded. The DMRB model predicts that NOx emissions per vehicle in 2020 (from Light Duty Vehicles travelling at 80kph) will be less than half those in 2003. This reflects anticipated improvements in the vehicle fleet. Since 2003, measurements made at very many sites across the UK have failed to show the improvements that were predicted, both using the DMRB 2003 emission factors and the 2009 updated dataset. This prompted Defra in 2010 to note that “analyses of historical monitoring data have identified a disparity between the measured concentrations and the projected decline in concentrations associated with the emissions forecasts” “For NO\textsubscript{2}, levels have largely remained stable [over the past 6 – 8 years] at urban roadside and background sites, but show a slight upward trend in inner London. At monitoring sites close to motorways and dual-carriageways, there is evidence that NOx concentrations have fallen at some, but not all locations, while NO\textsubscript{2} concentrations have levelled off” “On this basis, it might … be expected that the forecast reductions in background NOx and NO\textsubscript{2} concentrations associated with the road traffic component are optimistic”.

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14 [http://www.apis.ac.uk](http://www.apis.ac.uk)
17 These comments were made after the emission factors used by the DMRB model were superseded, and the same comments can be made regarding both emissions datasets.
2.9 Concern regarding future-year emission projections was at the heart of a recent Inspectors ruling\textsuperscript{18} for refusal of planning permission. The Inspector noted that “the modelled concentrations in 2013 are lower than would otherwise have been the case had 2010/11 emission rates been assumed to continue”. Taking into account the guidance issued by Defra, the Inspector further concluded that “under these circumstances it would be reasonable to expect sensitivity tests to be undertaken on the outcome of the modelling, based on the possibility that the emissions reductions suggested by [the official forecasts] would not be realised”.

2.10 The SEC assessment makes no mention of uncertainty regarding its future year projections and their potential to under-predict concentrations in the future.

2.11 It is also noted that no assessment is given for the intermediate period prior to 2021 when emissions per vehicle would be higher (albeit with potentially lower traffic volumes).

**Calculations Carried Out**

2.12 The SEC assessment is of the difference between traffic associated with the Core Strategy allocation and that associated with the ‘Trend Based Requirement’ (TBR). It is unclear why the impact assessed is the difference between these allocations, rather than the total traffic generated by the TBR. It is considered that assessing the total impact associated with TBR-related traffic would be more appropriate, as this would show the impact of any revised Core Strategy.

2.13 The SEC assessment also calculates “Headroom AADT above TBR housing allocations” for both annual mean NO\textsubscript{x} and nitrogen deposition. The basis of these calculations is not at all clear. For example, for NO\textsubscript{x}, Table 2 of the SEC assessment states that the road component of NO\textsubscript{x} concentrations in 2020 associated with 30,000 vehicles per day is 11.5 µg/m\textsuperscript{3}, with the total NO\textsubscript{x} (including the background) being 19.2 µg/m\textsuperscript{3}. This gives a headroom of 10.8 µg/m\textsuperscript{3} below the 30 µg/m\textsuperscript{3} critical level. If 30,000 vehicles per day give rise to 11.5 µg/m\textsuperscript{3}, it is not clear how an additional 120,000 vehicles per day can be accommodated within the 10.8 µg/m\textsuperscript{3} headroom as SEC’s Table 2 suggests. Passenger cars emit less NO\textsubscript{x} than heavier vehicles and so, assuming the AADT described in the “headroom” statistics relates solely to passenger cars, one would not expect a linear relationship with the emissions from 30,000 vehicles; but the disparity does require explanation, particularly since no qualification is made regarding the composition of the vehicle fleet. Without an explanation of how the calculation was carried out, it is impossible to have any confidence in these results.

\textsuperscript{18}APP/J4423/A/10/2143547; http://www.sheffieldeastend.org.uk/PlanningInspectorsDECISIONSbursArcher Rd082011.pdf
Use of Background Deposition Fluxes

2.14 The SEC assessment quotes an unspecified “ecological specialist” stating that the APIS background “ambient levels of NOx deposition” often over-predict at rural roadside locations compared with the results of “site specific studies”. No further explanation is given, but this statement appears to form the basis of comments by both SEC and JOA that the APIS-derived total nitrogen deposition rate is likely to be a considerable overestimate. It is not clear whether the term “ambient levels of NOx deposition” is intended to refer to ambient concentrations of NOx, (i.e. in the air), to NO₂ deposition fluxes to vegetation, or, as SEC have taken it, total nitrogen deposition fluxes. The background NOx concentrations used by APIS come from Defra’s Pollution Climate Mapping model, which has been verified against a substantial dataset of national monitoring data. While there will be site-specific inaccuracies, there is no basis for expecting an overall positive bias to the mapped ambient NOx concentrations. It is considered that there is no basis for the assertions made by SEC and JOA that APIS is likely to have over-predicted background nitrogen deposition fluxes.

2.15 Nitrogen deposition fluxes vary appreciably over relatively short distances; with higher fluxes near to NOx and ammonia sources and lower fluxes distant from any source\(^{19}\). The data available from APIS represent the results from spatially-averaged modelling carried out by CEH; typically using 5km x 5km average data. Spatial averages will, by definition, tend toward over-predicting the lowest values and under-predicting the highest values. They nevertheless represent background conditions. Near to an emission source, such as a busy road, the APIS background fluxes will tend to under-predict total deposition because they were never intended to contain sufficient resolution to deal with near-field effects.

2.16 The SEC report has not assessed total nitrogen deposition fluxes near to roads. The correct assessment methodology\(^{20}\) would be to use a local model to predict the contribution from the road and (after subtracting the spatially-averaged contribution from the road) add that to the background. This has not been done by SEC, even though the modelling that SEC carried out would have enabled them to do so. The SEC report is, therefore, highly likely to have under-predicted the total nitrogen deposition flux; since it has ignored the contribution from the road.

Comments Made Regarding Overestimating Local Deposition

2.17 The SEC assessment states that “The worst case assumption of all NO₂ emitted from the road being deposited in the SAC or Ramsar site has been made”\(^{21}\). JOA (2011) takes this point further, noting that “In any event, the ‘worst case scenario’ is unlikely to occur, as most nitrogen emitted in the area is likely to be deposited outside the UK”. These statements are not supported by the


\(^{21}\) It is assumed that the SEC report means NOx emitted from traffic on the road, and not NO₂.
information presented. No mass balance calculations have been presented and the SEC model has not assumed that all the emitted NOx is deposited in the European sites. The SEC statement is therefore not justified and the JOA statement compounds the error.

Other Inaccurate Statements and Assumptions

2.18 There are a large number of inaccurate statements made in the SEC memorandum. One example is: “Since the 2009 AA was produced, … updates to the Defra local air quality management support pages predict declining background levels of NOx and NO\textsubscript{2}. This means that the potential headroom in terms of N deposition, and thus AADT, will have increased”. Defra’s Predicted background levels of NOx and NO\textsubscript{2} have shown reductions into the future for many years. The key recent change is that the decline in the road traffic component of these backgrounds has been called into question. Comments are also made that a more thorough assessment should be carried out at project level; which implies that a proper assessment is not required at strategic level. Specifying a thorough project level assessment does not negate the need to carry out a proper strategic level assessment, using the best information that is currently available.

2.19 There are a number of assumptions and statements made in the SEC and JOA reports which are not specifically commented on in this note. An example is the traffic assumptions used, including flows, fleet compositions and average speeds. The lack of comment here does not mean that the assumptions used or statements made are accepted.

3 Conclusions

3.1 Air Quality Consultants Ltd has reviewed documents submitted by Jennifer Owen and Associates and Southdown Environmental Consultants submitted to the Wealden District Council Core Strategy Examination in relation to air pollution and at European sites. A large number of failings were identified. The assessment:

- does not consider all required pollutants;
- is based on incorrect vehicle emission factors;
- uses an inappropriate modelling methodology;
- does not consider conditions at worst-case locations within the European sites;
- takes no account of recent evidence that vehicle emissions are not falling in line with previous projections;
- only considers a fraction of the traffic associated with its ‘Trend Based Assessment’ data;
- presents unsupported data regarding “headroom AADT”;
- fails to consider nitrogen deposition fluxes near to the road; and
• makes misleading statements regarding over-predicting nitrogen deposition fluxes.

3.2 For these reasons, it is felt that the assessment presented is not fit for purpose and that its conclusions cannot be relied upon. Statements made in the JOA submission regarding the assessment being worst case are clearly misleading, since the results presented are very clearly not worst-case.

3.3 The JOA submission states\(^\text{22}\) that: “the higher rate of housing provision cannot be assumed to result in unacceptable levels of nitrogen deposition unless it is properly assessed”. It is more usual to take a precautionary position. For example, the Infrastructure Planning Commission’s guidance on applying the habitats regulations\(^\text{23}\) explains that: “The developer should carry out the necessary preparatory work during pre-application to a level of detail that will enable the competent authority to meet its duty under the 2010 Habitats Regulations (as amended). This work should result in information which will show beyond reasonable doubt whether any European sites are likely to be affected by the … proposal, either alone or in combination with other plans or projects, describe the likely impacts on the conservation objectives of the European sites … and describe whether the impacts are likely to be significantly adverse.” (our emphasis).

3.4 The submissions by JOA and SEC do not properly assess the impacts on the European sites. Without such an assessment, it cannot be assumed that the higher rate of housing provision would not result in unacceptable impacts.

\(^{22}\) In paragraph 1.17.

A1 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc MIAQM

Prof Laxen is the Managing Director of Air Quality Consultants, a company which he founded in 1993. He has over forty years experience in environmental sciences and is a member of Defra’s Air Quality Expert Group and the Department of Health’s Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM\(_{10}\), PM\(_{2.5}\) and ozone and was responsible for setting up UK’s urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities’ air quality Review & Assessment reports. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries and published over 70 scientific papers and given numerous presentations at conferences.

Dr Ben Marner, BSc (Hons) PhD CSci MIEnvSc MIAQM

Dr Marner is a Technical Director with AQC, and has more than thirteen years relevant experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to Defra, the Highways Agency, Transport Scotland, Transport for London, and numerous local authorities. Dr Marner has provided public inquiry expert witness services.

Full CVs are available at [www.aqconsultants.co.uk](http://www.aqconsultants.co.uk)