

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix CT-001-00003

Route-wide: Air quality

Technical note – Updated guidance on the assessment methodology for Phase 2b SES2 and AP2 ES

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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1 Introduction

1.1 Purpose of the note

- 1.1.1 This technical note provides further information on the assessment of air quality during construction and operation of the Proposed Scheme.
- 1.1.2 A version of this note was initially published in the Environmental Impact Assessment (EIA) Scope and Methodology Report (SMR) as part of the High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) (the main ES)¹; see Volume 5, Appendix: CT-001-00001, Part B. In addition, this note was updated as part of the Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement (SES1 and AP1 ES)²; see Volume 5, Appendix: CT-001-00003. This note has been updated for the assessment of the Supplementary Environmental Statement 2 (SES2) scheme and Additional Provision 2 (AP2) revised scheme.
- 1.1.3 The SMR in the main ES provides the general methodology to be followed, and the technical notes provide a more detailed framework for assessing air quality effects during construction and operation.

1.2 Changes to this technical note since the EIA Scope and Methodology Report (SMR)

- 1.2.1 Since the publication of the main ES, the technical note was updated in the SES1 and AP1 ES to include updates to:
- changes to published guidance documents;
 - additional elements to the assessment of ecological sites based on discussions with Natural England; and
 - further clarification on assessing impacts and significance.
- 1.2.2 For the SES2 and AP2 ES this technical note has been further updated for as summarised in Table 1.

¹ High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

² High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement>.

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Table 1: Summary of changes since the EIA Scope and Methodology Report (SMR)

Section number	Section title	Summary of change
2.1	Guidance documents and elsewhere	Updated references for Department for Environment, Food and Rural Affairs (Defra) guidance TG22 and PG22 (previously TG16 and PG16).
5.1	Type of assessment required	Definition of change in traffic flows to be used for SES2 and AP2 ES and Habitats Regulations Assessment (HRA).
5.5	Modelled pollutants, model version and emission factors	Use of Defra's updated Emissions Factors Toolkit (EFT) to calculate emissions beyond 2030. Addition of ammonia for ecological assessments.
5.8	Background concentrations	Further explanation on where ecological sites critical levels and ammonia data are to be obtained from.
8.3	Significance of effects	Explanation of how significance of effects are assessed in the SES2 and AP2 ES and HRA for ammonia.
9	Route-wide modal shift assessment	Use of Defra's updated EFT to calculate emissions.

2 General considerations

2.1 Guidance documents

2.1.1 The following guidance documents are relevant for the assessment of air quality:

- The Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) Technical Guidance (TG22) (August 2022) – referred to as ‘Defra TG22 guidance’³;
- Defra LAQM Policy Guidance (PG22) (August 2022) – referred to as ‘Defra PG22 guidance’⁴;
- Highways England Design Manual for Roads and Bridges (DMRB) LA 105 guidance (November 2019) – referred to as ‘DMRB guidance’⁵;
- Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction (June 2016) – referred to as ‘IAQM construction dust guidance’⁶;
- Greater London Authority (GLA) Supplementary Planning Guidance on the Control of Dust and Emissions during Construction and Demolition⁷ (July 2014);
- IAQM guidance on the assessment of mineral dust impacts for planning (May 2016) – referred to as ‘IAQM mineral dust guidance’⁸;
- IAQM and Environmental Protection UK (EPUK) guidance on land-use planning and development control (January 2017) – referred to as ‘IAQM/EPUK guidance’⁹;

³ Department for Environment, Food and Rural Affairs (2022), *Local Air Quality Management Technical Guidance (TG22)*. Available online at <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>.

⁴ Department for Environment, Food and Rural Affairs (2022), *Local Air Quality Management Policy Guidance (PG22)*. Available online at: <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-Policy-Guidance-2022.pdf>.

⁵ Highways Agency (2019), *Design Manual for Roads and Bridges (DMRB), Sustainability and Environmental Appraisal, LA 105 Air Quality*, Highways Agency, London. Available online at: <https://www.standardsforhighways.co.uk/dmrbs/search/10191621-07df-44a3-892e-c1d5c7a28d90>.

⁶ Institute of Air Quality Management (2016), *Guidance on the assessment of dust from demolition and construction, v1.1*. Available online at: <https://iaqm.co.uk/guidance/>.

⁷ Greater London Authority (2014), *Supplementary Planning Guidance, Control of Dust and Emissions during Construction and Demolition*. Available online at: <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance-and-spgs/control-dust-and->

⁸ Institute of Air Quality Management (2016), *Guidance on the assessment of mineral dust impacts for planning, v1.1*. Available online at: <https://iaqm.co.uk/guidance/>.

⁹ Institute of Air Quality Management (2017), *Land-use planning and development control: Planning for air quality, v1.2*. Available online at: <https://iaqm.co.uk/guidance/>.

- IAQM guidance on the assessment of air quality impacts on designated nature conservation sites (May 2020) – referred to as ‘IAQM ecology guidance’¹⁰; and
- Natural England’s approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (June 2018)¹¹.

2.2 Baseline data

- 2.2.1 Baseline monitoring data should be reported from the nearest available sites that represent the location under assessment. Where data capture is less than 90% in a year, commentary will be given on how these data may or may not reflect annual mean concentrations.

2.3 Interfaces

- 2.3.1 Any results that relate to receptors within an adjacent community area (CA) will be included as part of the relevant Volume 2 Community Area report of the SES2 and AP2 ES.

2.4 Meteorological data

- 2.4.1 When dispersion modelling is undertaken, a sensitivity analysis will be performed using five years of hourly sequential meteorological data from a station as indicated below (depending on location). The results for the full assessment will then be presented based on 2018 meteorological data, unless the sensitivity analysis suggests that another year is likely to lead to results that would materially affect the conclusions of the assessment. The choice of any year other than 2018 will be justified.
- 2.4.2 Data from the meteorological station at Manchester Airport will be used in the assessment, unless there are particular local features to suggest another site is more appropriate.

2.5 Limitations

- 2.5.1 Non-scheme car park emissions will not be assessed unless professional judgement indicates that they may contribute significantly to the outcome and have not been included in the baseline.
- 2.5.2 Emissions from rail brake and track wear during operation are assumed to be negligible and will not be included in the assessment. Trains and much of the Proposed Scheme infrastructure will be electrically operated. Emissions from power plants used to power the

¹⁰ Institute of Air Quality Management (2020), *A guide to the assessment of air quality impacts on designated nature conservation sites, v1.1*. Available online at: <https://iaqm.co.uk/guidance/>.

¹¹ Natural England (2018), *Natural England’s approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations*. Available online at: <http://publications.naturalengland.org.uk/publication/4720542048845824>.

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trains and infrastructure are outside the scope of a local air quality assessment and will not be included in the assessment.

3 Assessment of dust emissions

3.1 Type of assessment required

- 3.1.1 Emissions of dust and particulates during construction will be assessed following the IAQM construction dust guidance⁶. This section provides an interpretation of the guidance for application to the assessment of the Proposed Scheme.
- 3.1.2 Within the IAQM guidance, an 'impact' is described as a change in pollutant concentrations or dust deposition and an 'effect' is described as the consequence of an impact. The main impacts that may arise during construction are:
- dust deposition, resulting in soiling of surfaces;
 - visible dust plumes; and
 - elevated PM₁₀ concentrations.
- 3.1.3 The IAQM guidance considers the potential for dust emissions from dust-generating activities, such as demolition of existing structures, earthworks, construction of new structures and trackout. Earthworks refer to the processes of soil stripping, ground levelling, excavation and land capping, while trackout is the transport of dust and dirt from the site onto the public road network where it may be deposited and then re-suspended by vehicles using the network. This arises when vehicles leave the site with dusty materials, which may then spill onto the road, or when they travel over muddy ground on site and then transfer dust and dirt onto the road network.
- 3.1.4 For each of these dust-generating activities, the guidance considers three separate effects: annoyance due to dust soiling, harm to ecological receptors and the risk of health effects due to a significant increase in PM₁₀ exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and PM₁₀ exposure.
- 3.1.5 The methodology takes into account the scale to which the above effects are likely to be generated (classified as small, medium or large), along with the levels of background PM₁₀ concentrations and the distance to the closest receptor, in order to determine the sensitivity of the area. This is then taken into consideration when deriving the overall risk for the site. Suitable mitigation measures are also proposed to reduce the risk of dust emissions from the site.

3.2 Types of receptors

- 3.2.1 The IAQM guidance details two types of relevant receptors that will be taken into account in the assessment – human and ecological receptors.
- 3.2.2 A human receptor is defined as any location where a person may experience the annoyance effects of airborne dust or dust soiling, or exposure to PM₁₀ over a time period relevant to the air quality standards. For the purposes of the assessment this is mainly residential

dwellings. The IAQM guidance also directs that some commercial premises may have a particular sensitivity to dust, however, the assessment must take into account the actual situation at premises of this type as they may already have protected their operations against increased dust levels. Some horticultural operations are also considered to be dust sensitive.

- 3.2.3 An ecological receptor is any habitat that may be sensitive to dust soiling from direct impacts (e.g. excessive dust deposition) or indirect impacts on fauna (e.g. foraging habitats).

3.3 Spatial scope of assessment

- 3.3.1 The IAQM guidance suggests that an assessment is required where there are sensitive receptors within 350m of the boundary of the site (or 50m for ecological receptors), within 50m of the route used by construction vehicles on the public highway and up to 500m from the site entrance. It is acknowledged in the guidance that these values are conservative and hence there is scope for specific criteria to be applied at certain locations if required.

3.4 Temporal considerations

- 3.4.1 The assessment of impacts will consider the construction activities throughout the construction period. However, a separate assessment will not be undertaken for every year throughout construction at every site. The assessment will instead capture the periods where the risks of adverse impacts are at their highest.
- 3.4.2 The assessment of each major construction activity will therefore draw upon the construction programme to identify the duration and location of activities that would give rise to air quality impacts. As the IAQM guidance provides a three-scale level of risk for various activities that depends on their scale and distances to sensitive receptors, it is likely that the overall risk will change at different times during the construction period.
- 3.4.3 The assessment will therefore identify any changes in the risk of adverse effects through the construction period and set out an appropriate level of mitigation to reduce those risks. The level of mitigation proposed will be consistent with that proposed in the IAQM guidance document and detailed within the draft Code of Construction Practice (CoCP) which is set out in the main ES (see Volume 5, Appendix: CT-002-00000).

3.5 Mitigation measures

- 3.5.1 When undertaking the construction impact assessment, the mitigation measures detailed within the draft CoCP will be applied. The assessment will also take into consideration any policies and commitments made by HS2 Ltd.
- 3.5.2 The IAQM guidance notes that with the application of sufficient mitigation measures, no significant effects would be anticipated from construction activities. Should further

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mitigation measures be necessary at certain locations, these will be formulated taking into consideration the measures detailed in the IAQM guidance and best practice.

4 Assessment of mineral dust emissions

4.1 Type of assessment required

- 4.1.1 Emissions of dust and particulates from mineral extraction operations during construction will be assessed following the relevant IAQM mineral dust guidance. This section provides an interpretation of the guidance for application to the assessment of the Proposed Scheme.
- 4.1.2 Dust arising from mineral extraction operations can be distinguished between coarser particles that can reduce amenity in the local community due to visible dust plumes and dust soiling ('disamenity dust') and smaller particles that can increase local pollutant concentrations of particulate matter (PM₁₀ and PM_{2.5}) which is associated with a range of health effects.
- 4.1.3 Within the IAQM mineral dust guidance, an 'impact' is described as a change in suspended particulate matter concentration or dust deposition and an 'effect' is described as the consequence of an impact to human health or disamenity. The main impacts that may arise during mineral activities are:
- dust accumulation, resulting in soiling of surfaces and disamenity;
 - visible dust plumes; and
 - elevated concentrations of particulate matter.
- 4.1.4 The IAQM mineral dust guidance considers the potential for emissions from dust-generating activities, such as preparation of the land, extraction, processing, handling and transportation of extracted material.
- 4.1.5 The assessment will be undertaken using the source-pathway-receptor approach described in the IAQM mineral dust guidance. This is a concept whereby a hypothetical relationship is applied between the source of the pollutant, the pathway by which exposure may occur and the receptor that could be adversely affected.
- 4.1.6 The methodology takes into account the effectiveness of the pathway and the scale of the source to derive the risk of dust impacts at individual receptors. This is then combined with the sensitivity of each receptor to derive the likely magnitude of the effect that will be experienced. Consideration is then given to the overall effects from dust deposition from each mineral extraction site.
- 4.1.7 For the assessment of suspended particulate matter, consideration needs to be given to the existing background PM₁₀ concentrations in the area. The process contribution from the mineral extraction activities is then estimated at each receptor and an overall PM₁₀ impact for the area is derived.

4.2 Types of receptors

- 4.2.1 The IAQM guidance details two types of relevant receptors that will be taken into account in the assessment – human and ecological receptors. A human receptor is defined as any location where a person may experience the disamenity effects of dust or the health effects from exposure to PM₁₀ over a time period relevant to the air quality standards. For the purposes of the assessment this is mainly residential dwellings. An ecological receptor is any habitat that may be sensitive to dust deposition from direct impacts on vegetation or aquatic ecosystem or indirect impacts on fauna.

4.3 Spatial and temporal scope of assessment

- 4.3.1 The IAQM guidance suggests where there are sensitive receptors within 1km of dust generating activities, an assessment of PM₁₀ concentrations will be required. Where there are sensitive receptors within 250m (soft rock) or 400m (hard rock) of extraction activities, an assessment of disamenity dust will be required.
- 4.3.2 The assessment of impacts will consider the mineral extraction operations throughout the construction period. It will identify the risk of adverse effects during the construction period and set out an appropriate level of mitigation to reduce those risks. The level of mitigation proposed will be consistent with that proposed in the IAQM mineral dust guidance and has been detailed within the draft CoCP.

4.4 Mitigation measures

- 4.4.1 When undertaking the assessment of mineral dust impacts the mitigation measures detailed within the draft CoCP will be applied. The assessment will also take into consideration any policies and commitments made by HS2 Ltd. Should further mitigation measures be necessary at certain locations, these will be formulated taking into consideration the measures detailed in the IAQM mineral dust guidance and best practice.

5 Assessment of vehicle emissions

5.1 Type of assessment required

- 5.1.1 Traffic data will be screened using the following criteria taken from the current and previous DMRB guidance to identify where further assessment is required. These criteria are the following:
- change in road alignment by 5m or more;
 - change in daily traffic flows by 1,000 vehicles or more as annual average daily traffic (AADT);
 - change in daily flows of heavy duty vehicles (HDV) by 200 AADT or more;
 - change in daily average speed by 10kph or more; or
 - change in peak hour speed by 20kph or more.
- 5.1.2 The screened in roads will then be included in an atmospheric dispersion model for detailed assessment.
- 5.1.3 Consideration will also be given as to whether other roads that would be screened out using the above criteria are to be included in the assessment. An example of this is roundabout links and slip roads along dual carriageway road links that have been screened in.
- 5.1.4 For the assessment in the SES2 and AP2 ES and Habitats Regulations Assessment (HRA), the comparison of traffic flows is undertaken between the ‘without’ Proposed Scheme traffic and ‘with’ the Proposed Scheme traffic, ideally based on annualised traffic where available or daily peak traffic otherwise.
- 5.1.5 For the HRA in combination assessment an additional comparison of traffic flows is to be undertaken between the base year traffic and the ‘with’ Proposed Scheme traffic, ideally based on annualised traffic where available or daily peak traffic otherwise.

5.2 Types of receptors

- 5.2.1 Human receptors to be included in the air quality assessment of vehicle emissions will be taken from the Ordnance Survey (OS) AddressBase Plus database. These will be screened for sensitivity to air quality following the Defra TG22 guidance.
- 5.2.2 Ecological receptors to be included in the air quality assessment will be those national or international designated sites with habitats sensitive to nitrogen deposition. These could include Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), National Nature Reserves (NNR), Special Protection Areas (SPA) or Ramsar sites.
- 5.2.3 Receptors will be chosen so the worst affected relevant sensitive exposure (residential properties, schools, hospitals, nursing homes) on each road and at each junction on the assessed road network is represented. If several receptors are present at a junction and it is

unclear which of them would be the worst affected receptor, all of the potential worst affected receptors will be modelled. Where there is no sensitive exposure at junctions, receptors will be chosen alongside the screened in roads so that all possible worst case effect locations are represented.

- 5.2.4 For assessment of car parks, receptors will be chosen near the perimeter of the car park where worst case effects are likely, considering contributions from other modelled sources (car parks and roads). Additionally, receptors included in any combustion plant assessment will be included in the model runs to account for cumulative effects.
- 5.2.5 All sensitive human receptors will be modelled at a height of 1.5m and at the façade closest to the modelled roads. For ecological receptors, transects will be used from the edge of the road towards the ecological site, with modelled points at 0m, 10m, 20m, 30m, 40m, 50m, 75m, 100m, 150m and 200m from the road unless the shape of the site and potential impacts requires different distances to characterise the impacts. All ecological receptors will be modelled at ground level, i.e. height of 0m unless local conditions require otherwise.

5.3 Spatial scope of assessment

- 5.3.1 Any quantitative air quality assessment will cover the roads which meet the screening criteria and roads which adjoin them to enable the effects at junctions to be assessed.

5.4 Scenario nomenclature

- 5.4.1 The following years will be assessed:
- 2018 current baseline (for model verification, if required);
 - selected year(s) within the construction period for the assessment of the effects of construction. The year(s) of assessment will be selected based on the worse case peak period during the construction programme and when significant effects might be expected; and
 - an operational scenario for the first full operational year after construction is completed.
- 5.4.2 For the SES2 and AP2 ES assessment and HRA, the scenario without the Proposed Scheme in place and the scenario with the Proposed Scheme in place will both be assessed. This uses traffic data from the 'with' and 'without' Proposed Scheme scenarios, with background pollutant concentrations, deposition rates and emission factors representing the future year being assessed.
- 5.4.3 For the assessment of the Proposed Scheme in combination with other plans and projects, as part of the HRA, a different 'without' scheme scenario is used and described as the 'do nothing' scenario. This uses traffic data from the current baseline (a worst-case assumption), but with background pollutant concentrations, deposition rates and emission factors representing the future year being assessed.

5.5 Modelled pollutants, model version and emission factors

- 5.5.1 Only annual mean nitrogen dioxide (NO₂), PM₁₀ and PM_{2.5} concentrations are required to be modelled (and oxides of nitrogen (NO_x) for ecological receptors). The treatment of short-term statistics is explained in the following paragraphs.
- 5.5.2 NO_x output from the models for both on road sources and car parks will be combined with the background NO_x and NO₂ concentrations in the Defra NO_x to NO₂ conversion spreadsheet¹² to obtain total roadside and background annual mean NO₂ concentrations. Modelled combustion plant NO₂ contributions will be added to these values to yield a total annual mean NO₂ concentration.
- 5.5.3 The predicted number of exceedances of the 1-hour NO₂ objective will only be reported if the annual mean NO₂ concentrations are over 60µg/m³. Therefore, this less onerous statistic is not likely to be reported, unless there is a very short term activity being examined where high peaks in NO₂ concentrations are expected.
- 5.5.4 To calculate the annual mean PM₁₀ (or PM_{2.5}) concentrations, the background PM₁₀ (or PM_{2.5}) concentrations will be added to the roadside concentration output (and any modelled combustion plant output) from the model.
- 5.5.5 The number of exceedances of the 24-hour PM₁₀ objective will be calculated using the formula in the Defra TG22 guidance, that is: No. 24-hour mean exceedances = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$.
- 5.5.6 The most recent versions of ADMS-Roads and ADMS will be used for any dispersion modelling assessment. Emissions suitable for use in the ADMS-Roads model will be generated using the most recent Emissions Factors Toolkit (EFT)¹³ available at the start of the assessment. EFT version 11 onwards includes the ability to calculate emissions beyond 2030, therefore, the EFT has been used to calculate emissions for the opening year (e.g. 2039). It should be noted that the use of EFT for years beyond 2030 is likely to lead to inconsistencies such as in terms of the use of 2030 backgrounds and other associated Defra tools, which only provide data up to 2030. Therefore, overall concentrations are likely to be conservative and worst-case (i.e. higher than if 2039 backgrounds and other associated Defra tools for 2039 were available). However, the latest version of EFT is appropriate to use for the 2039 opening year with the assumptions that it incorporates about future vehicle technology such as electric vehicle fleet penetration.

¹² Department for Environment, Food and Rural Affairs (2020), *NO_x to NO₂ calculator*. Available online at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/>.

¹³ Department for Environment, Food and Rural Affairs (2021), *Emissions Factors Toolkit (version 11)*. Available online at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>.

- 5.5.7 The assessment will also incorporate HS2 Ltd’s vehicle emissions requirements which are detailed in HS2 Phase 2a Information Paper E14 Air Quality¹⁴. These include the use of Euro 4 petrol and Euro 6 diesel light goods vehicles (LGV), and Euro VI heavy goods vehicles (HGV) as a minimum.
- 5.5.8 Emission factors for heavy vehicles using the site haul routes, such as 20t HGV and 40t articulated dump trucks (ADT), will be taken from the National Atmospheric Emissions Inventory (NAEI).
- 5.5.9 An assessment of nitrogen and acid deposition, and where applicable ammonia (NH₃), will be undertaken for SSSI, SAC, SPA and Ramsar ecological sites with habitats sensitive to nitrogen. A deposition velocity relevant to the habitat of each site will be used, as detailed in the IAQM ecological guidance¹⁰, or alternatively as provided by the relevant Ecology specialists. The predicted change in deposition will be compared against the applicable critical loads for each site.

5.6 ADMS model parameters

- 5.6.1 ADMS-Roads meteorological setting will remain as default, except for the surface roughness and minimum Monin-Obukhov length¹⁵ – advice on the relevant values to be used will be taken from the ADMS Roads User Guide¹⁶ based on the characteristics of the study area as shown in Table 2.
- 5.6.2 For the meteorological site, the surface roughness will be selected as representative of the meteorological station location and no minimum Monin-Obukhov length will be selected.
- 5.6.3 Terrain will not be included in dispersion modelling unless justified using professional judgement.

¹⁴ High Speed Two Ltd (2021), High Speed Two Phase 2a, *Information Paper, E14: Air Quality*. Available online at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960731/E14_Air_Quality_v1.3.pdf.

¹⁵ The minimum Monin-Obukhov length is a parameter describing the stability of the atmosphere.

¹⁶ Cambridge Environmental Research Consultants (2020), *ADMS Roads User Guide v5.0*. Available online at:
https://www.cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS-Roads5.0_User_Guide.pdf.

Table 2: Surface roughness values for ADMS

Study area	Surface roughness (m)
Large urban areas	1.5
Cities / woodlands	1.0
Parkland, open suburbia	0.5
Agricultural areas (max)	0.3
Agricultural areas (min)	0.2
Root crops	0.1
Open grassland	0.02
Short grass	0.005

5.7 Car parks, stationary idling vehicles

- 5.7.1 Emissions from car parks will be assessed using ADMS-Roads. These will include new car parks for the operation of the Proposed Scheme and any car parks introduced during construction if operational for over nine months. Emissions from movements within the car park will be estimated using the EFT spreadsheet. The travel speed will be set at 5kph and the travel distance within the car park will be set to the car park perimeter for surface car parks with half the perimeter distance added for each floor above ground level for multi-storey car parks.
- 5.7.2 Consideration will be given to the inclusion of places where vehicles may stand with engines idling e.g., taxi stands (use design length of taxi ranks, number of vehicles, duration of stay etc.) and pick-up and drop-off areas. Emissions will be calculated using the latest EFT version and the methodology described in the TG22 guidance. Cold start emissions from car parks will also be calculated using emission factors from the NAEI¹⁷ and distributed within the car park area.
- 5.7.3 Car parks will be modelled as area sources at ground level for surface cars parks, as volume sources using the height of the car park for multi-storey car parks, or as point sources at ventilation points for mechanically ventilated underground car parks (or at the entrance or openings of the car park if not mechanically ventilated), using emissions calculated for cold start and internal movement emissions uniformly distributed throughout the sources.

5.8 Background concentrations

- 5.8.1 Data for background concentrations will be taken from the latest maps available on the Defra website¹⁸ and from local monitoring information available in the area. Professional

¹⁷ National Atmospheric Emissions Inventory. Available online at: <https://naei.beis.gov.uk/data/ef-transport>.

¹⁸ Department for Environment, Food and Rural Affairs, *Background maps*. Available online at: <https://uk-air.defra.gov.uk/data/laqm-background-home>.

judgment will be used to determine which data is most appropriate to be used for the assessment of each area.

- 5.8.2 If local monitoring data is not available for the base year of 2018, it will be adjusted using the same factors for the area as those used in the Defra background maps. Local background monitoring data will also be adjusted, if used, for the required assessment years.
- 5.8.3 Background NO_x and NO₂ concentrations will be sector-removed using the Defra tool. No sector-removal will be undertaken for PM₁₀ and PM_{2.5} concentrations.
- 5.8.4 For the ecological sites, data on critical loads, critical levels and nitrogen and acid deposition, and where applicable NH₃, will be taken from the most recent information available on the Air Pollution Information System (APIS) website¹⁹, unless otherwise provided by the Ecology specialists. No reduction in future background deposition rates will be applied.

5.9 Speeds

- 5.9.1 Where data exist on actual speeds these will be used. In the absence of actual or modelling traffic speed data, the following speeds will be used (unless justified otherwise):
- speed limit; and
 - junctions and roundabouts at 20kph.

5.10 Model verification

- 5.10.1 An existing baseline year of traffic data will be used for the study area (i.e. 2018 current baseline scenario). A full assessment of the entire study area will not be required; however, this information will be used to test model performance and undertake model verification.
- 5.10.2 The model will be verified at selected suitable continuous and/or diffusion tube NO₂ monitoring sites in accordance with the Defra TG22 guidance. Kerbside sites will not be included in the model verification exercise. Adjustment to the model using the procedure detailed in the Defra TG22 guidance will be made if the average difference between modelled and monitored NO₂ concentrations exceeds 25% of monitored concentrations or if there is a consistent under or over prediction.
- 5.10.3 Where monitoring of NO₂ concentrations is undertaken for the Proposed Scheme, the analysis of the data (including annualisation and/or bias adjustment) will follow the Defra TG22 guidance.
- 5.10.4 Predicted PM₁₀ and PM_{2.5} concentrations will not be adjusted.

¹⁹ Air Pollution Information System, *Site relevant critical loads*. Available online at: <http://www.apis.ac.uk/>.

6 Combustion plant assessment

6.1 Type of assessment required

- 6.1.1 Emissions from any buildings will be considered in the assessment. Professional judgement will be used to determine the most appropriate method for assessment which will be qualitative or quantitative, including dispersion modelling. This should include consideration of the criteria for assessment included in the IAQM/EPUK guidance.
- 6.1.2 Where relevant, professional judgement and/or dispersion modelling will be used to suggest design modifications including height and location of flues/stacks, particularly in relation to any adjacent or neighbouring buildings or structures.
- 6.1.3 Professional judgement will be used as to whether modelling of plant that is not used throughout the year is appropriate (e.g. back-up generators run only for testing other than in the event of power failure).
- 6.1.4 Dispersion modelling will be undertaken with the atmospheric dispersion model ADMS and/or ADMS-Roads, using the most up to date version as of the date of receipt of the model input data.

6.2 Pollutants emissions and model inputs

- 6.2.1 The modelling assessment will consider annual mean NO_x emissions for gas fired plant and NO_x, PM₁₀ and PM_{2.5} emissions for other fired plant.
- 6.2.2 Inputs to the model will be derived from the boiler size and fuel type, using the boiler specifications if available.
- 6.2.3 Only annual mean concentrations will require modelling. NO₂ concentrations will be assumed to be 100% of NO_x predicted concentrations as detailed in the Defra and Environment Agency guidance on air emissions risk assessment²⁰. The handling of short term statistics is explained in Section 5.5 of this technical note.

6.3 Types of receptors

- 6.3.1 Receptors will be selected based on either their proximity to the source or as the likely most affected receptors. Receptors will include all locations where people might reasonably be (including residential, hotels, nurseries, hospitals, schools, nursing home buildings) and/or

²⁰ Department for Environment, Food and Rural Affairs and Environment Agency (2021), *Air emissions risk assessment for your environmental permit*. Available online at: <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

ecological receptors if considered sensitive to the pollutant being considered and present on a nationally or internationally designated site.

- 6.3.2 If receptors are present in several directions from the stack, the closest receptor in each direction will be selected. The height above ground of the receptors will be set to the height of opening windows and/or air intakes most similar in height to the stack height. Nearby receptors included in any quantitative road and car park assessment will be included in the model runs to account for cumulative effects.
- 6.3.3 Receptors will all be set at local ground level and also at various heights above ground if relevant. Consideration will be given in urban areas where there are many receptors at heights more than two metres above ground to modelling a series of grids at various heights (in order to ensure that exposure of receptors at height are considered).

7 Assessment of rail emissions

7.1 Type of assessment required

7.1.1 An assessment of emissions from diesel locomotives will be undertaken following the Defra TG22 guidance.

7.2 Pollutants emissions

7.2.1 The assessment will take into account both stationary and moving locomotives. The criteria detailed in the Defra TG22 guidance will be used for the assessment of NO₂ and/or sulphur dioxide (SO₂) concentrations. These are:

- locations where sensitive receptors are within 15m from sites that locomotives remain stationary for periods of 15 minutes or more, at least 3 times a day; and
- locations where sensitive receptors are within 30m of the railway track and background annual mean NO₂ concentrations are above 25µg/m³.

7.2.2 Where these criteria are met, it will be concluded that there is a risk of exceedance of the air quality standards and mitigation measures will be proposed.

8 Assessment of significance

8.1 Type of assessment required

8.1.1 The significance of effects resulting from the Proposed Scheme on local air quality from vehicle and/or combustion plant emissions will be assessed using the framework described in this section.

8.2 Describing the impacts

8.2.1 Predicted annual mean pollutant concentrations will be compared between the 'with' and 'without' Proposed Scheme assessment scenarios in the SES2 and AP2 ES. For the HRA the concentrations will be compared between the 'with' and 'without' Proposed Scheme scenarios as well as compared between the 'with' Proposed Scheme and the 'do nothing' assessment scenarios, for the in combination assessment. The predicted change in concentrations will be used along with the predicted concentrations from the 'with' Proposed Scheme scenario to assess local air quality impacts at individual receptors for both the SES2 and AP2 ES and HRA assessments.

8.2.2 The impact descriptors shown in Table 3, taken from the IAQM/EPUK guidance, will be used to describe the impact on human receptors. Changes in pollutant concentrations less than 0.5% of the air quality standard will be described as 'negligible'. Where an increase in concentrations has been predicted with the Proposed Scheme, the resulting impact will be described as 'adverse'. Where a decrease in concentrations has been predicted with the Proposed Scheme, the resulting impact will be described as 'beneficial'.

Table 3: Impact descriptors for individual receptors (adapted from the IAQM/EPUK guidance)

Predicted annual mean concentration in relation to standard	Percent change in concentrations as a result of the Proposed Scheme in relation to standard			
	1%	2–5%	6–10%	> 10%
<75%	Negligible	Negligible	Slight	Moderate
76 – 94%	Negligible	Slight	Moderate	Moderate
95 – 102%	Slight	Moderate	Moderate	Substantial
103 – 109%	Moderate	Moderate	Substantial	Substantial
>110%	Moderate	Substantial	Substantial	Substantial

8.3 Significance of effects

8.3.1 The approach used to assess significance described in the IAQM/EPUK guidance is designed to be a measure of the significance of the changes in air quality in terms of compliance with air quality standards for human receptors and is not intended to be an assessment of any potential health impacts. That is to say, a significant air quality impact determined on the

basis of the IAQM/EPUK approach would not necessarily, or usually, denote a significant health impact. However, the assessment method is intended to provide information on changes in pollutant concentrations that can be used to assess health effects, by flagging up locations and impacts which may merit further consideration.

- 8.3.2 Sensitive human receptors predicted to experience negligible or slight impacts will be described as having no significant air quality effects. Receptors predicted to experience moderate or substantial impacts will be described as having significant air quality effects.
- 8.3.3 For ecological receptors, there is a risk of significant effects if the predicted change in NO_x concentration is greater than 1% of the air quality standard for NO_x.
- 8.3.4 For ecological receptors, where applicable, there is a risk of significant effects if the predicted change in NH₃ concentration is greater than 1% of the air quality critical level for NH₃.
- 8.3.5 For ecological receptors if the predicted change in nitrogen deposition is greater than 1% of the lower critical load for the site, then there is a risk of significant effects. In such cases, the judgement of significance will be undertaken by Ecology specialists and reported within the ecology assessment.
- 8.3.6 For the assessment of acid deposition on ecological receptors, if the total concentration is predicted to be less than the lower critical load, then the effect is considered to be not significant. If the change in concentration is more than 1% of the maximum critical load and the total for acid deposition is greater than the maximum critical load, then the assessment of significance will be undertaken by Ecology specialists and reported within the ecology assessment.

9 Route-wide modal shift assessment

- 9.1.1 A route-wide air quality assessment will be undertaken for changes brought about by passenger modal shift from the operation of the Proposed Scheme. This relates to moving passengers from road to rail and cutting emissions in the process.
- 9.1.2 NO_x, PM₁₀ and PM_{2.5} emissions will be calculated for changes in vehicle kilometres from accessing long distance rail and highway local trips. The latest version of EFT will be used to separately calculate emissions from petrol, diesel and electric cars.

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