



Air Quality Assessment: Transcontinental Advanced Coatings UK, Wrexham

December 2023



Experts in air quality
management & assessment

Document Control

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Executive Summary

The potential air quality impacts associated with the proposed Regenerative Thermal Oxidiser (RTO) system at Transcontinental Advanced Coatings (AC) UK have been assessed.

The assessment has demonstrated that the majority of increases in pollutant concentrations will be below published screening criteria. Where increases in concentrations exceed the screening criteria, the relevant air quality standards will not be exceeded in any location where there is relevant exposure.

The overall operational air quality effects of the proposed RTO are thus judged to be 'not significant'.

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1 Introduction

- 1.1 This report describes the potential air quality impacts on public health associated with the proposed Regenerative Thermal Oxidiser (RTO) system at Transcontinental Advanced Coatings (AC) UK in Wrexham Industrial Estate (the 'facility').
- 1.2 The existing RTO system at the facility, which is used to treat gases from the production lines, is being replaced. The facility currently operates under a Part A(2) activities permit issued by Wrexham County Borough Council (WCBC) for the manufacture of medical products.
- 1.3 Dispersion modelling is required to ensure that emissions associated with the proposed RTO system operating at the emission limit values set out in the existing permit are acceptable. The assessment focuses on the following pollutants for human health impacts:
- nitrogen dioxide (NO₂);
 - hydrogen chloride (HCl);
 - dimethylformamide (DMF);
 - carbon monoxide (CO); and
 - ammonia (NH₃).
- 1.4 When processes at the facility are using nitrogen containing compounds (specifically DMF), the permitted NO_x emission limit value is higher than when DMF is not present within the airstream. For the purposes of this assessment, it has been assumed that the facility operates continuously at this higher emission rate; in reality, average operational emissions will be significantly less, thus a worst-case approach has been considered.
- 1.5 The locations of the existing and proposed RTOs that form the application boundary within the wider Transcontinental AC UK site are shown in Figure 1.



Figure 1: Application Boundary (Western Area is the Existing RTO, Eastern Area is the Proposed RTO) within the Transcontinental AC UK Site

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- 1.6 This report describes existing local air quality conditions and the predicted air quality in the future assuming that the proposed RTO is installed. It has been prepared taking into account all relevant local and national guidance and regulations to support the full planning application for the replacement RTO.
- 1.7 This report assesses the air quality impacts of the proposed development using an approach and structure that addresses the requirements of a full planning application. The requirements of an environmental permitting application are specific, and differ from the requirements of a planning submission. This report should not, therefore, be submitted in support of an environmental permitting application.

2 Policy Context

- 2.1 All European legislation referred to in this report is written into UK law and remains in place.

Air Quality Strategy 2007

- 2.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an Air Quality Action Plan (AQAP) which identifies appropriate measures that will be introduced in pursuit of the objectives.

Clean Air Strategy 2019

- 2.3 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the UK Government, in partnership with the Governments of Scotland, Wales and Northern Ireland, will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

The Environment (Air Quality and Soundscapes) (Wales) Bill

- 2.4 The environment (Air Quality and Soundscapes) (Wales) Bill was passed through the Senedd in November 2023 (Welsh Government, 2023). The Act gives the Welsh Government the power to set long-term, legally binding environmental targets, and outlines how targets will be set, reviewed and monitored.

The Clean Air Plan for Wales

- 2.5 In August 2020, the Welsh Government published the Clean Air Plan for Wales (Welsh Government, 2020), which aims to *“improve air quality and reduce the impacts of air pollution on human health, biodiversity, the natural environment and our economy”*. The Plan sets out the following four themes, around which the plan is structured, with actions in order to enable collaborative approaches to reducing air pollution:

- People: Protecting the health and well-being of current and future generations;

- Environment: Taking action to support our natural environment, ecosystems and biodiversity;
- Prosperity: Working with industry to reduce emissions, supporting a cleaner and more prosperous Wales; and
- Place: Creating sustainable places through better planning, infrastructure and transport.

2.6 The Plan details intentions to publish a Clean Air Zone Framework in Spring 2021, stating an expectation *“to see Clean Air Zones established in towns and cities throughout Wales to reduce the impact of transport emissions on health. Some of these may be supported by a charging element. Clean Air Zones, where appropriate, would enable a range of co-ordinated actions to deliver significant reductions in public and environmental exposure to harmful airborne pollutants from all sources”*.

2.7 The Plan also includes plans to *“introduce LAQM policy changes by 2023 to ensure the regime is public health focused and proactively finding and tackling areas of pollution”*.

2.8 The Plan states that the Welsh Government will *“publish and consult on a White Paper on a Clean Air Act for Wales before the end of this Senedd Term”*, which will include:

- *“New powers for smoke control linked to tackling air pollution from domestic burning (PM_{2.5})*
- *A requirement for a Clean Air Plan / Strategy to be published / reviewed every 5 years*
- *Potential new air quality targets (for example, taking account of WHO guidelines for air quality)*
- *Clarified and strengthened local air quality management legislation*
- *Strengthened powers to address road vehicle idling*
- *Consolidated powers to implement Clean Air Zones / Low Emission Zones*
- *Focused powers to protect vulnerable groups from the effects of air pollution*
- *Enhanced air quality monitoring and modelling*
- *A potential new duty on public bodies to adhere to guidance encouraging different ways of working and actions to reduce air pollution and support decarbonisation.”*

Environment Act 2021

2.9 The UK’s new legal framework for protection of the natural environment, the Environment Act (2021) passed into UK law in November 2021. The Act gives the Government the power to set long-term, legally binding environmental targets. It also establishes an Office for Environmental Protection (OEP), responsible for holding the Government to account and ensuring compliance with these targets.

Planning Policy

National Policies

- 2.10 Land-use planning policy in Wales is established within the policy document Planning Policy Wales (PPW) (Welsh Government, 2021), which provides the strategic policy framework for the effective preparation of local planning authority development plans. With regard to pollution and health effects, it states:

“Planning authorities have a role to play in the prevention of physical and mental illnesses caused, or exacerbated, by pollution, disconnection of people from social activities (which contributes to loneliness) as well as the promotion of travel patterns which facilitate active lifestyles. The planning system must consider the impacts of new development on existing communities and maximise health protection and well-being and safeguard amenity. This will include considering the provision of, and access to, community and health assets, such as community halls, libraries, doctor’s surgeries and hospitals. Health impacts should be minimised in all instances, and particularly where new development could have an adverse impact on health, amenity and well-being. In such circumstances, where health or amenity impacts cannot be overcome satisfactorily, development should be refused”.

“Planning authorities should develop and maintain places that support healthy, active lifestyles across all age and socio-economic groups, recognising that investment in walking and cycling infrastructure can be an effective preventative measure which reduces financial pressures on public services in the longer term. The way a development is laid out and arranged can influence people’s behaviours and decisions and can provide effective mitigation against air and noise pollution. Effective planning can provide calming, tranquil surroundings as well as stimulating and sensory environments, both of these make an important contribution to successful places”

“Green infrastructure can be an effective means of enhancing health and well-being, through linking dwellings, workplaces and community facilities and providing high quality, accessible green spaces. In all development and in public spaces especially, there should be sensitive management of light, and exposure to airborne pollution should be kept as low as reasonably practicable. The compatibility of land uses will be a key factor in addressing air quality and creating appropriate soundscapes which are conducive to, and reflective of, particular social and cultural activities and experiences, particularly in busy central areas of towns and cities. Equally, the provision of quiet, tranquil areas which provide peaceful sanctuaries in otherwise noisy environments can help to reduce general levels of pollution and promote both mental and physical well-being”.

- 2.11 PPW places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. Local development plans should enable consideration of the effects that the proposed development may have on air quality, as well as the effect that air quality may have on

the proposed development. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location.

- 2.12 PPW is supported by a series of Technical Advice Notes (TANs) and National Assembly for Wales Circulars. Local planning authorities have to take PPW, TANs and Circulars into account when preparing Development Plans.
- 2.13 With respect to planning policy guidance, TAN 18 on transport (Welsh Government, 2007) makes reference to local air quality and the need for Air Quality Action Plans to be prepared for any Air Quality Management Areas declared. The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas.

Local Policies

- 2.14 WCBC adopted its Unitary Development Plan (UDP) in 2005 (Wrexham County Borough Council, 2005). The only policy within the UDP which mentions air quality is Policy GDP1, which states:

“All new development should:

...

f) Ensure the safety and amenity of the public and safeguard the environment from the adverse effects of pollution of ...air... arising from the development.”

- 2.15 The Council has been progressing with a new Local Development Plan (LDP). The LDP covers the period 2013-2028 and would replace the UDP as the primary planning policy document against which the Council consider planning applications, if adopted. The LDP was submitted for examination by an independent Inspector on the 30th November 2018. A consultation on proposed Focused and Minor Editing Changes took place in February 2019 and examination in public hearing sessions were undertaken in 2019 and 2020. The Matters Arising Changes consultation took place between 23rd May and 6th July 2022. The LDP has been found sound by an Inspector, who recommended adoption of the plan; however at an Extraordinary meeting on 19th April 2023 and at a further meeting on the 14th June 2023, the Council voted against the adoption of the LDP. Following a Judicial Review in November 2023, a Judge quashed the Council's previous decisions to not adopt the LDP, and ordered the Council to adopt the LDP. As the LDP has been through examination, been endorsed by a Planning Inspector, and ordered to be adopted by a Judge, this still forms a significant material consideration in the determination of this planning application.

Air Quality Action Plans

National Air Quality Plan

- 2.16 Defra has produced an Air Quality Plan to tackle roadside NO₂ concentrations in the UK (Defra, 2017). There is currently no straightforward way to take account of the effects of the Plan in the modelling undertaken for this assessment.

Welsh Government Supplemental Air Quality Plan

- 2.17 The Welsh Government has produced a supplemental plan to the 2017 UK plan for tackling roadside NO₂ concentrations (Welsh Government, 2018). The document sets out the work done to date to identify how the Welsh Government will reduce concentrations of NO₂ around roads where levels are above legal limits. The plan expands on Section 7.6 (Additional Actions in Wales) of the 2017 UK plan for tackling roadside NO₂ concentrations, and sets out how the Welsh Government will comply within the shortest possible time with the limit values for NO₂.

Local Air Quality Action Plan

- 2.18 WCBC has not declared any AQMAs and thus has not prepared an air quality action plan.

3 Assessment Criteria

- 3.1 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (Wales) Regulations (2000) and the Air Quality (Amendment) (Wales) Regulations (2002). The objectives for NO₂ were to have been achieved by 2005, and continue to apply in all future years thereafter.
- 3.2 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2022). The annual mean objectives are considered to apply at the façades of residential properties, schools, hospitals etc.; they are not considered to apply at hotels. The 8-hour mean objective is assumed to apply where the annual mean objective applies, together with hotels and gardens of residential properties. The 1-hour mean objectives apply wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets. Neither the objectives nor limit values apply in places of work where members of the public have no free access and where relevant provisions concerning health and safety at work apply (AQC, 2016).
- 3.3 European Union (EU) Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets a limit value for NO₂, and is implemented in UK law through the Air Quality Standards Regulations (2010)¹. The limit value is the same numerical concentration as the UK objective, but achievement is a national obligation rather than a local one and concentrations are reported to the nearest whole number. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit value. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit value being exceeded, unless such studies have been audited and approved by Defra and the Department for Transport's (DfT's) Joint Air Quality Unit (JAQU).
- 3.4 The relevant Environmental Assessment Levels (EALs) used in this assessment are provided in Table 1; the EALs for NO₂ and CO are the air quality objectives. Where there is no formal objective, such as for HCl, NH₃ or DMF, Natural Resources Wales' Assessment Levels have been used as EALs.

¹ As amended through The Air Quality Standards (Amendment) Regulations 2016 and The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

Table 1: Air Quality Criteria for Human Health

Pollutant	Averaging Period	Objective / EAL ($\mu\text{g}/\text{m}^3$)	Acceptable Exceedance Criteria
NO ₂	Annual Mean	40	Zero exceedances
	1-hour	200	Not to be exceeded more than 18 times a year
HCl	Annual Mean	20	Zero exceedances
	1-hour	750	Zero exceedances
DMF	Annual Mean	300	Zero exceedances
	1-hour Mean	6,100	Zero exceedances
CO	8-hour Rolling Mean	10,000	Zero exceedances
	1-hour Mean	30,000	Zero exceedances
NH ₃	Annual Mean	2,500	Zero exceedances
	1-hour	180	Zero exceedances

Screening Criteria

3.5 The Environment Agency (EA) has also adopted criteria (EA, 2023) that allow health-related Process Contributions (PCs) to be screened out as not significant regardless of the baseline environmental conditions. The emissions from a process can be considered to be not significant if:

- the long-term (annual mean) process contribution is <1% of the long-term environmental standard; and
- the short-term (15-minute, 1-hour, 8-hour and 24-hour mean) process contribution is <10% of the short-term environmental standard.

3.6 The next step in the EA's screening process for long-term contributions is to add the PC to the local background concentration to calculate the predicted environmental concentration (PEC). For short-term contributions the PC is compared against the short-term environmental standard minus twice the long-term background concentration. The emissions are insignificant if:

- the long-term PEC is less than 70% of the long-term environmental standard; and
- the short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration.

3.7 However, the EA also advises that, where detailed dispersion modelling has been undertaken, no further action is required if resulting PECs do not exceed environmental standards.

3.8 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)² have developed an approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions of nitrogen dioxide from point sources, such as energy plant, have the potential for significant air quality

² The IAQM is the professional body for air quality practitioners in the UK.

effects. The approach is that any change in concentration smaller than 0.5% of the long-term environmental standard will be *negligible*, regardless of the existing air quality conditions. Where the change in concentration represents more than 0.5% of the standard, existing conditions are taken into consideration when describing the impacts. This is more stringent than the EA screening criterion of 1% (EA, 2023) set out above, but the guidance was not specifically designed for industrial developments, being more relevant to considering impacts on the primary pollutants associated with road traffic emissions, nitrogen dioxide and particulate matter, thus it is considered more appropriate to use the EA criterion for other pollutants.

3.9 As a first step, the assessment of the emissions from the proposed RTO system within the facility has considered the predicted PCs using the following criteria:

- is the long-term (annual mean) PC less than 0.5% (for NO₂) or 1% (for all other pollutants) of the long-term environmental standard?; and
- is the short-term (24-hour mean or shorter) process contribution less than 10% of the short-term environmental standard?

3.10 Where both of these criteria are met, then the impacts are *negligible* and thus 'not significant'. Where these criteria are breached then a more detailed assessment, considering total concentrations (incorporating local baseline conditions), has been provided.

4 Assessment Approach

Study Area

4.1 Impacts as a result of RTO emissions have been predicted over a 10 km x 10 km model domain, centred half way between the existing and proposed RTO system exhausts. Concentrations of NO₂, HCl, DMF, CO and NH₃ have been predicted across this area using nested Cartesian grids (see Figure 2). These grids have a spacing of:

- 5 m x 5 m within 200 m of the facility;
- 25 m x 25 m within 400 m of the facility;
- 50 m x 50 m within 1,000 m of the facility;
- 250 m x 250 m within 2,000 m of the facility; and
- 500 m x 500 m within 5,000 m of the facility.

4.2 The receptor grid has been modelled at a height of 1.5 m above ground level. The extent of this modelled receptor grid defines the 'Study Area'.

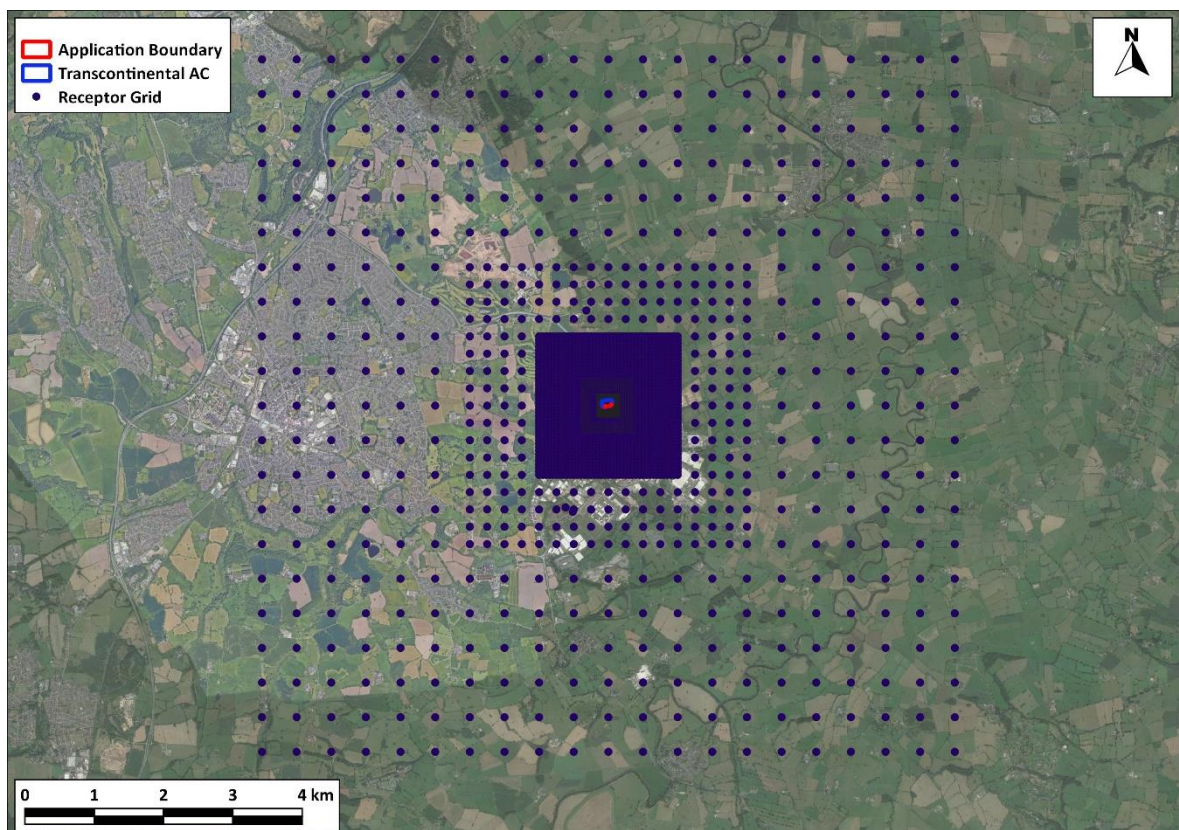


Figure 2: Nested Cartesian Grids of Receptors

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Receptors

- 4.3 In addition to the receptor grid described in Paragraph 4.1, concentrations have been predicted eight existing receptors representing locations where the impacts of the proposed RTO system emissions are likely to be greatest. These locations are described in Table 2 and shown in Figure 3.

Table 2: Description of Receptor Locations

Receptor	Type	X Coordinate	Y Coordinate	Heights Modelled (m) ^a
A	Residential	338000	351066	1.5
B	Residential	337989	351128	1.5
C	Residential	338473	350885	1.5
D	Residential	337435	349146	1.5
E	Residential	337539	349083	1.5
F	Residential	338818	349740	1.5
G	Residential	338881	350782	1.5
H	Residential	337734	351991	1.5

^a A height of 1.5 m is used to represent ground-floor level exposure.



Figure 3: Receptor Locations

Imagery ©2023 Airbus, Bluesky, Infoterra Ltd & COWI A/S, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

- 4.4 Selected receptors may be representative of air quality conditions at a number of properties; consideration has been given to how many sensitive locations each modelled receptor represents when considering the impacts of the proposed RTO and the overall significance of effects.

Existing Conditions

- 4.5 Existing sources of emissions and baseline air quality conditions within the study area have been defined using a number of approaches:
- information on existing air quality has been obtained by collating the results of monitoring carried out by WCBC and by Defra. This covers both the study area and nearby sites, the latter being used to provide context for the assessment;
 - background concentrations have been defined for NO₂ and CO using Defra's background maps (Defra, 2023b). These cover the whole of the UK on a 1 x 1 km grid; and
 - the contributions from the existing RTO system have been determined using dispersion modelling (see below)

Impacts of the Proposed RTO System

- 4.6 As the proposed RTO system will replace the currently operational system at the facility, the approach has been to initially assess the resulting changes in PCs against the screening criteria set out in Paragraphs 3.5 to 3.9.
- 4.7 Where the changes cannot be screened out as insignificant, the assessment has compared the PECs resulting from the proposed RTO system with the EALs to determine any significant effects.

Emissions Data

- 4.8 The emissions release parameters input into the model for the existing RTO system have been taken from the stack emissions testing report prepared by Element (2023). The emission flow rate for the proposed RTO has been provided by Transcontinental AC UK, while the stack location, height and diameter have been taken from plans prepared by Environmental Integrated Solutions.
- 4.9 Transcontinental AC UK have confirmed that the only fundamental change will be the location of the stack thus, where data are not available for the proposed RTO, it has been assumed that they will be the same as the existing RTO.
- 4.10 The proposed RTO will be required to meet the emissions limits set out in the current permit. To ensure a worst-case assessment, both the existing and proposed RTO systems have been assumed to be operating continuously at the emission limit values.
- 4.11 Further details of the emissions data used in this assessment are provided in Appendix A1.

Modelling Methodology

- 4.12 Emissions from the proposed and existing RTO systems have been modelled using the ADMS-6 dispersion model. ADMS-6 is a next generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model input parameters are set out in Appendix A1. The air quality modelling has been carried out based on a number of necessary assumptions, detailed further in Appendix A1. Where possible, a realistic worst-case approach has been adopted, with the same assumptions being used for both the existing and proposed RTO systems.

Assessment Scenarios

- 4.13 In order to allow for uncertainties in local and future-year conditions, the dispersion model has been run five times, for the years 2018 – 2022, inclusive, using meteorological data from the Hawarden meteorological monitoring site. The maximum predicted concentration from any of these years has been used throughout this assessment.
- 4.14 ADMS-6 takes a relatively simplistic approach to modelling building downwash effects, thus additional uncertainty is introduced when using the buildings module. It would not, however, be appropriate to ignore the potential effects of the entrainment of the plume in building downwash; for this reason, the model has been run with all nearby buildings included.
- 4.15 Finally, local terrain has been included within the model based on OS Terrain 50 data, as shown in Figure A1.4 in Appendix A1. The ADMS User Guide recommends that the effect of terrain should be included if the gradient in the study area exceeds 1:10; the study area extends across an area where gradients exceed the 1:10 threshold.
- 4.16 On this basis, the assessment has considered the scenario with all nearby buildings and with terrain throughout the assessment in line with the model developers' recommendations. The sensitivity of the model to assumptions on the treatment of buildings and terrain is discussed in Paragraphs 4.19 to 4.24.

Uncertainty

- 4.17 The modelling is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each RTO, all of which in reality are variable and uncertain. The emission parameters have also been calculated based on testing of the existing RTO at the facility; the proposed RTO may operate under slightly different conditions, although, as processes occurring on-site are well established, it is not expected that the operational parameters will be too dissimilar. It is not, however, possible to fully understand the implications of this until the proposed RTO is operational and testing carried out.

- 4.18 There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not practical to verify the point-source model outputs. Where these parameters have been estimated the approach has been to use reasonable worst-case assumptions. Sensitivity tests have also been applied to address specific uncertainties and to ensure a worst-case assessment.

Sensitivity Tests

- 4.19 As discussed in Paragraph 4.18, the point source dispersion model used in this assessment is required to simplify real-world conditions into a series of algorithms. This is because atmospheric turbulence is a stochastic (random) process which cannot be completely resolved by deterministic methods. These simplifications introduce uncertainties that cannot be easily quantified, and it is generally not possible to verify point-source model outputs. Acknowledging this fact, a number of sensitivity tests have been undertaken to investigate some of the key modelling uncertainties associated with the model created for this assessment; the sensitivity tests have considered nitrogen oxides only, as it is anticipated that the sensitivity of the model will be the same regardless of the pollutant assessed. Based on this particular model setup, it is deemed appropriate to run sensitivity tests of the following parameters:
- Buildings; and
 - Terrain.
- 4.20 It is important to emphasise that the aim of the sensitivity analysis is not to find a model setup that obtains the maximum possible prediction from the model, but to provide greater understanding of how assumptions on key input variables may affect the assessment, so that these factors can be considered when evaluating the significance of potential effects.
- 4.21 Sensitivity tests have been undertaken by running the model with and without the above parameters, in order to quantify the impact these model options may have on predicted concentrations.
- 4.22 The results of the sensitivity test at the worst-case specific receptor have been compared and presented as a ratio to the base model (assuming the base model is that described in Section 4). For example, a value of 0.8 in the table indicates the maximum result from the sensitivity test is 20% smaller than the base model, whilst a value of 1.2 indicates the maximum result from the sensitivity test is 20% greater than the base model.
- 4.23 Table 3 presents the sensitivity tests for the annual mean and 99.79th percentile of hourly means. The analysis indicates the model is sensitive to the inclusion of buildings, with the results for the no building scenario over 50% lower than the with building scenario. The model is relatively insensitive to the effects of terrain, with the results within 4% of the base model outputs.

Table 3: Model Sensitivity Results as Ratios to the Base Model

Model Sensitivity Test	Annual Mean (Dimensionless)	99.79 th Percentile of 1-hour Means (Dimensionless)
Base Model (all buildings and terrain file included)	1.00	1.00
No Buildings (terrain included)	0.50	0.47
Without Terrain (all buildings included)	0.96	0.99

Summary

- 4.24 On balance, when taking into account the approach taken to meteorological conditions, the sensitivity testing for building downwash and the assessment of emissions at the permitted values, the assessment can be expected to over-predict the total concentrations associated with the RTO at the facility. The approach has been designed to provide a robust and conservative assessment.

Assessment of Significance

- 4.25 There is no official guidance in the UK in relation to development control on how to assess the significance of air quality impacts. The approaches developed jointly by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) and by the EA (2023) have therefore been used.
- 4.26 The overall significance of the air quality impacts is determined using professional judgement; the experience of the consultants preparing the report is set out in Appendix A2. Full details of the EPUK/IAQM approach are provided in Appendix A3.

5 Baseline Conditions

Relevant Features

- 5.1 The facility is located in Wrexham Industrial Estate, approximately 5 km east of Wrexham city centre. The facility is immediately surrounded by industrial and commercial warehouses; the closest residential properties are located adjacent to Industrial Estate Road and Bryn Lane, 410 m north and 460 m northeast, respectively.

Nitrogen Dioxide

- 5.2 Figure 4 sets out the background annual mean NO₂ concentrations in the study area taken from Defra's published maps for 2022 (Defra, 2023b).

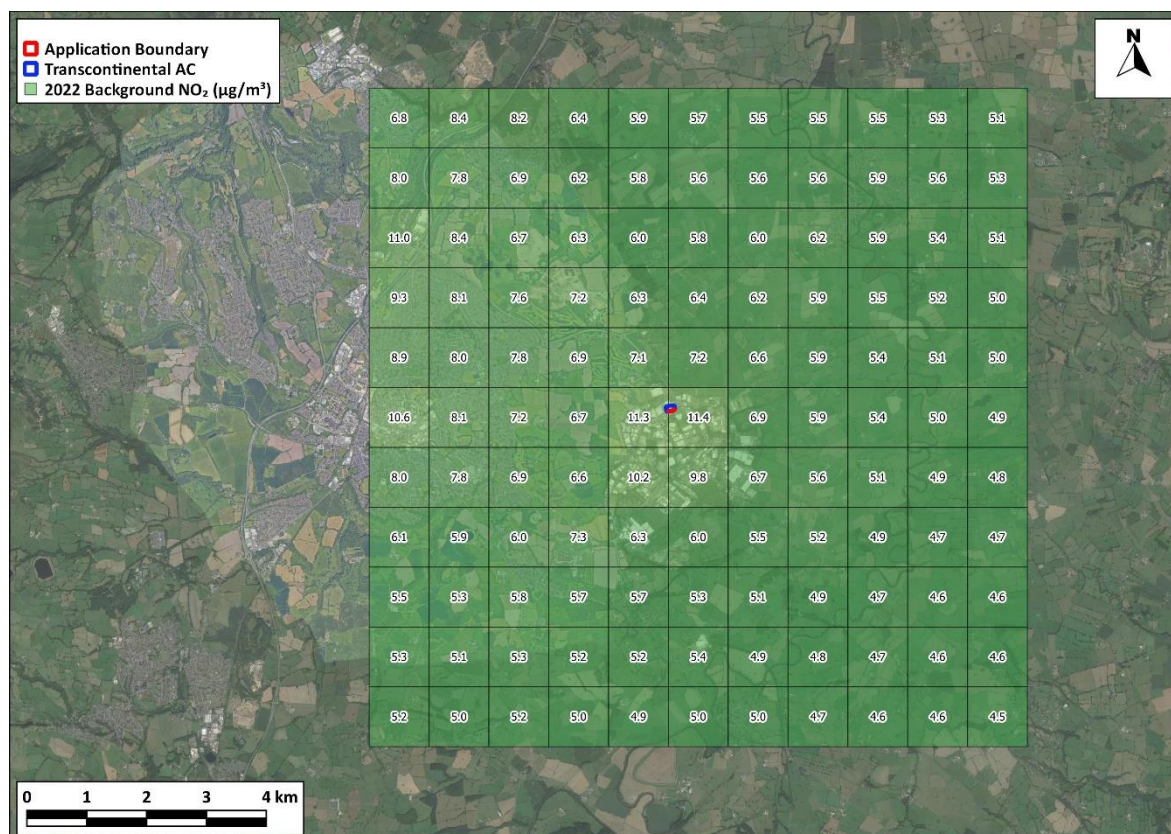


Figure 4: Defra's Predicted NO₂ Background Concentrations in the Study Area (µg/m³)

Imagery ©2023 Airbus, Bluesky, Infoterra Ltd & COWI A/S, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

- 5.3 Figure 5 shows the NO₂ monitoring sites in the study area, operated by WCBC and Defra in 2021 (North Wales Authorities, 2022), which is the most recent year for which WCBC has published its measurements. Measurements made by WCBC are also tabulated in Table 4. These include both roadside and suburban sites, with the measurements at the roadside sites higher than those at

suburban sites. While 2020 and 2021 results have been presented in this Section for completeness, they are not relied upon in any way as they will not be representative of 'typical' air quality conditions due to the considerable impact of the Covid-19 pandemic on traffic volumes and thus pollutant concentrations.

- 5.4 The majority of the monitoring sites within the study area are located adjacent to the ring roads surrounding the centre of Wrexham. The highest concentrations are regularly recorded at the bus station (Site 31), however, measured concentrations are well below the objective at all sites.
- 5.5 Monitoring site 42 is set back from the A5156/A534 by approximately 5 m (North Wales Authorities, 2022), and is therefore broadly representative of the nearest roadside residential properties to the facility, albeit these are set back by approximately 10 m. There are no monitoring sites within, or close to, the industrial estate; however, since these roads are likely to be minor, and not carrying significant volumes of traffic, measured concentrations at the suburban monitoring sites (58 and 60) are likely to be most representative of baseline concentrations at sensitive receptors in the wider industrial estate area.

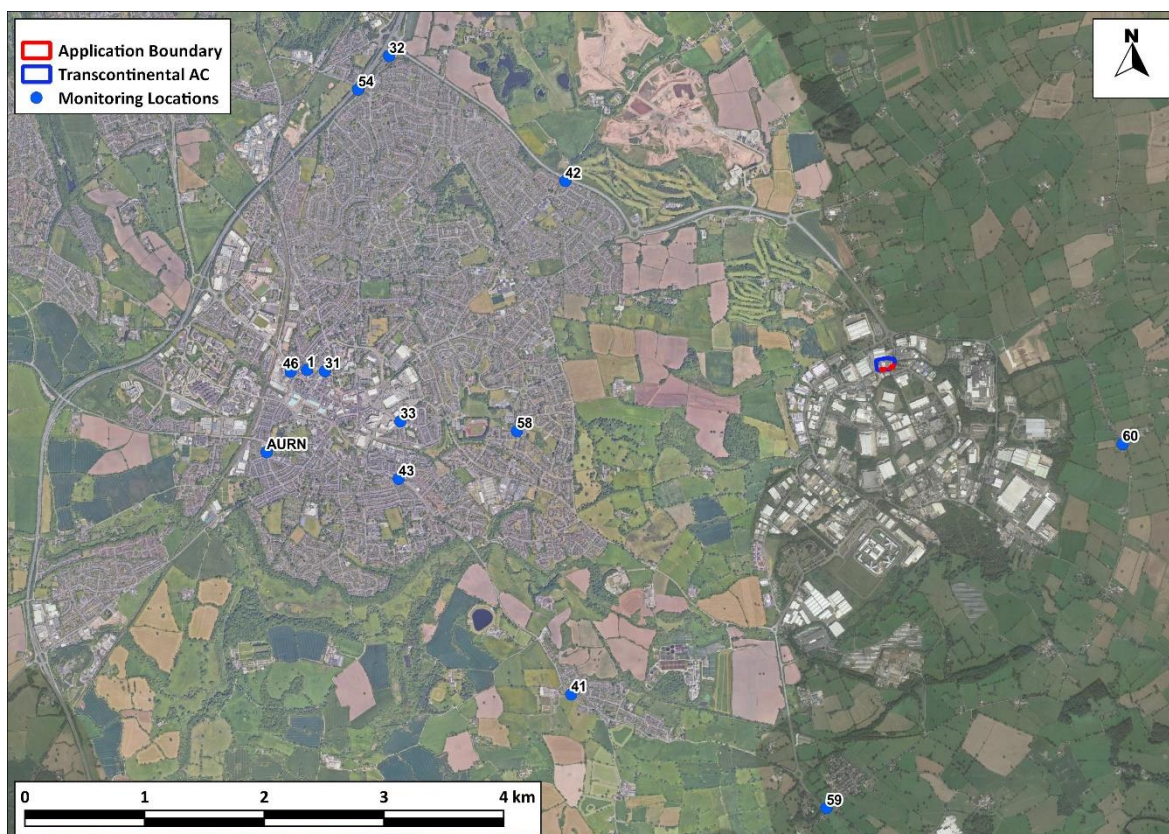


Figure 5: NO₂ Monitoring Sites in the Study Area

Imagery ©2023 Airbus, Bluesky, Infoterra Ltd & COWI A/S, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

Table 4: Summary of NO₂ Monitoring

Site ID	Site Type	Location	2017	2018	2019	2020	2021
Automatic Monitor - Annual Mean (µg/m³)							
AURN ^a	Roadside	Victoria Road	16.5	18.2	16.0	13.0	14.7
Objective			40				
Automatic Monitor - No. of Hours > 200 µg/m³							
AURN ^a	Roadside	Victoria Road	0	0	0	0	0
Objective			18				
Diffusion Tubes - Annual Mean (µg/m³)							
1	Roadside	Grosvenor Road	27.3	24.9	24.2	18.8	22.8
31	Roadside	Bus Station	31.8	28.6	27.3	20.0	24.0
32	Roadside	Sycamores	26.7	27.2	23.7	18.2	18.9
33	Roadside	Smithfield Road	17.5	18.5	15.6	19.3	21.0
41	Roadside	Marchwiel	15.0	15.4	13.9	10.3	13.0
42	Roadside	Llan-Y-Pwll	24.4	23.2	20.6	17.1	19.6
43	Roadside	Hightown	18.4	19.3	17.0	14.4	16.5
46	Roadside	Regent Street	23.0	24.4	22.7	16.1	19.7
54	Roadside	Pandy Lane	-	-	22.7	15.2	18.4
58	Suburban	St Anne's School	-	-	12.7	10.5	10.7
59	Roadside	Cross Lanes	-	-	11.2	8.4	9.7
60	Suburban	St Paul's School	-	-	7.7	6.8	7.4
Objective			40				

^a Operated by Defra and the Devolved Administrations as part of the Automatic Urban and Rural Network (AURN).

Hydrogen Chloride

- 5.6 No local monitoring of HCl concentrations is undertaken within Wrexham.
- 5.7 Defra and the Devolved Administrations measure background HCl concentrations at a number of urban background sites as part of the Acid Gas and Aerosols Network (AGANET). The nearest sites to the application site are Plas y Brenin, Cwmystwyth, Rosemaund, Sutton Bonnington, Ladybower and Narbeth. The measured concentrations for 2015 (the latest year for which results are available) ranged between <0.04 µg/m³ (Cwmystwyth) and 1.01 µg/m³ (Ladybower).
- 5.8 The measured concentration at Ladybower for 2015 (1.01 µg/m³) has been used in this assessment, not because it is the closest site but because it provided the highest, and thus most precautionary, measurements. For 1-hour mean concentrations, the approach to calculating baseline concentrations has been to double the annual mean baseline concentration (i.e. 2.02 µg/m³), as is standard practice (Environment Agency, 2021).

- 5.9 Baseline annual mean and 1-hour mean concentrations are well below the human health EALs as set out in Table 1.

DMF

- 5.10 Background pollutant data for DMF have not been required, as it has been possible to draw a conclusion on the risk of impacts based on the PCs alone.

CO

- 5.11 No local monitoring of CO concentrations is undertaken within Wrexham; the AURN site in Wrexham ceased measuring CO in 2007.
- 5.12 Defra measures CO concentrations at a number of other sites as part of the AURN. The nearest sites to the application site with available data are Leeds (125 km northeast), Cardiff (175 km south) and Port Talbot (172 km southwest). Measured maximum daily 8-hour rolling mean and maximum 1-hour mean concentrations for the years 2018 to 2022 are summarised in Table 5, all of which are well below the objectives.

Table 5: Summary of CO Monitoring ($\mu\text{g}/\text{m}^3$)

Site ID	Site Type	Location	2018	2019	2020	2021	2022
Maximum 8-hour Rolling Mean							
UKA00501	Urban Industrial	Port Talbot Margam (277406, 188719)	2,000	3,600	2,300	2,900	2,200
UKA00217	Urban Background	Cardiff Centre (318416, 176526)	610	2,000	750	590	900
UKA00222	Urban Background	Leeds Centre (429967, 434260)	990	1,000	860	880	630
Objective			10,000				
Maximum 1-hour Mean							
UKA00501	Urban Industrial	Port Talbot Margam (277406, 188719)	5,088	6,256	5,844	4,492	6,611
UKA00217	Urban Background	Cardiff Centre (318416, 176526)	1,549	7,206	952	805	1,357
UKA00222	Urban Background	Leeds Centre (429967, 434260)	1,591	1,509	1,217	1,108	1,013
Objective			30,000				

- 5.13 In addition to the concentrations at the AURN sites, estimated annual mean background concentrations in the study area have been determined from Defra's background pollutant maps; it should, however, be noted that these are based on 2010 data, as no later year is available. The concentrations across the study area range between $205 \mu\text{g}/\text{m}^3$ and $237 \mu\text{g}/\text{m}^3$.

- 5.14 The maximum concentrations from any presented year (3,600 $\mu\text{g}/\text{m}^3$ for the 8-hour rolling mean, and 7,206 $\mu\text{g}/\text{m}^3$ for the 1-hour mean) have been used as the baselines within this study. This is a conservative approach as it is unlikely that peak, short-term impacts from different emission sources will coincide.
- 5.15 Baseline maximum daily 8-hour rolling mean and 1-hour mean concentrations are well below the human health EALs.

Ammonia

- 5.16 No local monitoring of NH_3 concentrations is undertaken within Wrexham.
- 5.17 Defra and the Devolved Administrations measure background NH_3 concentrations at a number of rural background sites as part of the National Ammonia Monitoring Network (NAMN). The nearest site to the application site with available data is Bickerton Hill, 12 km east of the facility. Measured annual mean concentrations for the years 2018 to 2022 are summarised in Table 6 (Defra, 2023a).

Table 6: Summary of Annual Mean NH_3 Monitoring ($\mu\text{g}/\text{m}^3$)

Site ID	Site Type	Location	2018	2019	2020	2021	2022
UKA00297	Rural Background	Bickerton Hill (349940, 352601)	3.3	3.0	1.5	2.4	2.3
Annual Mean EAL			2,500				

- 5.18 The maximum concentration from any presented year (3.3 $\mu\text{g}/\text{m}^3$) has been used as the annual mean baseline within this study; this is considered conservative, since most ammonia emissions are from agriculture, and therefore applying a baseline from a rural site is likely to be worst-case compared to an urban location.
- 5.19 For 1-hour mean concentrations, the approach to calculating baseline concentrations has been to double the annual mean baseline concentration (i.e. 6.6 $\mu\text{g}/\text{m}^3$), as is standard practice (EA, 2023).
- 5.20 Baseline annual mean and 1-hour mean concentrations are well below the human health EALs as set out in Table 1.

6 Impact Assessment

Nitrogen Dioxide

- 6.1 The maximum predicted changes to the PCs and the total PECs at any location on the modelled grid, and at the specific human health receptors identified in Table 2 and Figure 3, are set out in Table 7. Figure 6 and Figure 7 show the predicted annual mean and 1-hour mean PECs as a result of operation of the proposed RTO.

Table 7: Nitrogen Dioxide PCs and PECs at Specific Receptors

Receptor ID	Annual Mean NO ₂ AQS (40 µg/m ³)				1-hour Mean AQS (200 µg/m ³) ^a			
	PC ^b		PEC ^c		PC ^b		PEC ^c	
	µg/m ³	% AQS ^d	µg/m ³	% AQS ^d	µg/m ³	% AQS ^d	µg/m ³	% AQS ^d
Max on Grid ^e	20.95	52.4	40.7	101.6	141.80	70.9	225.8	112.9
A	2.72	6.8	14.0	35.0	3.52	1.8	46.5	23.2
B	2.16	5.4	12.9	32.3	3.12	1.6	41.8	20.9
C	1.16	2.9	15.8	39.4	7.58	3.8	53.5	26.7
D	0.01	<0.1	10.4	26.1	0.16	0.1	27.7	13.8
E	0.01	<0.1	10.4	26.1	-0.06	<-0.1	27.7	13.8
F	0.20	0.5	11.6	29.0	1.09	0.5	30.4	15.2
G	0.25	0.6	13.0	32.5	2.44	1.2	37.9	18.9
H	0.26	0.7	9.4	23.5	1.48	0.7	28.0	14.0

^a 99.79th percentile of 1-hour means.

^b Calculated as the change between the existing and proposed RTOs.

^c After adding the relevant baseline concentrations.

^d Based on unrounded numbers.

^e This row has been greyed out as the AQS does not apply at this location.

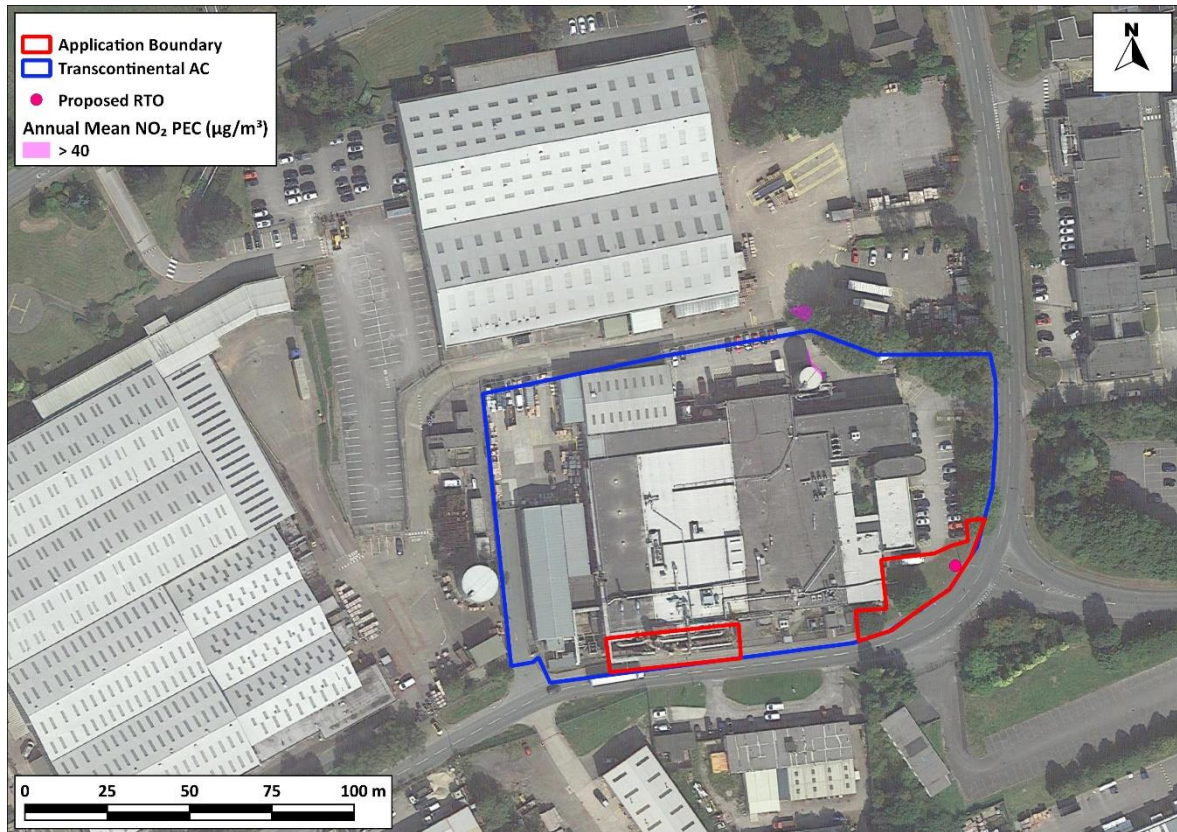


Figure 6: Contour Plot of Annual Mean NO₂ PECs

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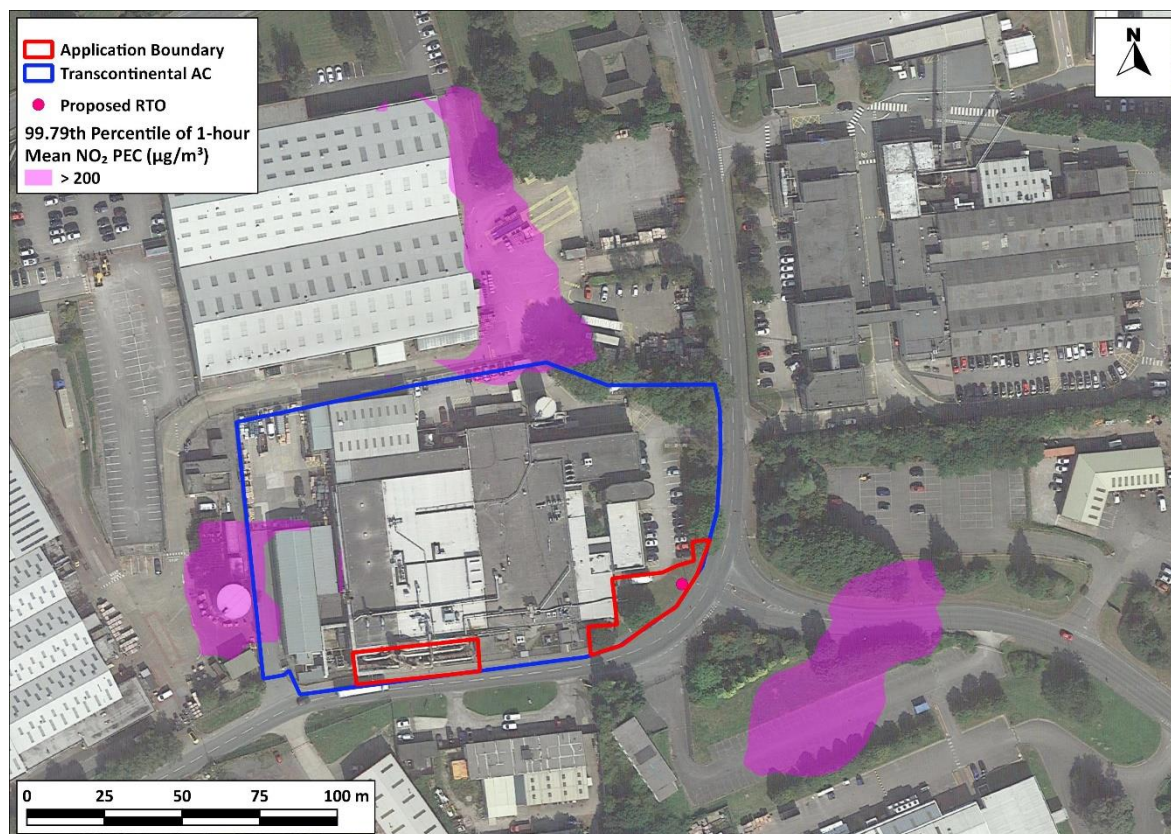


Figure 7: Contour Plot of 99.79th Percentile of 1-hour Mean NO₂ PECs

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- 6.2 Table 7 shows that the PC exceeds 0.5% of the long-term AQS at several assessed locations; the maximum PEC on the modelled grid also exceeds the AQS. Figure 6 shows that the PEC is only exceeded in a small area of a car park, where there is no relevant exposure. There is thus no risk that the AQS will be exceeded as a result of emissions from the proposed RTO at locations of relevant exposure, and the effects for annual mean NO₂ can be considered insignificant.
- 6.3 Table 7 also shows that the maximum change to the PC on the modelled grid exceeds 10% of the short-term AQS; the maximum PEC also exceeds the AQS. Figure 7 shows that the PEC is only exceeded in areas of the car parks and roads, where there is no relevant exposure. There is thus no risk that the AQS will be exceeded as a result of emissions from the RTO at locations of relevant exposure, and the effects for 1-hour mean NO₂ can be considered insignificant.
- 6.4 It should also be noted that these predicted changes and PECs are based on the facility operating continuously at the levels permitted when nitrogen containing compounds are in the airstream, as described in Paragraph 1.4. In reality, there will be periods of time when there are no nitrogen containing compounds in the airstream, during which the permitted levels are significantly lower.

Hydrogen Chloride

- 6.5 The maximum predicted changes to the PCs and the total PECs for each assessed receptor are set out in Table 8.

Table 8: Hydrogen Chloride PCs and PECs at Specific Receptors

Receptor ID	Annual Mean HCl EAL (20 µg/m ³)				1-hour Mean HCl EAL (750 µg/m ³) ^a	
	PC ^b		PEC ^c		PC ^b	
	µg/m ³	% EAL ^d	µg/m ³	% EAL ^d	µg/m ³	% EAL ^d
Max on Grid^e	1.00	5.0	2.40	12.0	18.63	2.5
A	0.13	0.6	1.3	6.7	0.35	<0.1
B	0.10	0.5	1.3	6.4	0.32	<0.1
C	0.06	0.3	1.2	6.1	0.80	0.1
D	<0.01	<0.1	1.0	5.1	0.17	<0.1
E	<0.01	<0.1	1.0	5.1	0.11	<0.1
F	0.01	<0.1	1.1	5.5	0.29	<0.1
G	0.01	0.1	1.1	5.4	0.36	<0.1
H	0.01	0.1	1.1	5.6	0.25	<0.1

^a 100th percentile of 1-hour means.

^b Calculated as the change between the existing and proposed RTOs.

^c After adding the relevant baseline concentration of 1.01 µg/m³.

^d Based on unrounded numbers.

^e This row has been greyed out as the annual mean EAL does not apply at this location.

- 6.6 Table 8 shows that the maximum change to the PC on the modelled grid exceeds 1% of the long-term EAL, although it is not exceeded at any of the specific receptors. The PECs remain well below 70% of the EAL at all locations, including at the worst-case location across the entire grid. There is thus no risk that the EAL will be exceeded as a result of emissions from the RTO, and effects for HCl can be considered insignificant.
- 6.7 Table 8 also shows that the maximum predicted change to the 100th percentile of 1-hour mean HCl concentrations is 2.5% of the EAL (750 µg/m³). As the changes to the PCs are less than 10% of the short-term EAL at all locations, the effects can be screened out as insignificant, irrespective of the PEC.

Dimethylformamide

- 6.8 The maximum predicted changes to the predicted PCs for each assessed receptor are set out in Table 9.

Table 9: Dimethylformamide PCs at Specific Receptors ^a

Receptor ID	Annual Mean PC (300 µg/m ³)		1-hour Mean PC (6,100 µg/m ³) ^b	
	µg/m ³	% EAL ^c	µg/m ³ ^b	% EAL ^c
Max on Grid ^d	0.20	0.1	3.73	0.1
A	0.03	<0.1	0.07	<0.1
B	0.02	<0.1	0.06	<0.1
C	0.01	<0.1	0.16	<0.1
D	<0.01	<0.1	0.03	<0.1
E	<0.01	<0.1	0.02	<0.1
F	<0.01	<0.1	0.06	<0.1
G	<0.01	<0.1	0.07	<0.1
H	<0.01	<0.1	0.05	<0.1

^a Calculated as the change between the existing and proposed RTOs.

^b 100th percentile of 1-hour means.

^c Based on unrounded numbers.

^d This row has been greyed out as this location is not relevant exposure.

- 6.9 Table 9 shows that the maximum predicted change to the annual mean PC is 0.1% of the EAL (300 µg/m³) and the maximum predicted change to the 100th percentile of 1-hour mean PCs at any location is 0.1% of the EAL (6,100 µg/m³).
- 6.10 As the changes to the PCs are less than 1% of the long-term EAL and less than 10% of the short-term EAL at all locations, the effects can be screened out as insignificant, irrespective of the PEC.

Carbon Monoxide

- 6.11 The maximum predicted changes to the predicted PCs and PECs for each assessed receptor are set out in Table 10.

Table 10: Carbon Monoxide PCs at Specific Receptors ^a

Receptor ID	8-hour Rolling Mean (10,000 µg/m ³) ^b		1-hour Mean (30,000 µg/m ³) ^c	
	µg/m ³	% EAL ^d	µg/m ³	% EAL ^d
Max on Grid ^e	143.73	1.4	186.34	0.6
A	3.42	<0.1	3.51	<0.1
B	3.03	<0.1	3.20	<0.1
C	6.07	0.1	7.95	<0.1
D	0.09	<0.1	1.68	<0.1
E	0.20	<0.1	1.10	<0.1
F	1.63	<0.1	2.87	<0.1
G	2.25	<0.1	3.64	<0.1
H	1.07	<0.1	2.48	<0.1

^a Calculated as the change between the existing and proposed RTOs.

^b 100th percentile of 8-hour rolling means.

^c 100th percentile of 1-hour means.

^d Based on unrounded numbers.

^e This row has been greyed out as this location is not relevant exposure.

- 6.12 Table 10 shows that the maximum 100th percentile of 8-hour rolling mean and 1-hour mean carbon monoxide PCs at any receptor are 1.4% of the EAL (10,000 µg/m³) and 0.6% of the EAL (30,000 µg/m³), respectively.
- 6.13 As the changes to the PCs are less than 10% of the short-term AQS at all locations, the effects can be screened out as insignificant, irrespective of the PECs.

Ammonia

- 6.14 The maximum predicted changes to the predicted PCs for each assessed receptor are set out in Table 11.

Table 11: Ammonia PCs at Specific Receptors ^a

Receptor ID	Annual Mean PC (180 µg/m ³)		1-hour Mean PC (2,500 µg/m ³) ^b	
	µg/m ³	% EAL ^c	µg/m ³	% EAL ^c
Max on Grid ^d	0.10	0.1	1.86	0.1
A	0.01	<0.1	0.04	<0.1
B	0.01	<0.1	0.03	<0.1
C	0.01	<0.1	0.08	<0.1
D	<0.01	<0.1	0.02	<0.1
E	<0.01	<0.1	0.01	<0.1
F	<0.01	<0.1	0.03	<0.1
G	<0.01	<0.1	0.04	<0.1
H	<0.01	<0.1	0.03	<0.1

^a Calculated as the change between the existing and proposed RTOs.

^b 100th percentile of 1-hour means.

^c Based on unrounded numbers.

^d This row has been greyed out as this location is not relevant exposure in terms of annual mean EALs.

- 6.15 Table 11 shows that the maximum predicted change to the annual mean PC is 0.1% of the EAL (180 µg/m³) and the maximum predicted change to the 100th percentile of 1-hour mean PCs at any location is 0.1% of the EAL (2,500 µg/m³).
- 6.16 As the changes to the PCs are less than 1% of the long-term EAL and less than 10% of the short-term EAL at all locations, the effects can be screened out as insignificant, irrespective of the PEC.

Significance of Operational Air Quality Effects

- 6.17 The operational air quality effects on public health without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A3, and takes account of the assessment that:
- both the annual mean and 1-hour mean NO₂ PECs will be below the relevant AQS in all locations where there is relevant exposure;
 - the annual mean HCl PEC will be well below 70% of the long-term EAL and the 1-hour mean PC will be below 10% of the short-term EAL in all locations;
 - the annual mean DMF PC will be below 1% of the long-term EAL and the 1-hour mean PC will be below 10% of the short-term EAL in all locations;

- both the 8-hour rolling mean and 1-hour mean CO PCs will be below 10% of the short-term AQS in all locations; and
- the annual mean NH₃ PC will be below 1% of the long-term EAL and the 1-hour mean PC will be below 10% of the short-term EAL in all locations.

7 Mitigation

- 7.1 The assessment has demonstrated that the emissions from the proposed RTO system will have an insignificant effect on air quality. As such, there is no requirement for mitigation.
- 7.2 The proposed RTO system should, however, meet the specifications set out in Appendix A1; if the installed plant does not conform to these specifications, additional assessment and/or mitigation may be required.

8 Conclusions

- 8.1 The assessment has considered the impacts of NO₂, HCl, DMF, CO and NH₃ emissions associated with the proposed RTO system at Transcontinental AC UK.
- 8.2 The assessment has demonstrated that any increases in concentrations of DMF, CO and NH₃ will be below the published screening criteria. Although increases in concentrations of NO₂ and annual mean HCl exceed the screening criteria, total HCl concentrations remain below the screening criterion and both the annual mean and 1-hour mean NO₂ PECs will be below the relevant AQS in all locations where there is relevant exposure.
- 8.3 The overall operational air quality effects of the proposed RTO are thus judged to be 'not significant'.
- 8.4 Taking into account these conclusions, it is judged that the proposed RTO is consistent with PPW. Health impacts due to air quality are minimised where practicable and there will be no significant adverse effects. The proposed development is also consistent with the existing UDP and emerging LDP, since the assessment has demonstrated there will be no adverse effects from pollution.

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10 Glossary

ADMS-6	Atmospheric Dispersion Modelling System model for point sources
AQAL	Air Quality Assessment Level
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
CO	Carbon monoxide
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMF	Dimethylformamide
EPUK	Environmental Protection UK
EU	European Union
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HCl	Hydrogen chloride
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management
µg/m³	Microgrammes per cubic metre
NH₃	Ammonia
NO	Nitric oxide
NO₂	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO ₂ + NO)
NPPF	National Planning Policy Framework
OEP	Office for Environmental Protection
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the

standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides

PC	Process Contribution
PEC	Predicted Environmental Concentration
PPG	Planning Practice Guidance
PPW	Planning Policy Wales
RTO	Regenerative Thermal Oxidiser
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TAN	Technical Advice Note
TEA	Triethanolamine – used to absorb nitrogen dioxide
WCBC	Wrexham County Borough Council
WHO	World Health Organisation

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A1 Modelling Methodology

Model Inputs

- A1.1 The emissions from the existing and proposed RTO systems have been predicted using the ADMS-6 dispersion model. ADMS-6 is a next generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer.
- A1.2 The model has been run to predict the contribution of the RTO system emissions to annual mean concentrations of nitrogen oxides, HCl, DMF and NH₃, the 99.79th percentile of 1-hour mean nitrogen oxides concentrations, the 100th percentile of 1-hour mean HCl, DMF, CO and NH₃ concentrations, and the 100th percentile of 8-hour rolling mean CO concentrations.
- A1.3 Model input selections are summarised in Table A1.1, and, where considered necessary, discussed further below. Input emission parameters are presented later in Table A1.2.

Table A1.1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	Yes – 12 km x 12 km Cartesian grid at 50 m resolution
Variable Surface Roughness File Used?	Yes – 12 km x 12 km Cartesian grid at 50 m resolution
Urban Canopy Flow Used?	No
Building Downwash Effects Modelled?	Yes
Meteorological Monitoring Site	Hawarden
Meteorological Data Years	2018 - 2022
Dispersion Site Surface Roughness Length (m)	N/A (variable surface roughness file used)
Dispersion Site Minimum MO Length (m)	30
Met Site Surface Roughness Length (m)	0.2
Met Site Surface Minimum MO Length (m)	1

- A1.4 The modelled emission parameters are shown in Table A1.2; orange highlighted cells contain the values entered into the model, for ease of reference.

Table A1.2: Emissions and Release Conditions for the Existing and Proposed RTOs

Parameter	Value	
	Existing RTO	Proposed RTO
Source Type	Point	
X-Coordinate, Y-Coordinate	338008.9, 350604.6	338098.0, 350629.7
Height (m)	12.0	13.0
Exhaust Flow (Am ³ /hr) for Actual Flow	175,041	211,670
Exhaust Flow (Am ³ /s) for Actual Flow	48.6	58.8
Flue Internal Diameter (m)	2.28	2.20
Exhaust Velocity (Am/s) for Actual Flow	11.9	15.5
Exhaust Temperature (°C)	112	
Exhaust Flow (Nm ³ /s) for Normalised Flow ^a	34.3	41.7
Permitted NO _x Emission Concentration while Nitrogen-Containing Compounds are Used (mg/Nm ³) ^a	300	
NO _x Emission Rate (g/s)	10.3	12.5
Permitted HCl Emission Concentration (mg/Nm ³) ^a	10	
HCl Emission Rate (g/s)	0.34	0.42
Permitted DMF Emission Concentration (mg/Nm ³) ^a	2	
DMF Emission Rate (g/s)	0.07	0.08
Permitted CO Emission Concentration (mg/Nm ³) ^a	100	
CO Emission Rate (g/s)	3.43	4.17
Permitted NH ₃ Emission Concentration (mg/Nm ³) ^a	1	
NH ₃ Emission Rate (g/s)	0.03	0.04

^a 'Normal' here refers to 0°C and 101 kPa.

A1.5 Entrainment of the plume into the wake of the buildings (the so-called building downwash effect) has been taken into account in the model. The building dimensions and flue location have been obtained from drawings provided by Transcontinental AC UK.

A1.6 The locations of the flues are shown in Figure A1.1 along with the modelled buildings and their heights.



Figure A1.1: Flue Locations & Modelled Buildings

Imagery ©2023 Airbus, Bluesky, Infoterra Ltd & COWI A/S, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

- A1.7 Hourly sequential meteorological data in sectors of 10 degrees from Hawarden for 2018 - 2022 have been used in the model.
- A1.8 The Hawarden meteorological monitoring station is located approximately 15 km to the northwest of the facility. Both the application site and the Farnborough meteorological monitoring station are located in north Wales where they will be influenced by the effects of inland meteorology in hilly topography. Measurements from this site are considered to provide the most robust basis to predict meteorology within the model domain.
- A1.9 Wind roses for the site for the years 2018 - 2022 is provided in Figure A1.2. Raw data were provided by the Met Office and processed by AQC for use in ADMS.

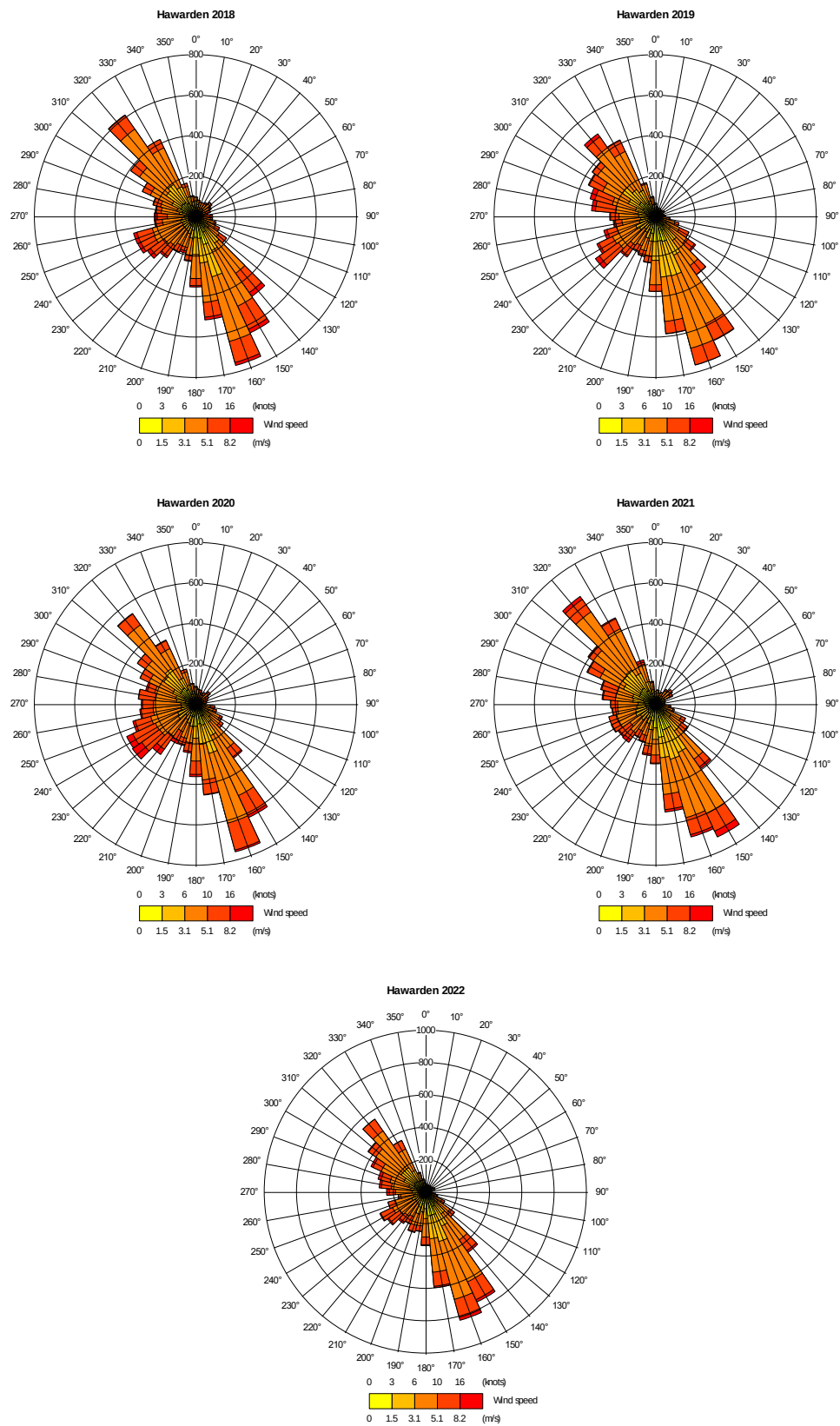


Figure A1.2: Wind Roses for 2018 - 2022

A1.10 The study area encompasses a range of land types. A variable surface roughness file has been used to represent the spatial variation of the surface roughness over each land type as shown in Figure A1.3. The following parameters have been used regarding surface roughness and land type:

- forest – 1 m;
- built-up area – 0.5 m;
- grassland – 0.2 m; and
- water – 0.0001 m.

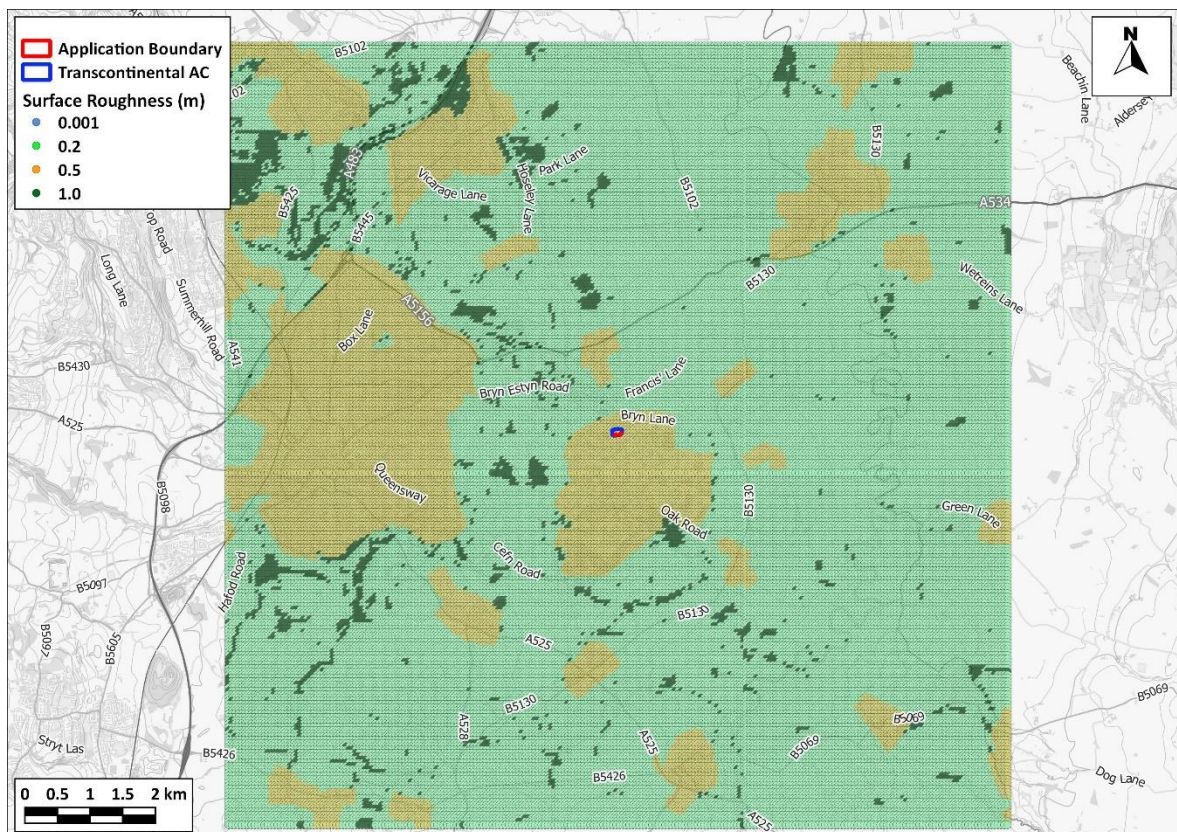


Figure A1.3: Surface Roughness across Modelled Area

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A1.11 Figure A1.4 shows the terrain across the modelled study area using Ordnance Survey (OS) Terrain 50 data. The area immediately surrounding the site is broadly flat, such that the base of the RTO flue is approximately at the same elevation as the base of the on-site buildings and nearest human health receptors. Terrain data have, however, been included in the model.

A2 Professional Experience

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

Dr Marner is the Director of Air Quality Modelling and Assessment at AQC and has over 20 years' relevant experience. 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 acted as expert witness at public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has developed a range of widely-used air quality models and contributed to the development of best practice. Dr Marner has provided support and advice to foreign governments, Highways England, Transport Scotland, Transport for London, Greater London Authority, the Joint Nature Conservation Committee, the Environment Agency, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. He currently advises the UK Government on air quality as part of its Air Quality Expert Group (AQEG), where his specific area of expertise relates to air quality assessment in the development control process.

Dr Frances Marshall, MSci PhD MEnvSc MIAQM

Dr Marshall is a Principal Consultant with AQC with ten years' relevant experience. Prior to joining AQC, she spent four years carrying out postgraduate research into atmospheric aerosols at the University of Bristol. Dr Marshall has experience preparing air quality assessments for a range of projects, including residential and commercial developments, road traffic schemes, energy centres, energy from waste schemes and numerous power generation schemes. She has experience in producing air quality assessments for EIA schemes, and has also assessed the impacts of Local Plans on designated ecological areas, prepared Annual Status Reports for Local Authorities, and undertaken diffusion tube monitoring studies. She is a Member of both the Institute of Air Quality Management and the Institution of Environmental Sciences.

Dr Imogen Heard, BSc (Hons) MSc PhD

Dr Heard is an Associate of AQC with over 12 years' experience in the field of air quality. She has been involved in numerous development projects including road schemes, energy from waste facilities, urban extensions and energy centres. These have included the use of ADMS-5 and ADMS-Roads dispersion models to study the impacts of a variety of pollutants, including nitrogen dioxide, PM₁₀ and PM_{2.5}, and the preparation of air quality assessment reports and air quality chapters for Environmental Statements. She also has experience in undertaking construction dust risk assessments, Air Quality Neutral assessments and human health risk assessments, as well as in preparing local authority reports. Prior to joining AQC she worked as a scientist in the Atmospheric

Dispersion and Air Quality area at the UK Met Office for four years, modelling the dispersion of a range of pollutants over varying spatial and temporal scales.

A3 EPUK & IAQM Planning for Air Quality Guidance

- A3.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

“Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations”.*

Recommended Best Practice

- A3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

“The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions”.

- A3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m² of commercial floorspace;
- are carried out on land of 1 ha or more.

- A3.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new “street canyon”, as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNO_x/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
 - Spark ignition engine: 250 mgNO_x/Nm³;
 - Compression ignition engine: 400 mgNO_x/Nm³;
 - Gas turbine: 50 mgNO_x/Nm³.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNO_x/Nm³ and 25 mgPM/Nm³.

A3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

“It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the “damage cost approach” used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential”.

A3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

“There may be a requirement to carry out an air quality assessment for the impacts of the local area’s emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development”.*

Impacts of the Development on the Local Area

A3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m² of floor space for all other uses or a site area greater than 1 ha.

A3.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or
- the development will have a centralised energy facility or other centralised combustion process.

A3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

A3.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A3.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

“Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NO_x gas boiler or a 30kW CHP unit operating at <95mg/Nm³.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable”.

- A3.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

“The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive ‘trigger’ for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality”.

- A3.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

“The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer”.

- A3.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Assessment of Significance

- A3.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

- A3.16 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either ‘significant’ or ‘not significant’. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A3.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A3.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A2.