Air Quality Assessment

Diesel Generators

Riccall, York

For H Barker & Son Limited

www.rpsgroup.com

Quality Management

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Executive Summary

This report details the air quality assessment undertaken to accompany the permit application for the two diesel generators at Riccall, York.

The assessment has been undertaken based upon appropriate information on the Proposed Development provided H Barker & Son Limited and its project team. In undertaking this assessment, RPS experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour. These professional responsibilities are in accordance with the code of professional conduct set by the Institution of Environmental Sciences for members of the Institute of Air Quality Management (IAQM).

Regarding the operational phase, the most important consideration is emissions from two diesel generators. This assessment predicts that ground-level concentrations will be within acceptable levels at sensitive receptors and will not give rise to any significant adverse effects.

The proposed development does not, in air quality terms, conflict with national or local policies. There are no constraints to the development in the context of air quality.

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1 Introduction

1.1 This report details the air quality assessment undertaken to accompany the permit application for two diesel generators at Riccall, York.

1.2 The Application Site is located within the administrative area of Selby District Council (SDC) which has not designated any Air Quality Management Area (AQMAs) and air quality in the area is generally quite good.

1.3 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects have then been described. The baseline air quality conditions have been established taking into account Defra estimates, local authority documents and the results of any local monitoring. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual effects.

2 Policy and Legislative Context

Air Quality Standards Regulations

2.1 The Air Quality Standards Regulations 2010 [1], amended by The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 [2], sets limit values for ambient air concentrations for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO2), ozone (O3), carbon monoxide (CO), lead (Pb) and benzene, certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs).

2.2 These limit values are legally binding on the Secretary of State. The Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

2.3 The statutory air quality limit values are listed in Table 2.1.

Table 2.1 Statutory Air Quality Limit Values

Pollutant	Averaging Period	Limit Values	Not to be Exceeded More Than
Nitrogen Dioxide (NO_2)	1 hour	200 µg.m^{-3}	18 times pcy
	Annual	40 µg.m^{-3}	-
Particulate Matter (PM_{10})	24 hour	50 µg.m^{-3}	35 times pcy
	Annual	40 µg.m^{-3}	-
Particulate Matter ($PM_{2.5}$)	Annual	20 µg.m^{-3}	-
Carbon Monoxide (CO)	Maximum daily running 8 hour mean	10,000 µg.m^{-3}	-
Sulphur Dioxide (SO_2)	15 minute	266 µg.m^{-3}	35 times pcy
	1 hour	350 µg.m^{-3}	24 times pcy
	24 hour	125 µg.m^{-3}	3 times pcy
Benzene (a)	Annual	5 µg.m^{-3}	-

(a) The generators emit hydrocarbons. The Environment Agency EAL for benzene (the most harmful local hydrocarbon pollutant) has been used for total hydrocarbons. This is a highly conservative and precautionary approach and unlikely in the extreme. This is a conservative approach.

Non-Statutory Air Quality Objectives and Guidelines

2.4 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 [3]. The Strategy sets UK air quality standards♦ and objectives# for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the Air Quality Standards Regulations.

2.5 The non-statutory objectives and guidelines are presented in Table 2.2.

Table 2.2 Non-Statutory Air Quality Objectives and Guidelines

Pollutant	Averaging Period	Guideline
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations
	Annual	25 µg.m^{-3}

Environmental Assessment Levels

2.6 The Environment Agency's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit*' [**Error! Bookmark not defined.**] provides further assessment criteria in the form of EALs.

2.7 Table 2.3 presents the following additional EALs for the pollutants relevant to this assessment.

Table 2.3 Environmental Assessment Levels (EALs)

Pollutant	Long-term EAL, µg.m^{-3}	Short-term EAL, µg.m^{-3}
Carbon monoxide (CO)	-	30,000 (1 hour mean)
Benzene		30 (24 hour mean)

2.8 Within the assessment, the statutory air quality limit and target values (as presented in Table 2.1) are assumed to take precedent over objectives, guidelines and the EALs. In addition, for those pollutants which do not have any statutory air quality standards, the assessment assumes the lower of either the EAL or the non-statutory air quality objective or guideline where they exist.

♦ Standards are concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific evidence and medical evidence on the effects of the particular pollutant on health, or on the wider environment, as minimum or zero risk levels.

Objectives are policy targets expressed as a concentration that should be achieved, all the time or for a percentage of time, by a certain date.

Environmental Permitting Regulations

2.9 The Environmental Permitting Regulations (EPR) 2016 [4] define activities that require an Environmental Permit from the Environment Agency (EA).

2.10 EPR is a regulatory system that employs an integrated approach to control the environmental impacts of certain listed industrial activities including the generation of energy from waste. The intention of the regulatory system is to ensure that best available techniques (BAT) are used to prevent or minimise the effects of an activity on the environment, having regard to the effects of emissions to air, land and water via a single permitting process.

2.11 To gain a permit, Operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use are the BAT for their installation and meet certain other requirements taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements are included for permitted sites to which these apply.

2.12 The essence of BAT is that the techniques selected to protect the environment should achieve a high degree of protection of people and the environment taken as a whole. Indicative BAT standards are laid out in national guidance and where relevant, should be applied unless a different standard can be justified for a particular installation. The EA is legally obliged to go beyond BAT requirements where EU Air Quality Limit Values may be exceeded by an existing operator.

2.13 The Environment Agency's on-line guidance entitled 'Environmental management – guidance, Air emissions risk assessment for your environmental permit' [**Error! Bookmark not defined.**] provides guidelines for air dispersion modelling. The assessment of air quality effects for the proposed development is consistent with this guidance.

3 Assessment Methodology

Approach

3.1 This air quality assessment includes the key elements listed below:

- Establishing the background Ambient Concentration (AC) from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of available air quality monitoring and Defra background map data in the vicinity of the proposed site.
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a "new generation" Gaussian dispersion model, ADMS 5. Assessment of Process Contributions (PC) from the facility in isolation, and assessment of resultant Predicted Environmental Concentrations (PEC), taking into account cumulative impacts through incorporation of the AC.

3.2 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management, and Chartered Environmentalist and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 18 years' experience.

Pollutant Concentrations

3.3 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

3.4 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.

Dispersion Model Selection

3.5 A number of commercially available dispersion models are able to predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 5, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions; the ADMS 5 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

3.6 ADMS comprises a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. Amongst the features of ADMS are:

- An up-to-date dispersion model in which the boundary layer structure is characterised by the height of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accurately than does the use of Pasquill-Gifford stability categories, which were used in many previous models (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non-Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;
- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and
- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

Model Inputs

Meteorological Data

3.7 The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed;
- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

3.8 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

3.9 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from Linton-on-Ouse between 2015 and 2019.

3.10 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 1.

Stack Parameters and Emissions Rates used in the Model

3.11 Stack emissions characteristics modelled are provided in Table 3.1 and the mass emissions are provided in Table 3.2.

Table 3.1 Stack Characteristics

Parameter	Unit	C13 Generator	C18 Generator
Stack height	m	3.5	2 (horizontal)
Internal diameter	m	0.15	0.2
Efflux velocity	$m.s^{-1}$	84.6	71.4
Efflux temperature	^{o}C	510	492
Actual O_2	%	11.26	11.42
Actual H_2O	%	8.54	8.02
Actual volumetric flow	$m^3.s^{-1}$	1.40	2.24

Normalised volumetric flow (Dry, 0°C, 5% O_2)	$m^3.s^{-1}$	0.27	0.44

*The C18 stack is horizontal so has been modelled as a jet source as this predicted higher concentrations at receptors compared with modelling it as a point source. It has been assumed that the jet points to the east. The nearest human health receptors are to the west of the site.

Table 3.2 Mass Emissions of Released Pollutants ($g.s^{-1}$)

Pollutants	C13	C18
PM	0.008	0.014
CO	0.161	0.074
NOx	0.334	0.580
Hydrocarbons	0.006	0.007
SO_2	0.159*	0.253*

*Based on 0.1% sulphur content fuel by weight

3.12 For the purposes of this assessment, all particles are assumed to be less than 10 μm in diameter (i.e. PM_{10}). Furthermore, all particles are also assumed to be less than 2.5 μm in diameter (i.e. $PM_{2.5}$). In reality, the PM_{10} and $PM_{2.5}$ concentrations will be a smaller proportion of the total particulate emissions and the $PM_{2.5}$ concentration will be a smaller proportion of the PM_{10} concentration. Therefore, this can be considered a conservative estimate of the likely particulate emissions in each size fraction.

Stack locations

3.13 The generators are mobile and therefore there is no set stack location. For the purposes of this assessment, it has been assumed that both generators will operate in two locations. Location 1 is closest to the human-health receptors and Location 2 is closest to the ecological receptors. The generators will not be used closer to the human-health or ecological receptors than at these locations.

3.14 The results presented in the human-health assessment are based on Location 1 and the results presented in the ecological impacts assessment are based on Location 2.

Operating Hours

3.15 The generators currently operate for 10 hours per week and are proposed to operate for an additional 15 hours per week for a total of 25 hours per week. The results presented in this report therefore consider the impacts of the additional 15 hours per week. The contribution from the existing 10 hours per week is considered in the background concentrations used.

Surface Roughness

3.16 The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length.

3.17 A surface roughness length of 0.2 m, which the software developer recommends for use in agricultural areas, has been used within the model to represent the average surface characteristics across the study area.

Building Wake Effects

3.18 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. The dominant structures (i.e. with the greatest dimensions likely to promote turbulence) included within the model are listed in Table 3.3.

Table 3.3 Dimensions of Buildings Included Within the Dispersion Model

ID	Name	Approx Centre Location		Height (m)	Length (m)	Width (m)	Angle (Degrees)
		X (m)	Y (m)				
1	Shed 1	463509.9	437229.8	4.8	19.07	98.94	172.56
2	Shed 2	463513.8	437196.4	4.8	18.38	100.06	169.69
3	Shed 3	463394.7	437187.3	4.8	18.16	99.47	174.79
4	Shed 4	463391.1	437215.1	4.8	18.71	99.64	171.15
5	Workshop	463584	437207.7	4.8	13.25	20.09	82.89
6	Building	463700	437269	11.1	24.81	73.22	172.6

Model Outputs

Receptors

3.19 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. Such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG22 [5] provides examples of exposure locations and these are summarised in Table 3.4.

Table 3.4: Example of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties.

		Kerbside sites (as opposed to locations at the buildings façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
Hourly-mean	All locations where the annual and 24-hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.20 The effects of the proposed development have been assessed at the façades of a representative selection of discrete local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 3.5 and illustrated in Figure 2.

Table 3.5: Modelled Sensitive Receptors

ID	Description	National Grid Reference	
		X(m)	Y(m)
1	Selby Road 1	463027	437173
2	Selby Road 2	463073	437089
3	Main Street	462474	437484
4	Station Road	462431	437621
5	Site Bungalow 1a	463613	437238
6	Site Bungalow 2a	463614	437207
7	Riccall Grange	463877	437591
8	Selby Road 3	463189	436562
9	Site Bungalow 1b	463644	437260
10	Site Bungalow 2b	463643	437220

Note: Receptors have been modelled at 1.5m above ground level, representative of typical head height

NO_X to NO_2 Relationship

3.21 The NOx emissions will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at the point of release. The NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal concern in terms of environmental health effects.

3.22 There are various techniques available for estimating the proportion of NOx converted to NO_2 by the time it has reached receptors which depends on the distance and hence travel time between the source and receptor. The methods used in this assessment are discussed below.

NO_X to NO_2 Assumptions

3.23 The NOx emissions will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at the point of release. The NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal concern in terms of environmental health effects. The Environment Agency advises [6] that:

"For combustion processes where no more than 10% of nitrogen oxides are emitted as nitrogen dioxide, you can assume worst case conversion ratios to nitrogen dioxide of:

35% for short-term average concentrations

70% for long-term average concentrations"

3.24 These ratios have been used in the assessment.

Modelling of Long-term and Short-term Emissions

3.25 Long-term (annual-mean) and daily-mean concentrations have been modelled for comparison with the relevant objectives. The models were run with both generators assumed to run for all hours in the year. The model output was then multiplied by the percentage of the year/day each engine is expected to run i.e. 0.089 for 15 hours per week and 0.5 for 12 hours per day.

3.26 For short-term NO_2, the objective is for the hourly-mean concentration not to exceed 200 $\mu g.m^{-3}$ more than 18 times per calendar year. As there are 8,760 hours in a non-leap year, the hourly-mean concentration would need to be below 200 $\mu g.m^{-3}$ in 8,742 hours, i.e. 99.79% of the time. Therefore, the 99.79th percentile of hourly NO_2 has been modelled.

Significance Criteria

3.27 The on-line EA guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit*' [**Error! Bookmark not defined.**] has been used. This guidance provides details for screening out substances for detailed assessment. In particular, it states that:

"*To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:*

- *the short-term PC is less than 10% of the short-term environmental standard*

- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

3.28 It continues by stating that:

"You must do detailed modelling for any PECs not screened out as insignificant."

3.29 It then states that further action may be required where:

- *"your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributions – if you think this is the case contact the Environment Agency)*
- *The PEC is already exceeding an environmental standard"*

3.30 The EA online guidance '*Environmental permitting: air dispersion modelling reports'* [7] states:

"For a detailed modelling assessment PCs are insignificant where they are less than:

- *10% of a short-term environmental standard*
- *1% of a long-term environmental standard*

At the detailed modelling stage there are no criteria to determine whether:

- *PCs are significant*
- *PECs are insignificant or significant*

You must explain how you judged significance and base this on the site specific circumstances."

3.31 On that basis, the results of the detailed modelling presented in this report have been used as follows:

- The effects are not considered significant if the short-term PC is less than 10% of the short-term Environmental Assessment Level (EAL) or the PEC is below the EAL; and
- The effects are not considered significant if the long-term PC is less than 1% of the long-term EAL or the PEC is below the EAL.

Uncertainty

3.32 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.33 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.34 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

3.35 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 3.6.

Table 3.6 Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes towards the results being towards the top of the uncertainty range, rather than a central estimate.
Model Input/ Output Data	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for 5 full years of meteorological conditions.	
	Receptors	The model has been run for a grid of receptors. In addition, receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	

3.36 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

4 Baseline Air Quality Conditions

Overview

4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. EPUK/IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality.

4.2 For this assessment, the background air quality has been characterised by drawing on information from the following public sources:

- Defra maps [8], which show estimated pollutant concentrations across the UK in 1 km grid squares;
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies; and
- results published by national monitoring networks.

4.3 A detailed description of how the baseline air quality has been derived for the proposed development is provided in Appendix B. The background concentrations used in the assessment are set out in Table 4.1.

Table 4.1 Summary of Assumed Background Concentrations

	Long-term	Short-term (a)	Data Source
Nitrogen dioxide (NO_2)	7.3 $\mu g.m^{-3}$	14.6 $\mu g.m^{-3}$	Defra mapped
Particulates (PM_{10})	14.1 $\mu g.m^{-3}$	28.1 $\mu g.m^{-3}$	Defra mapped
Carbon monoxide (CO)	200 $\mu g.m^{-3}$	400 $\mu g.m^{-3}$	5-year average (2016-2020) at Leeds Centre AURN
Sulphur Dioxide (SO_2)	1.42	2.84	

Note:
(a) Short-term background data approximately equate to the 90th percentile, which is approximately equivalent to 2 x the annual mean.

5 Assessment of Air Quality Impacts

Stack Emissions

5.1 The maximum predicted ground-level concentrations at the selected sensitive receptors have also been predicted and the results are presented in this section. The results assume that both generators are at Location 1.

5.2 The impacts at ecological receptors are assessed in Appendix B where it is assumed that both generators are at Location 2.

5.3 Table 5.1 summarise the total maximum predicted PC at sensitive receptors to ground-level concentrations. Table 5.2 outlines the PCs as a percentage of the relevant EAL. Cells are highlighted where the PC as a percentage of the EAL exceeds 1% for long-term and 10% for short-term objectives.

5.4 Where the PC cannot be screened out as insignificant, the resulting PECs have been calculated by adding the PC to the background AC. The site also includes an existing small waste incinerator plant (SWIP). Detailed dispersion modelling of the SWIP was undertaken in 2022 to support the permit application. The maximum SWIP PC across the modelled sensitive receptors has been added to derive the PEC.

5.5 A contour plot of the annual-mean NO_2 PC is shown in Figure 3. A contour plot of the 99.79th percentile of hourly-mean NO_2 PC is shown in Figure 4.

Table 5.1 Predicted Process Contributions ($\mu g.m^{-3}$)

Receptor	Annual Mean NO_2	99.79th percentile hourly mean NO_2	Annual Mean PM_{10}	90.41st percentile daily mean PM_{10}	Annual Mean $PM_{2.5}$	99.73rd percentile hourly mean SO_2	99.18th percentile 24 hour mean SO_2	99.9th percentile 15 min mean SO_2	8 hour running mean CO	Max 1 hour mean CO	Annual Mean Benzene	Max 24 hour mean benzene
Selby Road 1	0.03	7.55	0.001	0.05	0.001	9.12	1.28	16.24	0.13	7.44	0.001	0.05
Selby Road 2	0.03	7.99	0.001	0.05	0.001	9.20	1.29	17.34	0.12	8.34	0.001	0.06
Main Street	0.02	5.06	0.001	0.03	0.001	5.68	0.71	14.49	0.07	4.57	0.000	0.03
Station Road	0.02	5.22	0.001	0.03	0.001	5.81	0.75	11.62	0.07	4.70	0.000	0.03
Site Bungalow 1a	0.76	81.38	0.027	1.07	0.027	103.86	29.31	109.94	2.63	67.36	0.015	1.21
Site Bungalow 2a	0.77	82.92	0.027	1.21	0.027	105.50	33.93	113.96	2.94	63.23	0.016	1.34
Riccall Grange	0.12	17.88	0.004	0.13	0.004	20.04	2.39	40.96	0.47	25.22	0.002	0.10
Selby Road 3	0.02	8.29	0.001	0.03	0.001	8.95	0.96	21.66	0.08	11.80	0.000	0.04
Site Bungalow 1b	1.81	131.18	0.063	2.68	0.063	165.62	50.56	174.79	5.65	89.16	0.035	2.06
Site Bungalow 2b	1.58	161.56	0.055	2.44	0.055	203.59	78.22	223.11	5.40	129.91	0.031	2.59

Table 5.2 Predicted Process Contributions as a Percentage of EAL (%)

Receptor	Annual Mean NO_2	99.79th percentile hourly mean NO_2	Annual Mean PM_{10}	90.41st percentile daily mean PM_{10}	Annual Mean $PM_{2.5}$	99.73rd percentile hourly mean SO_2	99.18th percentile 24 hour mean SO_2	99.9th percentile 15 min mean SO_2	8 hour running mean CO	Max 1 hour mean CO	Annual Mean Benzene	Max 24 hour mean benzene
EAL ($\mu g.m^{-3}$)	**40**	**200**	**40**	**50**	**20**	**350**	**125**	**266**	**10000**	**30000**	**5**	**30**
Selby Road 1	0	4	0	0	0	3	1	6	0	0	0	0
Selby Road 2	0	4	0	0	0	3	1	7	0	0	0	0
Main Street	0	3	0	0	0	2	1	5	0	0	0	0
Station Road	0	3	0	0	0	2	1	4	0	0	0	0
Site Bungalow 1a	2	41	0	2	0	30	23	41	0	0	0	4
Site Bungalow 2a	2	41	0	2	0	30	27	43	0	0	0	4
Riccall Grange	0	9	0	0	0	6	2	15	0	0	0	0
Selby Road 3	0	4	0	0	0	3	1	8	0	0	0	0
Site Bungalow 1b	5	66	0	5	0	47	40	66	0	0	1	7

Receptor	Annual Mean NO_2	99.79th percentile hourly mean NO_2	Annual Mean PM_{10}	90.41st percentile daily mean PM_{10}	Annual Mean $PM_{2.5}$	99.73rd percentile hourly mean SO_2	99.18th percentile 24 hour mean SO_2	99.9th percentile 15 min mean SO_2	8 hour running mean CO	Max 1 hour mean CO	Annual Mean Benzene	Max 24 hour mean benzene
Site Bungalow 2b	4	81	0	5	0	58	63	84	0	0	1	9

5.6 The results presented in Table 5.1 and Table 5.2 show that the predicted PC is below 10% of the relevant short-term EAL and below 1% of the long-term EAL for all pollutants and receptors except NO_2 and SO_2 at the site bungalows and the impacts can be screened out as insignificant.

5.7 For NO_2 and SO_2 at the site bungalows, the PEC has been considered and summarised in Table 5.3.

Table 5.3 Predicted Environmental Concentration (µg.m^{-3})

Receptor	Annual Mean NO_2	99.79th percentile hourly mean NO_2	99.73rd percentile hourly mean SO_2	99.18th percentile 24 hour mean SO_2	99.9th percentile 15 min mean SO_2
EAL	**40**	**200**	**350**	**125**	**266**
AC	**7.3**	**14.6**	**2.84**	**2.84**	**2.84**
SWIP PC*	**2.08**	**18.28**	**24.86**	**12.76**	**29.29**
Site Bungalow 1a	10.12	114.21	131.56	44.91	142.07
Site Bungalow 2a	10.13	115.75	133.20	49.53	146.09
Site Bungalow 1b	11.17	164.01	193.32	66.16	206.93
Site Bungalow 2b	10.93	194.39	231.29	93.82	255.24

*Maximum PC taken from Table 5.1 of the 2022 RPS Air Quality Assessment for the SWIP.

5.8 Table 5.3 shows that when the PC is added to the AC and maximum PC from the SWIP at the site bungalows, the resulting PECs are below the EAL. On that basis the impacts are therefore not considered to be significant.

Significance of Effects

5.9 As set out in Section 3, it is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

5.10 Based on the predicted concentrations, the effects are deemed to be not significant, with no predicted exceedances of any objectives or standards at the modelled discrete receptors.

6 Mitigation

6.1 Predicted concentrations of pollutants have been demonstrated by the assessment to meet all relevant air quality standards, objectives and EALs. On that basis, no mitigation is proposed.

7 Conclusions

7.1 This assessment has considered the air quality impacts during the operational phase of the two diesel generators in Riccall, York.

7.2 Emissions from the diesel generators have been assessed through detailed dispersion modelling using best practice approaches. The assessment has been undertaken based on a number of conservative assumptions. This is likely to result in an over-estimate of the contributions that will arise in practice from the facility. The operational impact on receptors in the local area is considered to be not significant.

7.3 Overall, the effects of the diesel generators are not considered to be significant.

Glossary

ADMS	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
Effect	The consequences of an impact, experienced by a receptor
EPUK	Environmental Protection UK
IAQM	Institute of Air Quality Management
Impact	The change in atmospheric pollutant concentration and/or dust deposition. A scheme can have an 'impact' on atmospheric pollutant concentration but no effect, for instance if there are no receptors to experience the impact
R&A	Review and Assessment
Receptor	A person, their land or property and ecologically sensitive sites that may be affected by air quality
Risk	The likelihood of an adverse event occurring

Figures

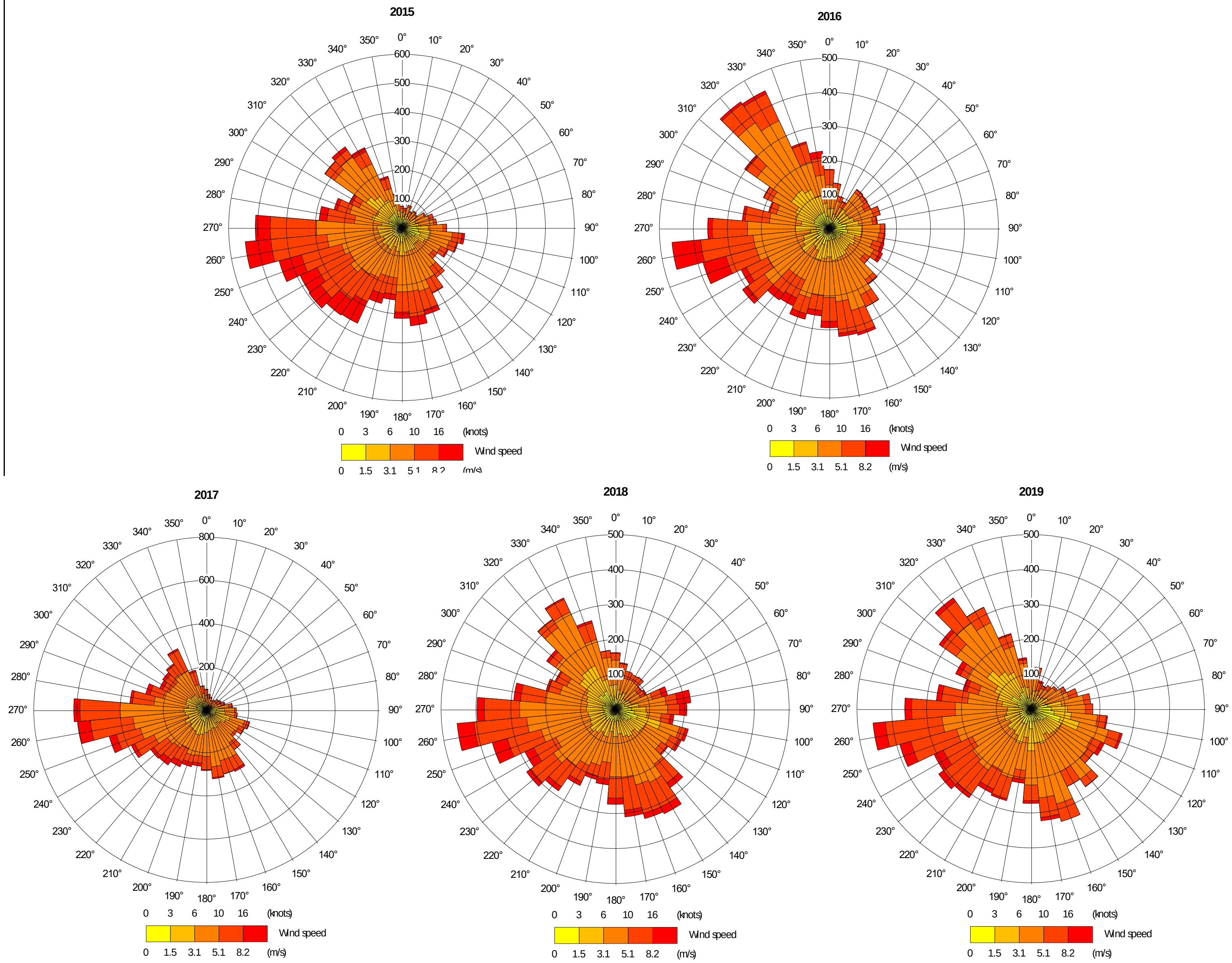

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Figure 1: Wind Roses – Linton-on-Ouse (2015 -2019)

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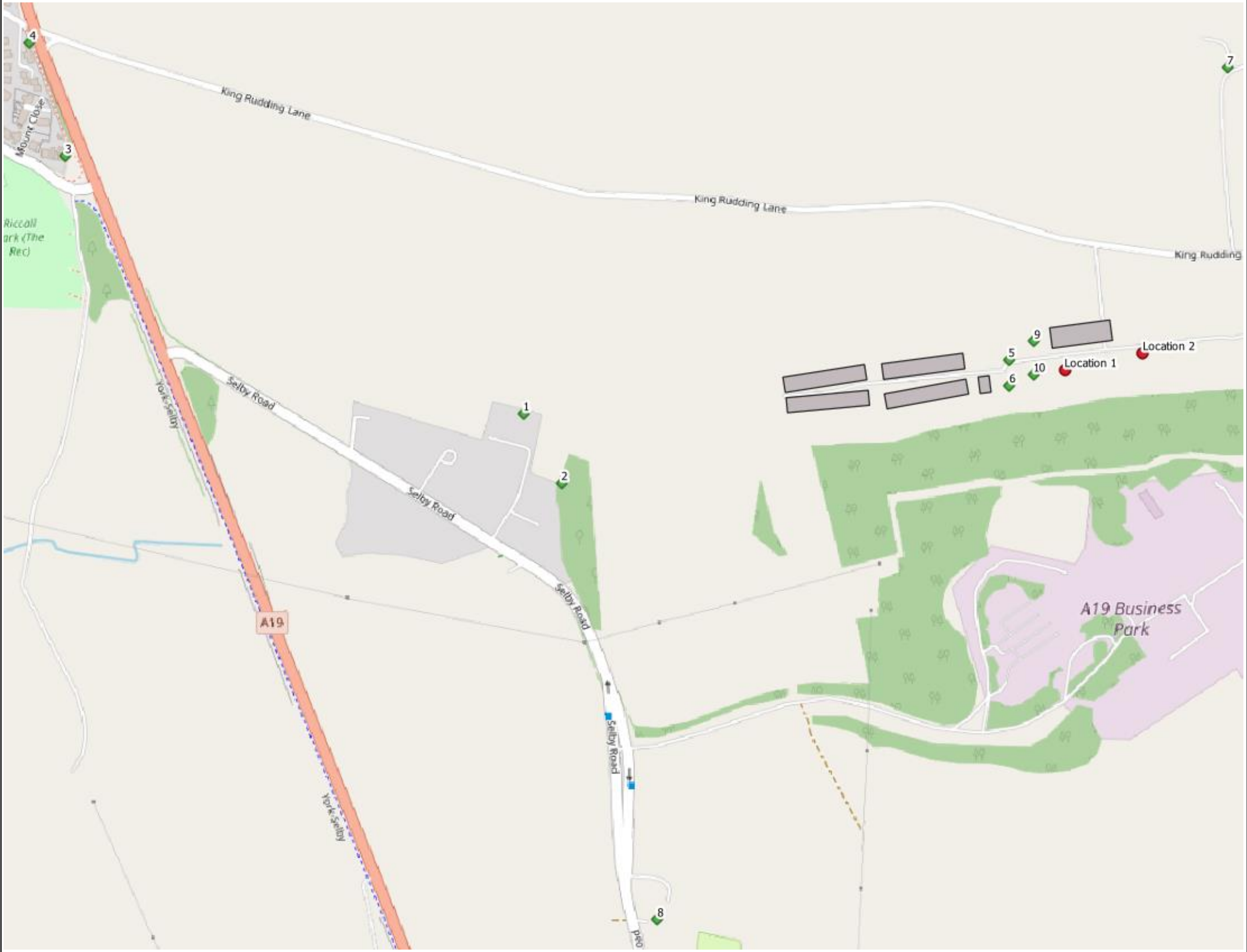

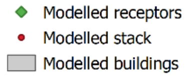

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Figure 2: Stacks and Modelled Receptors

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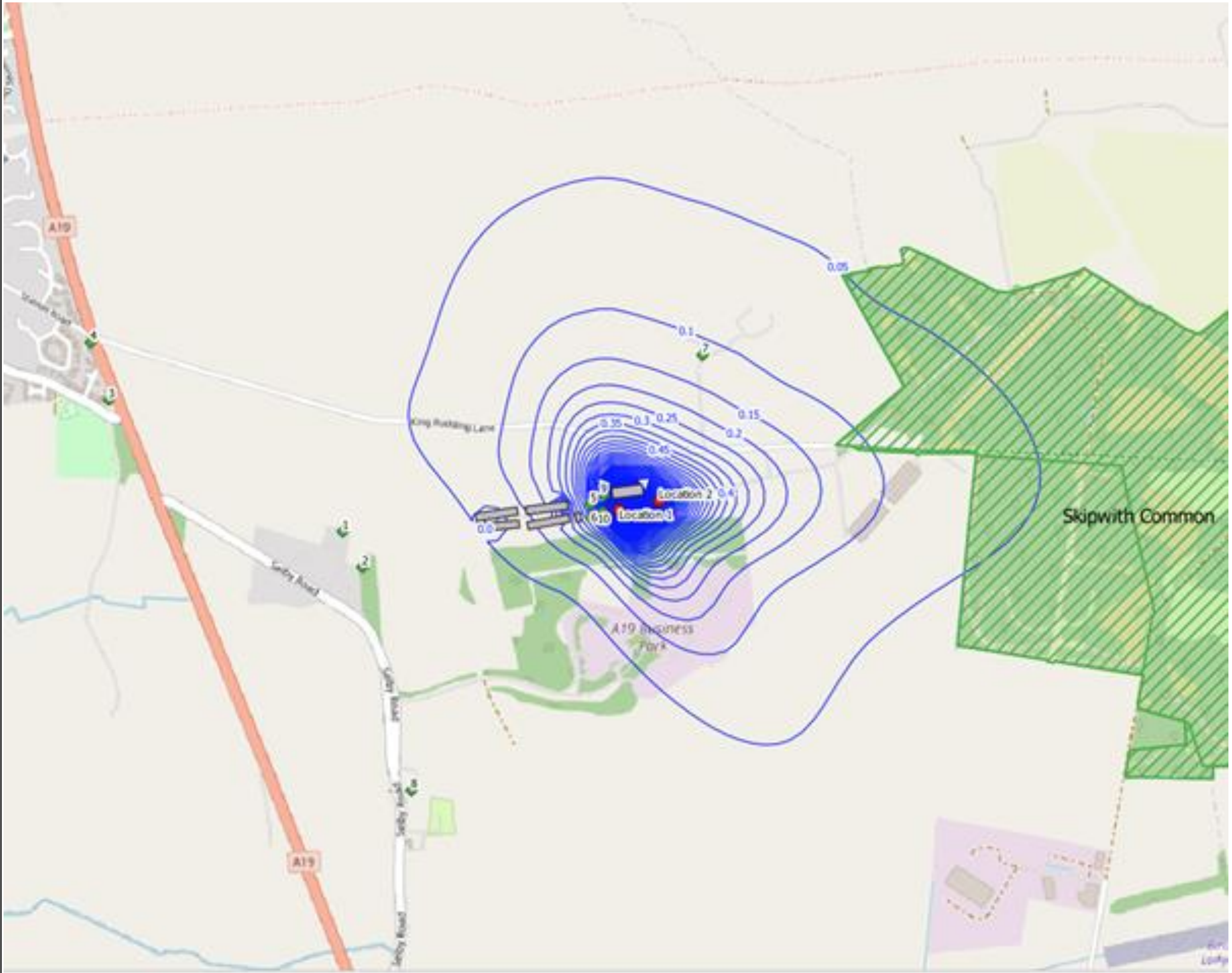

Modelled receptors
Modelled stack
Modelled buildings
Contour

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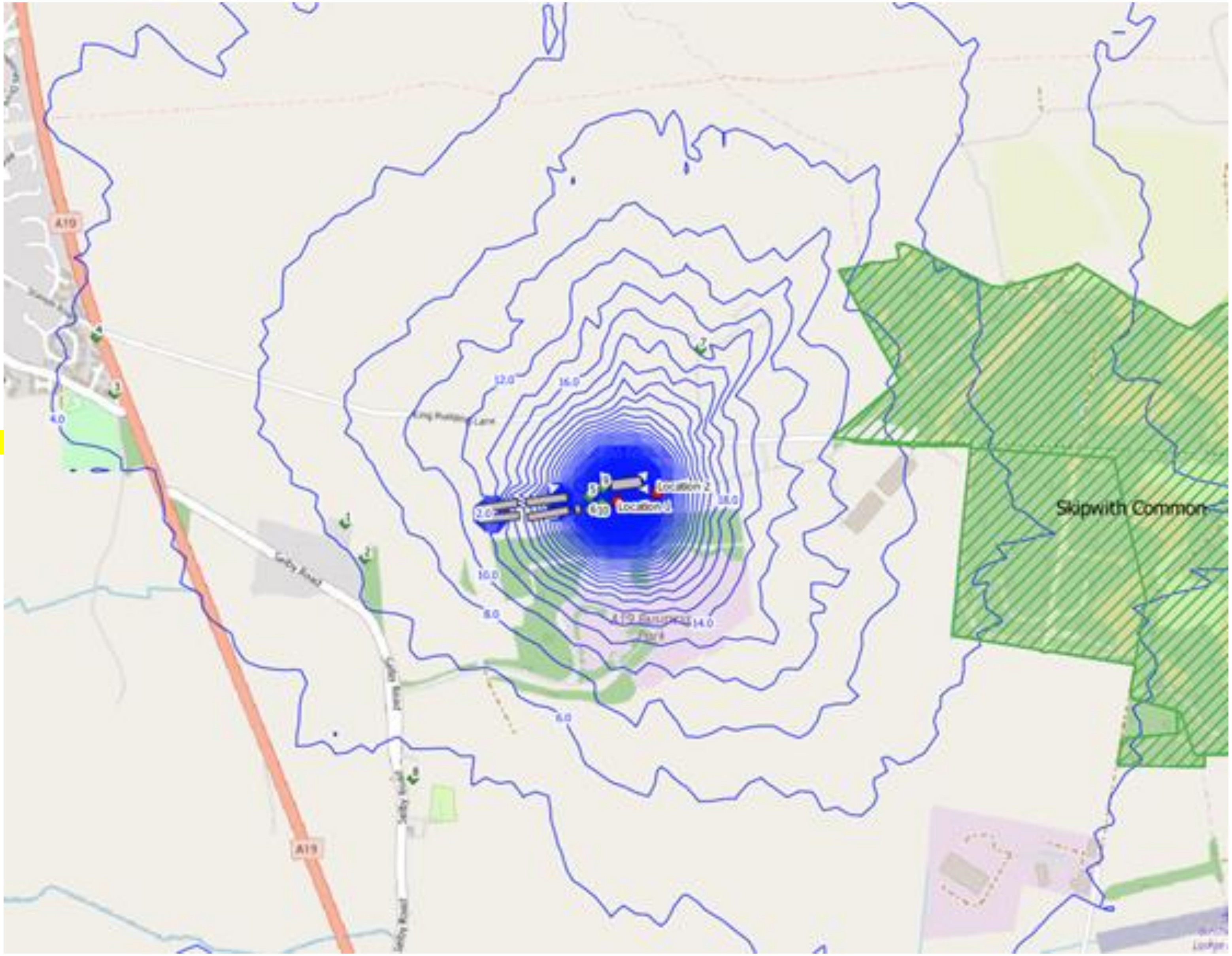
Figure 3: Annual mean NO_2 Process Contribution (μg.m^{-3})



Modelled receptors
Modelled stack
Modelled buildings
Contour

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Figure 4: 99.79th Percentile Hourly mean NO_2 Process Contribution (µg.m^{-3})

Appendices

Appendix A: Baseline

Nitrogen Dioxide and Particulate Matter

A.1 SDC do not monitor PM_{10} and the Defra mapped background concentration estimate for the grid square containing the Application Site of 14.1 $\mu g.m^{-3}$ has been used in the assessment.

A.2 SDC monitors NO_2 at several roadside and urban background locations in Selby. However, the nearest monitoring location is approximately 4.7 km from the site. Therefore, the Defra mapped background concentration estimate for the grid square containing the Application Site of 7.3 $\mu g.m^{-3}$ has been used in the assessment.

Sulphur Dioxide and Carbon Monoxide

A.3 The Automatic Urban and Rural Network (AURN) monitors ambient concentrations of, amongst others, SO_2 and CO.

A.4 The nearest monitoring location is at Leeds Centre AURN.

A.5 The concentrations monitored over recent years are provided in Table B.2.

Table B.1 Measured Annual-mean CO and SO_2 Concentrations

Pollutant	2016	2017	2018	2019	2020	Average
CO ($mg.m^{-3}$)	0.27	0.27	0.16	0.17	0.14	0.20
SO_2 ($\mu g.m^{-3}$)	1.48	1.46	1.40	1.44	1.32	1.42

A.6 The average concentrations have been used within the assessment.

Appendix B: Impacts at Ecological Receptors

Scope

B.1 The EA guidance on 'Screening for protected conservations areas' (EA, 2020b) requires identification of:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites (protected wetlands) within 10 km of the proposed development; and
- Sites of Special Scientific Interest (SSSIs) and Local Nature sites (ancient woods, local wildlife sites (LWSs) and national and local nature reserves) within 2 km of the proposed development.

B.2 As such, the assessment considers the impact of the development at the following designated sites:

- Lower Derwent Valley SAC, SPA, Ramsar and NNR;
- River Derwent SAC;
- Skipwith Common SAC, SSSI, NNR;
- York and Selby Cycle Track LWS; and
- Holly Carra/Hart Nooking Ancient Woodland.

Critical Levels

B.3 Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within UK air quality regulations. Where relevant, background concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [9].

Critical Loads

B.4 Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.

Critical Loads – Nutrient Nitrogen Deposition

B.5 Percentage contributions to nutrient nitrogen deposition have been derived from the results of the ADMS dispersion modelling. Deposition rates have been calculated using empirical methods recommended by the Environment Agency, as follows:

- The dry deposition flux ($\mu g.m^{-2}.s^{-1}$) has been calculated by multiplying the ground level NO_2, and SO_2 concentrations ($\mu g.m^{-3}$) by the deposition velocities ($m.s^{-1}$) set out in the table below.

Table 3 Deposition Velocities

Pollutant	Deposition Velocity ($m.s^{-1}$)	
	Grassland	Woodland
NO_x	0.0015	0.003
SO_2	0.012	0.024

- Units of $\mu g.m^{-2}.s^{-1}$ have been converted to units of $kg.ha^{-1}.year^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_2, and 157.7 for SO_2.
- Predicted contributions to nitrogen and sulphur deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads – Acidification

B.6 The acid deposition rate, in equivalents $keq.ha^{-1}.year^{-1}$, has been calculated by multiplying the dry deposition flux ($kg.ha^{-1}.year^{-1}$) by a conversion factor of 0.071428 for N and 0.0625 for S. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

B.7 Wet deposition in the near field is not significant compared with dry deposition for N and S [10] and therefore for the purposes of this assessment, wet deposition has not been considered.

B.8 Predicted contributions to acid deposition have been calculated and compared with the critical load function for the habitat types associated with the designated site as derived from the APIS database.

Significance Criteria

B.9 The PCs and PECs have been compared against the relevant critical level/load, for the relevant habitat type/interest feature.

B.10 For SACs, SPAs and Ramsars, the Environment Agency guidelines (EA, 2020b) state that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

B.11 It continues by stating that:

"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further. If your PEC is greater than 70% of the long-term environmental standard, you need to do detailed modelling."

B.12 For LWSs, it states:

"If your emissions meet both of the following criteria they're insignificant – you don't need to assess them any further:

- *the short-term PC is less than 100% of the short-term environmental standard*
- *the long-term PC is less than 100% of the long-term environmental standard*

You don't need to calculate PEC for local nature sites. If your PC exceeds the screening criteria you need to do detailed modelling."

Results

B.13 The predicted annual-mean NO_X, and SO_2 concentrations are compared with the critical levels in Table B.1.

B.14 The predicted daily-mean NOx concentrations are compared with the critical levels in Table B.2.

B.15 The predicted nutrient N deposition rates are compared with the critical load in Table B.3. The lowest critical loads for nitrogen deposition have been obtained from APIS.

B.16 The maximum predicted acid deposition rates are compared with the critical load function in Table B.4. The critical loads for the nitrogen and sulphur component for acid deposition have been also obtained from APIS.

Table B.1 Predicted Annual-Mean NOx and SO_2 Concentrations at Designated Habitat Sites ($\mu g.m^{-3}$)

Habitat Site	Annual-mean NOx PC	PC as % of CL	Annual-mean SO_2 PC	PC as % of CL
Critical Level	**30**		**20**	
Lower Derwent SAC, SPA, Ramsar and NNR	0.007	0	0.003	0
River Derwent SAC	0.006	0	0.003	0
Skipwith Common SAC, SSSI, NNR	0.146	0	0.066	1
York and Selby Track LWS	0.017	0	0.008	0
Holly Carra/Hart Nooking Ancient Woodland	0.017	0	0.008	0

Table B.2 Predicted Daily-Mean NOx Concentrations at Designated Habitat Sites ($\mu g.m^{-3}$)

Habitat Site	Daily-mean NOx PC	PC as % of CL
Critical Level	**75**	
Lower Derwent SAC, SPA, Ramsar and NNR	0.40	1
River Derwent SAC	0.38	1
Skipwith Common SAC, SSSI, NNR	4.03	5
York and Selby Track LWS	1.10	1
Holly Carra/Hart Nooking Ancient Woodland	1.10	1

Table B.3 Predicted Nutrient N Deposition at Designated Habitat Sites (kg.ha^{-1}.yr^{-1})

Habitat Site	CL	N Deposition PC	PC as % of CL
Lower Derwent SAC, SPA, Ramsar and NNR	20	0.001	0
River Derwent SAC	No data	0.001	-
Skipwith Common SAC, SSSI, NNR	10	0.025	0
York and Selby Track LWS	10	0.003	0
Holly Carra/Hart Nooking Ancient Woodland	10	0.003	0

The woodland deposition velocities have been used at all sites except Skipwith Common where the grassland deposition velocity has been used.

Table B.4 Predicted Acid Deposition at Designated Habitat Sites (keq.ha^{-1}.yr^{-1})

Habitat Site	Min N CL	Max N CL	Max S CL	N PC	S PC	AC - N	AC - S	SWIP PC – N*	SWIP PC – S*	PEC - N	PEC - S	PC as % of CLF	PEC as % of CLF
Lower Derwent SAC, SPA, Ramsar and NNR	0.223	0.633	0.41	0.0001	0.0007	2.8	0.3	0.001	0.001	2.801	0.302	0	-
River Derwent SAC	no data	no data	no data	0.0001	0.0007	0.8	0.2	0.001	0.001	0.801	0.202	-	-
Skipwith Common SAC, SSSI, NNR	0.223	0.526	0.16	0.0018	0.0147	1.5	0.2	0.006	0.009	1.508	0.233	3	329

York and Selby Track LWS	0.357	1.339	0.982	0.0002	0.0020	2.49	0.26	0.002	0.004	2.492	0.266	0	-
Holly Carra/Hart Nooking Ancient Woodland	0.357	1.805	1.448	0.0002	0.0021	2.49	0.26	0.002	0.004	2.492	0.266	0	-

The woodland deposition velocities have been used at all sites except Skipwith Common where the grassland deposition velocity has been used.
*Taken from Appendix D, Table D.4 of 2022 RPS Air Quality Assessment for proposed SWIP.

Interpretation of Results

Annual-mean NOx and SO_2

B.17 The maximum annual-mean NOx and SO_2 PCs do not exceed 1% of the critical level and the impacts can be screened out as insignificant.

Daily-mean NOx

B.18 The maximum daily-mean NOx PCs do not exceed 10% of the critical level and the impacts can be screened out as insignificant.

Nutrient N Deposition

B.19 The maximum nitrogen deposition PCs do not exceed 1% of the critical load and the impacts can be screened out as insignificant.

Acid Deposition

B.20 For all designated sites, except Skipwith Common, the PC does not exceed 1% of the CLF and the impacts can be screened out as insignificant. At Skipwith Common the PC is 3% of the CLF and the PEC exceeds the CLF, largely due to AC which also exceeds the PEC.

B.21 The projects ecologist has advised:

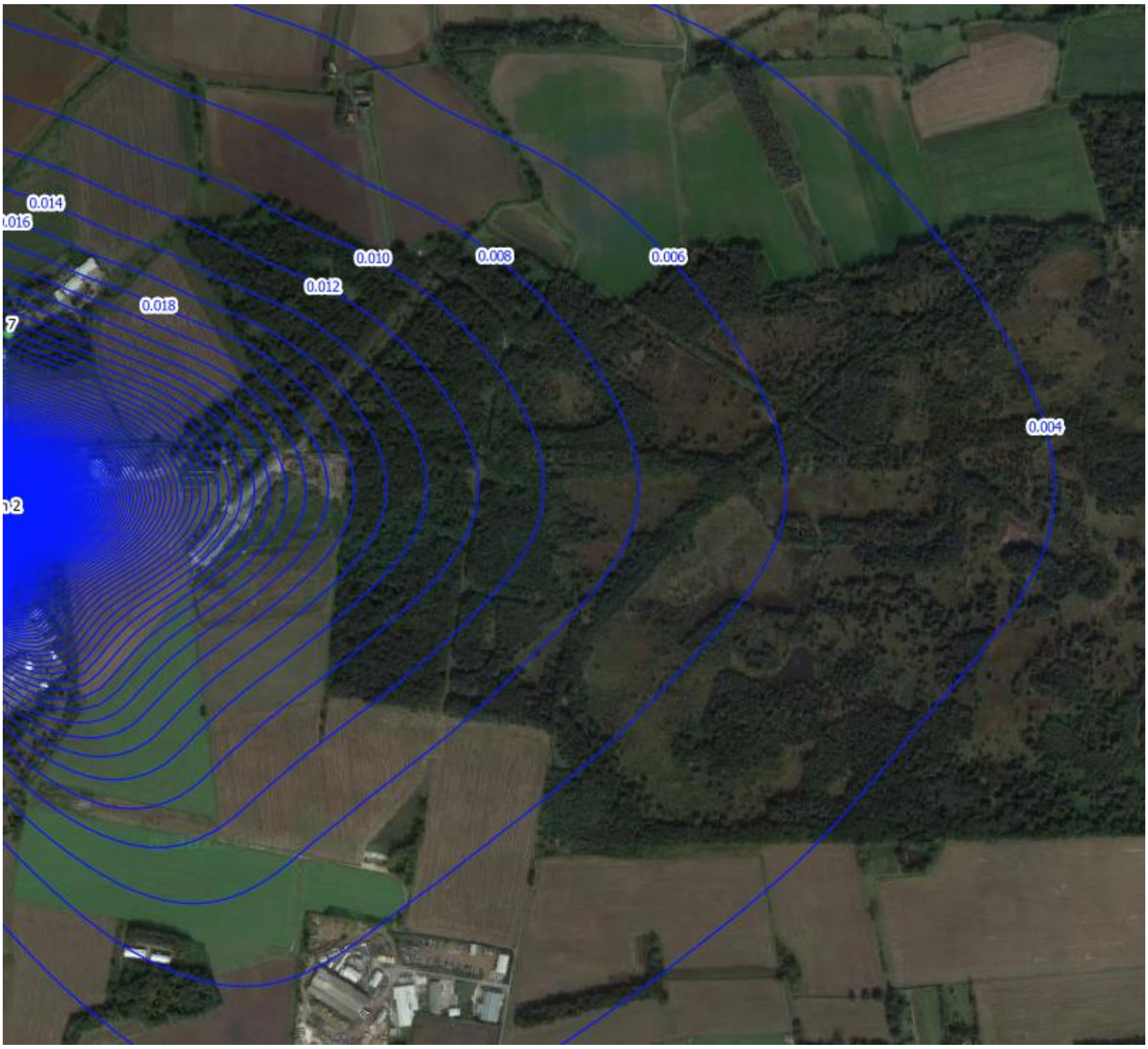
"The minimum CLF for the site relates to the areas of mire present within the site, an interest feature of the SSSI (MinCLminN: 0.223, MinCLMaxS: 0.16, MinCLMaxN: 0.526). With respect to the SAC, the minimum CLF for the heathland habitats for which the SAC is designated is somewhat higher (MinCLminN: 0.642, MinCLMaxS: 0.16, MinCLMaxN: 0.802) reflecting the fact that these habitats are less sensitive to acid deposition than mires.

This information has then been used to define the potential for effects on the SAC/SSSI from the increased acid deposition…

With respect to the impact on the most sensitive feature of the SSSI (the mire habitat), the key contour is the 0.008 keq/ha/yr. With respect to the interest features of the SAC (the heathland), it is the 0.012 keq/ha/yr. Both of these represent 1% of the relevant CLF; below this (i.e. to the west) it is unlikely that any effect would occur."

B.22 The figure below shows various contours of acid deposition.

Annual mean Acid Deposition Process Contribution (keq.ha^{-1}.yr^{-1})



B.23 The projects ecologist has advised:

"the area covered by the mire 1% CLF contour comprises primarily woodland with some mixed heathland. No mire habitat was present within the area studied.

Similarly, the area covered by the heathland 1% CLF contour comprises only woodland with no heathland present.

Further, the soils in the western end of the site have been noted as being more locally base-rich, where they occur near to the runways of the former airfield (NE 2019). As such, the habitats towards the site are likely to be less sensitive to acid deposition than those further to the east.

Therefore, on the basis of the habitat survey, there are no interest features for either the SAC or SSSI within the zone of influence of the site and, as such, no effects are predicted".

References

1 Defra, 2010, The Air Quality Standards Regulations.

2 The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020

3 Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.

4 OPSI (2016) The Environmental Permitting (England and Wales) Regulations 2016

5 Defra (2022) Local Air Quality Management Technical Guidance, 2016 (LAQM.TG22)

6 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

7 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

8 Drawn from Defra Maps at http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

9 Air Pollution Information System (APIS) http://www.apis.ac.uk/

10 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4