MOTT MACDONALD

Mitchell's Industrial Park

Air quality assessment for planning

14 November 2019

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1 Introduction

1.1 Overview

This air quality assessment has been undertaken for the proposed Mercia Power Response Ltd. (MPR) peaking plant site at Michell's Industrial Park (hereafter referred to as the 'proposed development'). The proposed development would consist of four, 2 Megawatt electrical (MWe) natural gas engines which would provide balancing services to the National Grid, operating on a short-term basis to meet peak demand or shortfalls in generation within the electrical distribution network.

This report provides an assessment of the following key impacts associated with the proposed development:

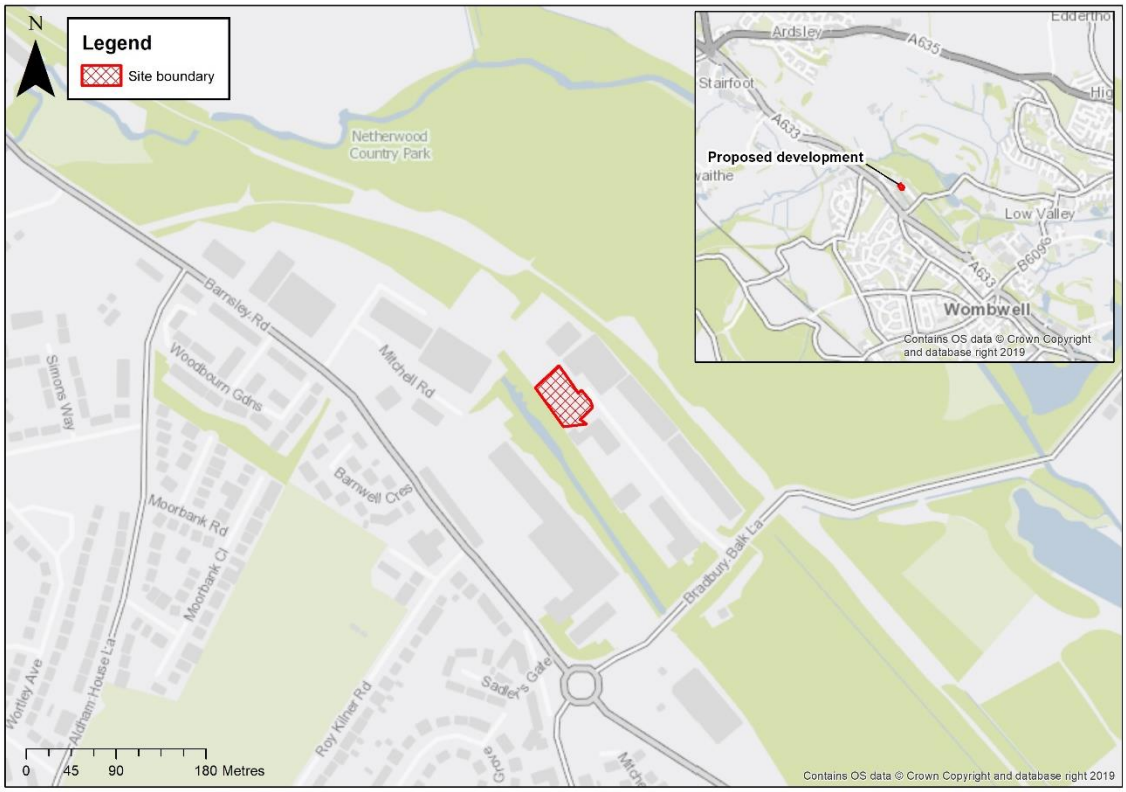
- Construction phase: nuisance, loss of amenity and health impacts caused by construction dust on sensitive receptors
- Operation phase: impacts from combustion plant emissions from the operation of the proposed development

1.2 Proposed development location

The proposed development is located at Mitchell's Industrial Park on Bradberry Balk Lane in Wombwell, within the administrative area of Barnsley Metropolitan Borough Council (BMBC). The proposed development is surrounded primarily by industrial/commercial land use, with some amenity land (Netherwood Country Park) to the north and east. The A633 Barnsley Road is located approximately 150m east.

Figure 1 shows the location and extent of the proposed development.

Figure 1: Proposed development location



1.3 Key pollutants

The assessment considers concentrations of oxides of nitrogen (NO_x) as this is the key pollutant of concern given that the engines will operate on natural gas. This is also BMBC's main pollutant of concern, where it is primarily associated with road traffic emissions[1].

Oxides of nitrogen is a term used to describe a mixture of nitric oxide (NO) and NO_2, referred to collectively as NO_X. These are primarily formed from atmospheric and fuel nitrogen as a result of high temperature combustion. The main sources in the UK are road traffic and power generation.

During the process of combustion, atmospheric and fuel nitrogen is partially oxidised via a series of complex reactions to NO. The process is dependent on the temperature, pressure, oxygen concentration and residence time of the combustion gases in the combustion zone. Most NO_X exhausting from a combustion process is in the form of NO, which is a colourless and tasteless gas. It is readily oxidised to NO_2, a more harmful form of NO_X, by chemical reactions with ozone and other chemicals in the atmosphere. NO_2 is a yellowish-orange to reddish-brown gas with a pungent, irritating odour and is a strong oxidant.

[1] Barnsley Metropolitan Borough Council, 2019. Annual Status Report 2018.

2 Legislation and policy context

2.1 Introduction

This section summarises the relevant international and national legislation, policy and planning guidance in relation to air quality for the proposed development. In addition, local planning policy guidance has been reviewed in order to identify relevant air quality policy implications related to the proposed development.

2.2 Legislation

2.2.1 European Union

EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in May 2008[2]. This Directive defines limit values and times by which they are to be achieved for the purpose of protecting human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

Directive 2008/50/EC sets out that the Limit Values apply everywhere with the exception of:

- any locations situated within areas where members of the public do not have access and there is no fixed habitation
- in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply
- on the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation

Defra assesses and reports on the compliance with the Air Quality Directive for each of the 43 zones and agglomeration across the UK.

2.2.2 England

2.2.2.1 Air Quality

The Air Quality Standards Regulations 2010[3] and Air Quality Standards (amendment) Regulations 2016[4] implement the EU's Directive 2008/50/EC on ambient air quality.

Part IV of the Environment Act 1995[5] requires that every local authority shall periodically carry out a review of air quality within its area, including likely future air quality. As part of this review, the authority must assess whether air quality objectives are being achieved, or likely to be achieved within the relevant periods. Any parts of an authority's area where the objectives are not being achieved or are not likely to be achieved within the relevant period must be identified and declared as an Air Quality Management Area (AQMA). Once such a declaration has been made, local authorities are under a duty to prepare an Action Plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.

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2 European Union. (1996), 'Ambient air quality assessment management', Framework Directive 96/62/EC.

3 Statutory Instrument. (2010), 'The Air Quality Standards Regulations', No. 1001. Queen's Printer of Acts of Parliament.

4 Statutory Instrument (2016) The Air Quality Standards (Amendment) Regulations, No. 1184.

5 Department for Environment Food and Rural Affairs. (2003), 'Part IV of the Environment Act 1995 Local Air Quality Management'.

The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in the Air Quality (England) Regulations 2000[6] and the Air Quality (England) (Amendment) Regulations 2002[7]. In most cases, the air quality objectives are numerically synonymous with the limit values specified in the EU Directives although compliance dates differ.

The Environment Act also requires that the UK Government produces a national 'Air Quality Strategy' (AQS) containing standards, objectives and measures for improving ambient air quality and to keep these policies under review. Further details of the AQS are presented in Section 2.3.1.

2.2.2.2 Environmental permitting

The EU Medium Combustion Plant Directive (MCPD) (Directive 2015/2193)[8] regulates emissions of NO_x into the air from combustion plants with a rated thermal input equal to or greater than 1 megawatt thermal (MWth) and less than 50 MWth. Schedules 25A and 25B of the Environmental Permitting (Amendment) Regulations 2018[9] implements this directive while also including additional provisions for generators. Generators are subject to the Environmental Permitting (EP) regulations if they:

- Have a capacity agreement or an agreement to provide balancing services; or,
- They form part of a specified generator[10] (SG) with a total rated thermal input of 1-50MWth.

Specified generators are subject to more stringent requirements than the MCPD in that, depending on the type of generator, they may be required to have a permit by an earlier date than would be required under the MCPD (where the earliest permitting date is 1st January 2024).

Under the EP regulations, the proposed development would be regulated under the MCPD and classified as a "new", Tranche B specified generator. As the engines on site are proposed to operate for more than 500 hours per year, the proposed development will be required to meet a NOx emission limit of 95mg/Nm^3 (standard conditions[11], dry @ 15% O_2). The engines will only operate on natural gas so there are no applicable emission limits for carbon monoxide (CO), sulphur dioxide (SO_2) or dust/particulate matter.

2.2.2.3 Statutory Nuisance

Section 79(1)(d) of the Environmental Protection Act 1990[12] defines one type of 'statutory nuisance' as "*any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*". Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. However, it is a defence if an operator employs the best practicable means to prevent or to counteract the effects of the nuisance.

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6 Statutory Instrument. (2000), 'Air Quality (England) Regulations', No. 928. Queen's Printer of Acts of Parliament.

7 Statutory Instrument. (2002), 'Air Quality (England) (Amendment) Regulations', No. 3043. Queen's Printer of Acts of Parliament.

8 Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants.

9 The Environmental Permitting (England and Wales) Regulations 2016 No.1154

10 Specified generator = Individual or multiple generators at the same location or site, operated by the same Operator and for the same purpose

11 At a temperature of 273.15K, pressure of 101.3kPa

12 Parliament of the United Kingdom. (1990), 'Environmental Protection Act', Chapter 43. Queen's Printer of Acts of Parliament.

2.3 Policy

2.3.1 UK Air Quality Strategy

As described above, the Environment Act 1995 requires the UK Government to produce a national AQS. The AQS establishes the UK framework for air quality improvements. Measures agreed at the national and international level are the foundations on which the strategy is based. The first Air Quality Strategy was adopted in 1997[13] and was replaced by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000.[14] The 2000 Strategy has subsequently been replaced by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007.[15] The 2007 Air Quality Strategy has now been superseded as of the 14th January 2019 with the Clean Air Strategy 2019 (CAS).[16]

Although the CAS does not set legally binding objectives, the CAS instead has targets for reducing total UK emissions of nitrogen oxides from sectors such as road transport, domestic sources and construction plant (non-road mobile machinery (NRMM)).

2.3.2 National Planning Policy Framework

The revised National Planning Policy Framework[17] was published on 24 July 2018 and sets out government planning policies for England. With regard to air quality it states that:

"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas…"

And:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

[13] Department for Environment Food and Rural Affairs. (March 1997), 'The United Kingdom National Air Quality Strategy', Cm 3587, Department for Environment Food and Rural Affairs.

[14] Department for Environment Food and Rural Affairs. (January 2000), 'The Environment Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air', Cm 4548, Department for Environment Food and Rural Affairs.

[15] Department for Environment Food and Rural Affairs. (July 2007), 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland', Cm 7169, Department for Environment Food and Rural Affairs.

[16] Department for Environment Food and Rural Affairs. (January 2019), 'The Clean Air Strategy'

[17] Department of Communities and Local Government (July 2018). Planning Policy Framework.

2.3.3 Local Planning Policy

2.3.3.1 Barnsley Metropolitan Borough Council Local Plan

The BMBC current Local Plan was adopted in January 2019[18] and outlines the key policies for future development within the Borough up to 2033. The Local Plan comprises of a number of objectives and policies.

The main policy of relevance to is found under Policy Poll1: Pollution Control and Protection. This states that: "*Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air, surface water and groundwater, noise, smell, dust, vibration, light or other pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.*

We will not allow development of new housing or other environmentally sensitive development where existing air pollution, noise, smell, dust, vibration, light or other pollution levels are unacceptable and there is no reasonable prospect that these can be mitigated against.

Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.".

Regarding air quality, Policy AQ1: Development in Air Quality Management Area states that*: "Development which impacts on areas sensitive to air pollution in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), taking into account any suitable and proportionate mitigation required for the development.*

We will only allow development which impacts on areas sensitive to air pollution which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality, subject to any required mitigation."

2.3.3.2 Barnsley Metropolitan Borough Council Air Quality Action Plan

The BMBC Air Quality Action Plan (AQAP)[19] was published in April 2017 (and updated in 2019) as part of BMBC's statutory duties under the Local Air Quality Management framework in response to monitored exceedances of the annual nitrogen dioxide objective in the Borough. The AQAP comprises of measures to improve air quality in Barnsley's AQMAs and the Borough as a whole between 2017 and 2021, the majority of which focus on reducing emissions from vehicles. These measures have been developed under the following five key themes:

- Reduce traffic
- Behavioural change
- Increase efficiency
- Improve fleet
- Regulation

[18] Barnsley Metropolitan Borough Council (2019). Barnsley Local Plan, Adopted January 2019

[19] Barnsley Metropolitan Borough Council (2019). Barnsley MBC Air Quality Action Plan 2017 (update 2019).

2.3.3.3 Barnsley Metropolitan Borough Council Air Quality and Emissions Good Practice guidance

The BMBC Air Quality and Emissions Good Practice guidance[20] was published in October 2018 and sets out the framework for "integrating air quality considerations into land-use planning and development management policies that can influence the reduction of road transport emissions".

This guidance details when an air quality assessment is likely to be required, key air quality legislation and the approach that should be followed to assess the impact from vehicle emissions associated with a development on air quality.

2.4 Summary

This section has identified the legislation and policy framework relevant to the assessment. On the basis of the above, applicable air quality standards for the protection of human health are summarised in Table 1.

It should be noted that the UK air quality objectives for the protection of human health only apply at locations where the members of the public might reasonably be exposed to pollutants for the respective averaging periods. Table 2 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment.

Table 1: Relevant Air Quality Standards for the protection of human health

Pollutant	Averaging period	Air Quality Objective and Limit Values		Attainment date
		Concentration	Allowance	
Nitrogen Dioxide (NO_2)	1-hour	200 µg/m^3	18 per calendar year[(c)]	31 December 2005[(a)] 1 January 2010[(b)]
	Annual	40 µg/m^3	-	31 December 2005[(a)] 1 January 2010[(b)]

Notes: [(a)] Air Quality (England) Regulations 2000 as amended.
[(b)] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations.
[(c)] Can be expressed as the 99.79th percentile of 1 hour means.

[20] Barnsley Metropolitan Borough Council (2018). Air Quality and Emissions Good Practice Planning Guidance, October 2018.

Table 2: Locations where the Air Quality Objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	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 building façade), or any other location where public exposure is expected to be short-term.
24 Hour	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.
1 Hour	All locations where the annual mean and 24 mean objectives apply. Kerbside sites (for example, 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 where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: Defra TG16[21]

Meanwhile, the UK air quality objectives for the protection of vegetation and ecosystems only apply in areas that are:

- more than 20 km from an agglomeration (i.e. an area with a population of more than 250,000); and,
- more than 5 km away from industrial sources regulated under Part A1 of the Environmental Permitting regulations, motorways and built up areas of more than 5,000 people.

Table 3 presents the critical levels that are relevant to the proposed development. The annual mean critical levels set for the UK air quality objectives and the limit values set in Directive 208/50/EC for the protection of vegetation and ecosystems are numerically equal.

Table 3: Critical levels for the protection of vegetation and ecosystems

Pollutant	Averaging period	Critical level
Nitrogen oxides (NO_x)	Annual	30µg/m^3
	Daily (24 hour)	75µg/m^3

[21] Department for Environment, Food and Rural Affairs (2018), Local Air Quality Management – Technical Guidance (16).

3 Methodology

3.1 Overview

This section sets out the approach that has been undertaken to assess the air quality effects associated with the construction and operation of the proposed development.

3.2 Construction

Construction of the proposed development will result in emissions of NO_2 and dust associated with:

- Construction activities, such as demolition and vehicle trackout, generating dust (section 3.2.1)
- Combustion plant emissions from temporary onsite energy plant (section 3.2.2)
- Construction vehicles on the local road network travelling to and from the proposed development (section 3.2.3)

The sections below detail the methodology used for assessing air quality impacts during the construction phase.

3.2.1 Construction dust emissions

Construction activities can result in temporary effects from dust. 'Dust' is a generic term which usually refers to particulate matter in the size range 1-75 microns in diameter; the most common effects from dust emissions are soiling and increased ambient PM_{10} concentrations[22]. Dust can arise from numerous construction activities such as concrete-batching, piling, sand blasting, wind erosion on material stock piles and earth-moving activities. It can be mechanically transported either by wind or through the movement of vehicles onto the public highway (transport of debris on vehicle wheels, or uncovered loads).

The Institute of Air Quality Management (IAQM) guidance[23] recommends splitting the construction activities into four separate source categories and determining the dust risk associated with each of these individually. This assessment has determined the risk of each of the following source categories:

- Demolition
- Earthworks
- Construction
- Trackout (the transport of dust and dirt onto the public road network).

The risk of each source for dust effects is described as 'negligible', 'low risk', 'medium risk' or 'high risk' depending on the nature and scale of the construction activities and the proximity of sensitive receptors to the construction activities or site boundary. The assessment is used to identify appropriate mitigation measures proportional to the level of risk, to reduce the effects such that they are not significant.

The assessment considers three separate effects from dust:

[22] British Standards Institution. 1992. Characterization of air quality. BS 6069-4.4:1993, ISO 7935:1992.

[23] Institute of Air Quality Management (2014). 'Guidance on the assessment of dust from demolition and construction.

- Annoyance due to dust soiling
- Harm to ecological receptors
- The risk of health effects due to a significant increase in exposure to PM_{10}.

Step 1 of the assessment applies screening criteria to the proposed development which states that an assessment will normally be required where there is:

- A 'human receptor' within:
  - 350m of the boundary of the site, or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- An 'ecological receptor' within:
  - 50m of the boundary of the site, or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

No further assessment is required if there are no receptors within the defined boundaries.

To assess the likely dust risk, firstly the overall dust emission magnitude ('small', 'medium' or 'large') from each of the dust sources identified (demolition, earthworks, construction and trackout) is established in accordance with the criteria outlined in in Appendix A.

The sensitivity of receptors is then defined (as high, medium or low) for each dust effect (dust soiling, human health and ecosystem impacts) in accordance with the criteria presented within Table 18 in Appendix A.

The sensitivity of the surrounding area is determined for each activity using the matrices in Table 19, Table 20 and Table 21 in Appendix A. The sensitivity of the area is based on: the distance of the source to the closest receptors, the receptor sensitivity, and (in the case of PM_{10} effects), the local background concentration. The highest level of area sensitivity defined for each dust effect has been used in this assessment.

The final step of the assessment combines the dust emission magnitude and the sensitivity of the area, using the matrices presented within Table 22, Table 23, Table 24 and Table 25 in Appendix A to determine the dust risk categories for each activity for dust soiling and health effects.

The dust risk category defined for each dust source and effect is then used to determine appropriate site-specific mitigation measures to be adopted. Significance is then assigned to construction effects following mitigation.

The results of the construction dust assessment are presented in Section 5.2.

3.2.2 Construction site plant emissions

Construction may require the use of different equipment such as excavators, cranes and on-site generators. All construction plant has an energy demand with some as a direct emission to air from exhausts. IAQM guidance[24] notes that effects from exhaust will likely not be significant and therefore are unlikely to need to be quantitatively assessed. Given the short-term and temporary nature of the site plant (the construction phase is expected to be less than six months), the effects of plant emissions on local air quality are considered to be of negligible significance relative to the road traffic contributions from the surrounding local road network. Construction

[24] Institute of Air Quality Management (2014). 'Guidance on the assessment of dust from demolition and construction.

plant emissions have therefore not been assessed further. However, mitigation measures to reduce the impacts associated with site plant on local air quality are presented in Section 6.

3.2.3 Construction road traffic emissions

Environment Protection UK (EPUK) and IAQM[25] guidance indicates that an assessment of traffic emissions is only likely to be required for large, long term construction sites that will generate an additional annual average flow of greater than 100 Heavy Duty Vehicles (HDVs) per day or greater than 500 Light Duty Vehicles (LDVs) per day at sites located outside of an AQMA.

The total additional flows of LDVs and HDVs during the construction phase are expected to be less than 20 vehicle flows per day for up to 3 months and therefore will be well below the IAQM/EPUK screening criteria. Therefore, construction traffic emissions are expected to be not significant, and no further consideration has been given to the effects of construction road traffic on ambient air quality.

3.3 Operation

Operation of the proposed development will result in emissions of NOx associated with:

- Vehicles on the local road network travelling to and from the proposed development (section 3.3.1)
- Combustion plant emissions from the gas fired engines onsite (section 3.3.2)

The sections below detail the methodology used for assessing air quality impacts during the operation phase.

3.3.1 Operation road traffic emissions

Trips associated with the proposed development are expected to generate additional vehicle flows on the local road network. This will generate additional emissions of NOx and therefore the operation phase of the proposed development has the potential to affect local air quality.

However, the vehicle trips to and from the proposed development will be de minimis as it will primarily consist of employees visiting the site to operate the engines (up to two per day) as well as infrequent maintenance visits from the engine manufacturer. Therefore, the increase in vehicle flows as a result of the proposed development will be well below the EPUK/IAQM indicative criteria for an assessment, and operation traffic emissions are not expected to be significant and have not been considered further within this assessment.

3.3.2 Onsite engine emissions

The main impact on air quality associated with the proposed development will be from emissions of NOx from the operation of the four 2MWe engines. A quantitative approach using atmospheric dispersion modelling has been used to assess the increase in NO_2 concentrations at sensitive receptors. For the purpose of modelling, it has been conservatively assumed that all four engines will be operating continuously at full load all year. During post-processing, annual concentrations have then been scaled down assuming the plant will operate for a maximum of 17 hours a day for every day of the year (see Section 3.3.2.8 for more details).

[25] Environmental Protection UK and Institute of Air Quality Management (January 2017), 'Land-Use Planning and Development Control: Planning for Air Quality' version 1.2

The assessment has been based on 2020 as this is assumed to be the opening year of the proposed development and is considered a worst case from an air quality perspective. This is because this year will have the highest background concentrations and therefore the highest modelled concentrations at receptors. Pollutant concentrations decrease over time due to improvements in vehicle and emissions technologies so the greatest risk of exceedances of the air quality objectives would be in the opening year.

The sections below detail the modelling approach adopted for the assessment of onsite engine emissions.

3.3.2.1 Model selection

Commercially available dispersion models are available to predict ground level concentrations arising from emissions to air from elevated point sources.

ADMS is a “new generation” dispersion model, developed by Cambridge Environmental Research Consultants (CERC), which models a wide range of buoyant and passive releases to the atmosphere either individually or in combination. ADMS brings together the results of recent research on dispersion modelling. The model calculates the mean concentration over flat terrain, allowing for the effect of plume rise, complex terrain, buildings, radioactive decay and deposition. The model has been subject to extensive validation. ADMS comprises of a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. The latest version of the model, ADMS 5.2.2.0, has been used in this assessment.

3.3.2.2 Buildings

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. ADMS includes a building effects module to calculate the dispersion of pollution from sources near large structures. The buildings likely to have a dominant effect (i.e. with the greatest dimensions likely to promote turbulence) which have been included within the model are listed in Table 4 and illustrated in Figure 2.

At the proposed development, it is possible that a 5m high acoustic fence will be installed around the engines to reduce the impact from noise. The presence of this acoustic fence has the potential to affect atmospheric dispersion as the height of the fence will be the same height as the stacks. A sensitivity test has therefore been undertaken to determine the effect that the fence could have on dispersion and the concentrations modelled at receptors. The results from this sensitivity test are presented in Appendix C.

Table 4: Building dimensions used within the assessment

Number	Name	X (m)	Y (m)	Height (m)	Length (m)	Width (m)	Angle (°)
1	Offsite 1	439231	404102	6	20.0	13.8	50
2	Engine 1	439212	404140	3.5	3.2	13.4	141
3	Engine 2	439214	404136	3.5	3.0	13.4	141
4	Engine 3	439219	404133	3.5	2.9	13.3	141
5	Engine 4	439222	404129	3.5	3.0	13.3	141
6	Gas meter kiosk	439224	404125	2.4	4.1	2.6	44
7	Oil store	439215	404150	2	3.0	2.9	144

Number	Name	X (m)	Y (m)	Height (m)	Length (m)	Width (m)	Angle (°)
8	Switchroom	439210	404160	3.2	4.6	6.2	55
9	DNO HV substation	439207	404166	2.4	2.7	3.9	51
10	Welfare kiosk	439199	404161	2.4	2.4	6.0	137
11	Offsite 2	439236	404181	8	22.9	40.8	141
12	Offsite 3	439255	404164	7	32.8	27.7	51
13	Offsite 4	439214	404198	8	30.9	20.1	228
14	Offsite 5	439286	404141	7	18.0	40.2	49
15	Offsite 6	439253	404100	6	17.3	34.1	50
16	Offsite 7	439311	404113	7	16.9	28.9	50
17	Offsite 8	439104	404177	7	62.2	38.4	122
18	Offsite 9	439175	404055	6	23.7	86.3	230

Figure 2: Building layout



Note: Proposed development boundary outlined in red.

3.3.2.3 Meteorology

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 the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise.
- 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. ADMS uses a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

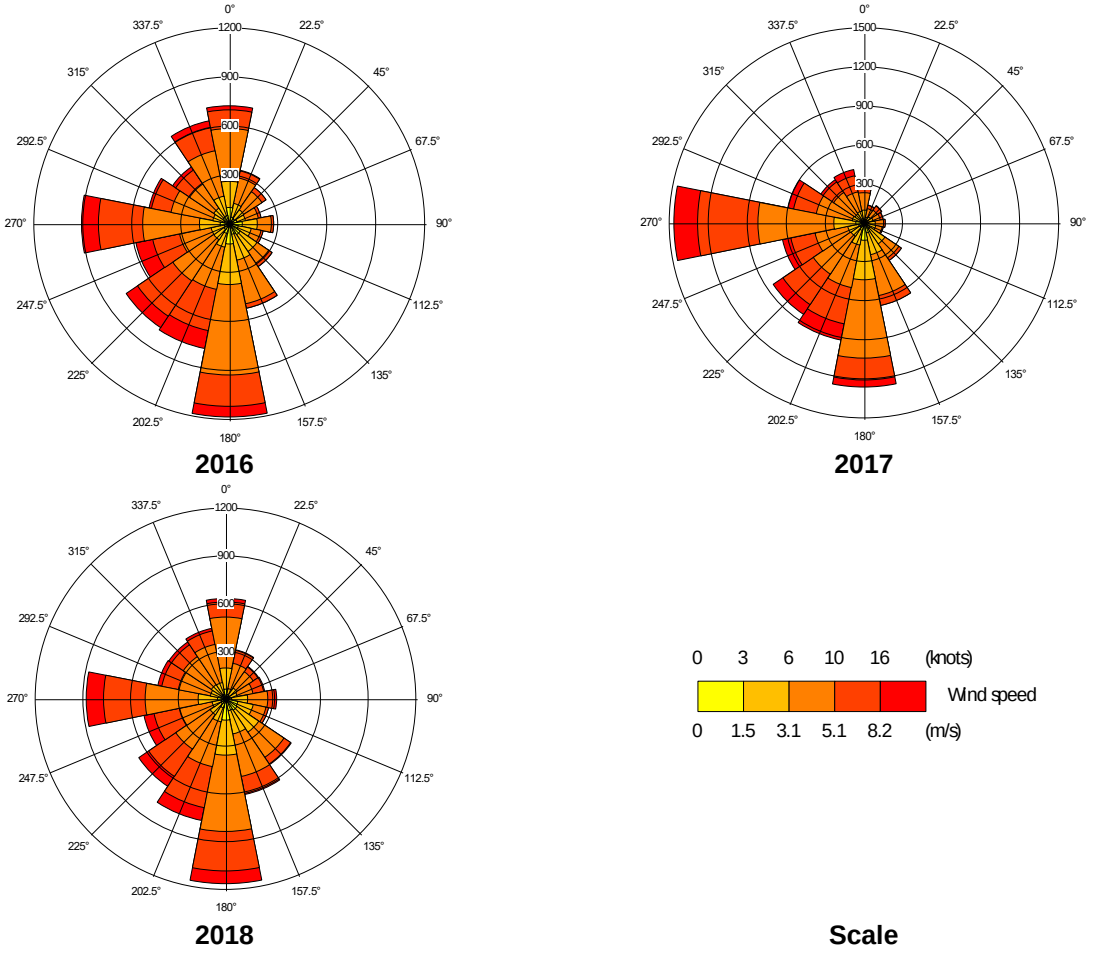
For meteorological data to be suitable for dispersion modelling purposes, parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. As recommended by Defra TG16[26], modelling was undertaken using three years of data. Data from Doncaster Sheffield Airport meteorological station was used as this was the most representative station due to its close proximity to the proposed development, located approximately 27 kilometres to the east. Three years of data from 2016 to 2018 were used.

Wind roses have been constructed for each of the three years of meteorological data used in this assessment. The wind roses presented in Figure 3 illustrate that in most years there is dominance in winds from the south and west, with less frequent winds from the north and east.

[26] Department for Environment, Food and Rural Affairs (2018), Local Air Quality Management – Technical Guidance (16)

Figure 3: Wind roses for Doncaster Sheffield Airport (2016 – 2018)



3.3.2.4 Terrain

The presence of elevated terrain can significantly affect (usually increase) ground level concentrations of pollutants emitted from elevated sources such as stacks by reducing the distance between the plume centre line and ground level and increasing turbulence and, hence, plume mixing.

Terrain in the region of the proposed development is generally flat, although there are some slopes with gradients more than 10%. Therefore, in accordance Defra TG16[27], terrain data has been included in the dispersion model.

3.3.2.5 Surface roughness

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. A surface roughness length of 0.5m has been assigned to the model domain. A surface roughness length of 0.2m has been assigned to Doncaster Sheffield Airport, as recommended by CERC.

[27] Department for Environment, Food and Rural Affairs (2018), Local Air Quality Management – Technical Guidance (16)

3.3.2.6 Emissions data

Emissions used in this assessment are based on an operational load of 100% (all engines at 2MWe) and assumes that exhaust gases will contain the maximum guaranteed concentration of pollutants permitted.

Table 5 presents the emission parameters used in the dispersion modelling. The NOx emissions modelled in this assessment for the proposed development are based on the emission guaranteed by the engine manufacturer. These emission guarantees are compliant with the MCP Emission Limit Values (ELVs) within the MCPD and the specified generator ELVs within the EP regulations.

Table 5: Stack emission parameters

Parameter	Units	Proposed development
Stack location	x,y	X:439205, Y:404135 X: 439208, Y:404131 X: 439213, Y:404129 X:439216, Y:404125
Stack height	m	5
Stack diameter	m	0.46
Exit temperature	°C	415
Efflux velocity (actual)	m/s	37.8
Volumetric flow rate (actual)	Am^3/s	6.28[(a)]
Volumetric flow rate (normalised)	Nm^3/s	1.48[(c)]
NO_x emission	mg/Nm³	250
	g/s	0.37

Notes: (a) Actual conditions = 9.3% O_2, 415ºC, 1 atm, 10.3% H_2O
(c) Normalised conditions = 5% O_2, 0ºC, 1 atm, dry air

3.3.2.7 NO_x to NO_2 relationship

The NO_X emissions associated with combustion activities at the proposed development will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at source. As described previously, 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.

There are various techniques available for estimating the portion of the NO_X that is converted to NO_2, which will increase with distance from the source. The EA's specified generator modelling guidance[28] identifies that a 70% conversion of NO_X to NO_2 should be used for calculation of annual average concentrations and a 35% conversion of NO_X to NO_2 should be used for calculation of short-term concentrations. The EA's recommended conversion rates have been used in this assessment.

3.3.2.8 Assessment of annual mean concentrations

The proposed development is expected to be operational between the hours of 6:00 to 23:00 Monday to Sunday. Therefore, the proposed development could theoretically operate for up to 6,188 hours per year, which is based on the site operating for up to 17 hours per day, every day of the year (although the required duration of operation is likely to be much less than this).

[28] Environment Agency, 2019. Specified generators: dispersion modelling assessment. Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

As the model has been run assuming continuous operation all year, the annual mean process contributions (PCs) have been scaled down by a factor of 6188/8760 to account for the likely total hours of operation across the year. This has been undertaken so that the annual concentrations of pollutants at discrete receptors are a representative worst-case. The short-term PCs have not been adjusted to account for all potential worst-case meteorological conditions.

3.3.2.9 Ambient concentrations

Background concentrations, or ambient concentrations (AC), are added to the PCs to determine the predicted environmental concentration (PEC) at modelled receptors. Defra's TG16[29] recommends that background maps or local authority/Defra monitoring data be used as a representative value for the background concentrations in the assessment. In the absence of nearby representative background monitoring, Defra NO_2 background concentrations have been used in this assessment to represent the ambient concentrations at gridded and some discrete receptors. For receptors 1 to 5, which are located on the A633 Barnsley Road, close to a local authority diffusion tube monitoring site (DT48), the distance corrected 2018 monitored concentration from DT48 has been used to represent the ambient concentration at these receptors (see Section 4.2.1 for details).

As the concentrations from the background maps and local authority monitoring are long-term (annual) average concentrations, short-term background concentrations have been estimated by doubling the long-term background concentrations. This is in accordance with EA risk assessment guidance[30].

3.3.2.10 Sensitive receptors

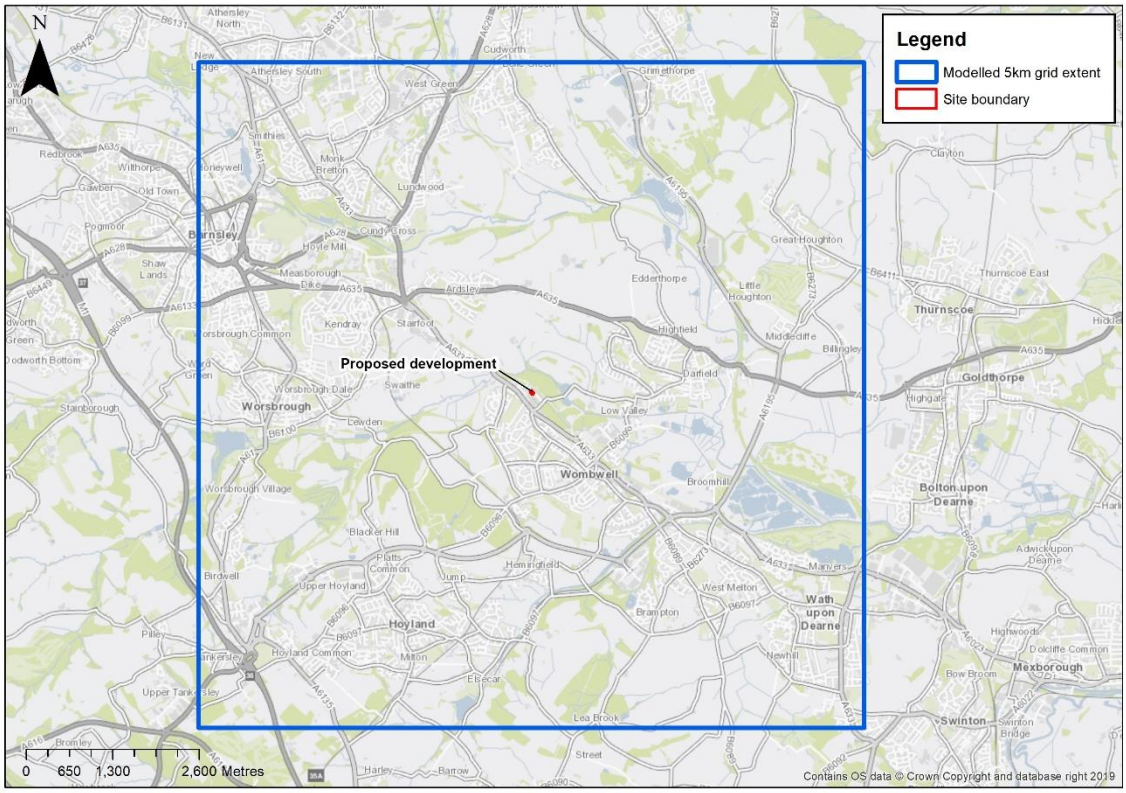
Gridded receptors and discrete human health receptors have been considered within this assessment.

Pollutant concentrations have been modelled across a Cartesian grid with 20 metre spacing up to 1km from the proposed development and 100m spacing up to 5km from the proposed development. The extent of the grid has been presented in Figure 4. This assessment has not considered on-site concentrations as the air quality objectives would not apply at these locations as there is no relevant public exposure.

[29] Department for Environment, Food and Rural Affairs (2018), Local Air Quality Management – Technical Guidance (16)

[30] Environment Agency, 2016. Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Figure 4: Gridded receptor model extent



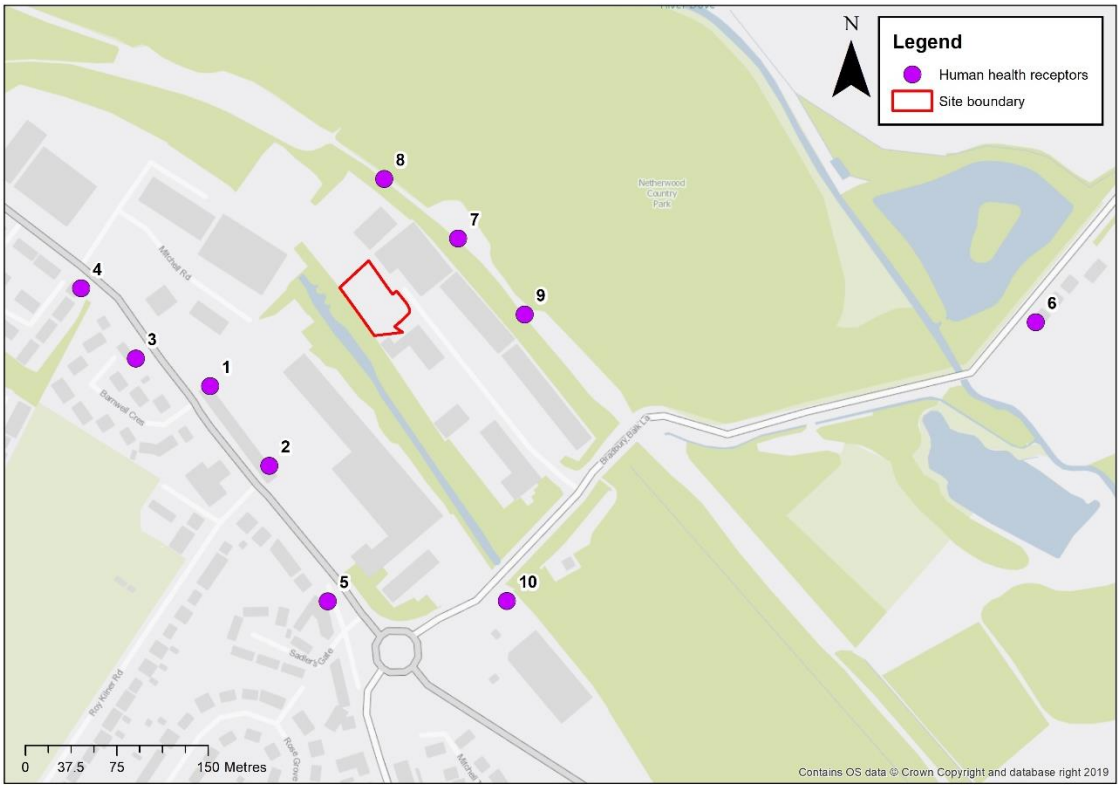
Ten discrete receptors representing the façades of the closest sensitive receptors (residential properties and recreation areas) have been included within the model so that a comparison against the air quality objectives can be made. Table 6 and Figure 5 show the locations of the discrete receptors considered within this assessment.

Table 6: Modelled human health receptors

Receptor number	Receptor name	X	Y	Height (m)
1	Barnsley Road 1	439076	404070	1.5
2	Barnsley Road 2	439124	404004	1.5
3	Barnwell Crescent	439015	404092	1.5
4	Woodbourn Gardens	438970	404150	1.5
5	Sadler's Gate	439172	403893	1.5
6	Netherwood Road	439753	404122	1.5
7[(a)]	Netherwood Country Park 1 (ST only)	439279	404191	1.5
8[(a)]	Netherwood Country Park 2 (ST only)	439219	404240	1.5
9[(a)]	Netherwood Country Park 3 (ST only)	439334	404129	1.5
10[(a)]	Lidl car park (ST only)	439319	403894	1.5

Note: [(a)] Annual objectives would not apply to these receptors, see Table 2 for more details

Figure 5: Modelled human health receptors



A review of ecological receptors has been carried out. Advice provided by the EA in their latest specified generator guidance[31] recommends that specific sites designated for their ecological importance need only be considered where they fall within set distances from the assessment site:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 5km; and,
- Sites of Special Scientific Interest (SSSIs) within 2km.

The EA risk assessment guidance[32] also recommends assessing the impact at local nature sites (Local Nature Reserves (LNR), Ancient Woodland (AW), National Nature Reserves (NNR) and Local Wildlife Sites (LWR)) within 2km.

No SPAs, SACs or Ramsar sites located within 5km of the proposed development and no relevant SSSIs or local nature sites are within 2km. While there is a one SSSI located within 2km of the proposed development (Stairfoot Brickworks SSSI), this has been designated on geological grounds. Therefore, this SSSI is not considered sensitive to air quality so has not been considered within this assessment. The nearest relevant ecological site is approximately 3.0km west (Worsborough Country Park LNR). As there are no relevant ecological sites within

[31] Environment Agency, 2019. Specified generators: dispersion modelling assessment. Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

[32] Environment Agency, 2016. Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

the applicable screening distances, the effects of the proposed development on ecological sites has not been considered further within this assessment.

3.3.2.11 Assessment criteria

A number of approaches can be used to determine whether the potential air quality effects of a development are significant. However, there remains no universally recognised definition of what constitutes 'significance' for air quality effects.

Guidance is available from a range of regulatory authorities and advisory bodies on how best to determine and present the significance of effects within an air quality assessment. It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively.

Any description of an effect of a development is informed by numerical results. However, an element of professional judgement must also be involved. To ensure that the descriptions of effects used within the assessment are clear, consistent and in accordance with the latest guidance, definitions for the assessment of air quality concentration changes at individual human health receptors have been adopted from the EPUK and IAQM 2017 guidance[33]. Table 7 provides effect descriptors for changes in NO_2 concentrations as a result of the proposed development.

The magnitude of any concentration change identified must be considered in relation to the Air Quality Assessment Level (AQAL), which may be an air quality objective, EU limit value or target value or an Environment Agency (EA) Environmental Assessment Level (EAL). For this report, the relevant AQALs have been presented in Table 1. The most important aspects to consider are the percentage of long term average concentrations at the individual receptor in the assessment year in relation to the AQAL and the percentage of change in concentration in relation to the AQAL.

EPUK recognises that professional judgement is required in the interpretation of air quality assessment significance. Table 7is intended as a tool to help interpret the results to the air quality assessment and will therefore be employed in conjunction with professional judgement. The approach is set out for annual mean concentrations but the descriptors below have been applied to both long and short term NO_2 concentrations/air quality objectives.

Table 7: Effect descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76%-94% of AQAL	Negligible	Slight	Moderate	Moderate
95%-102% of AQAL	Slight	Moderate	Moderate	Substantial
103%-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Notes: [(a)] AQAL = Air Quality Assessment Level i.e. 40µg/m^3 for annual mean NO_2 and 200µg/m^3 for hourly mean NO_2.
[(b)] Percentage pollutant concentrations are intended to be rounded to whole numbers. For example, the '<1%' category in this table includes all changes from 0.5% to 1.4% (equivalent to an annual mean NO_2 absolute concentration change of between 0.2µg/m^3 and 0.6µg/m^3). Changes of 0% (i.e. less than 0.5%) are described as negligible.

[33] Institute of Air Quality Management & Environmental Protection UK (2017). 'Land-use planning & development control: planning for air quality'.

(c) When defining the concentration as a percentage of the AQAL, use the ambient concentrations (AC) where there is a decrease in pollutant concentration and the 'with project' concentration for an increase.

3.4 Consultation

Consultation was undertaken with the Technical Officer for Pollution Control within the Public Health Directorate at BMBC in October/November 2019 via email regarding the methodology for the assessment (see Appendix B). This included a discussion of the receptors to include in modelling and the total hours of operation assumed when modelling the engines. The conclusion of this discussion was that the methodology proposed was acceptable.

4 Baseline conditions

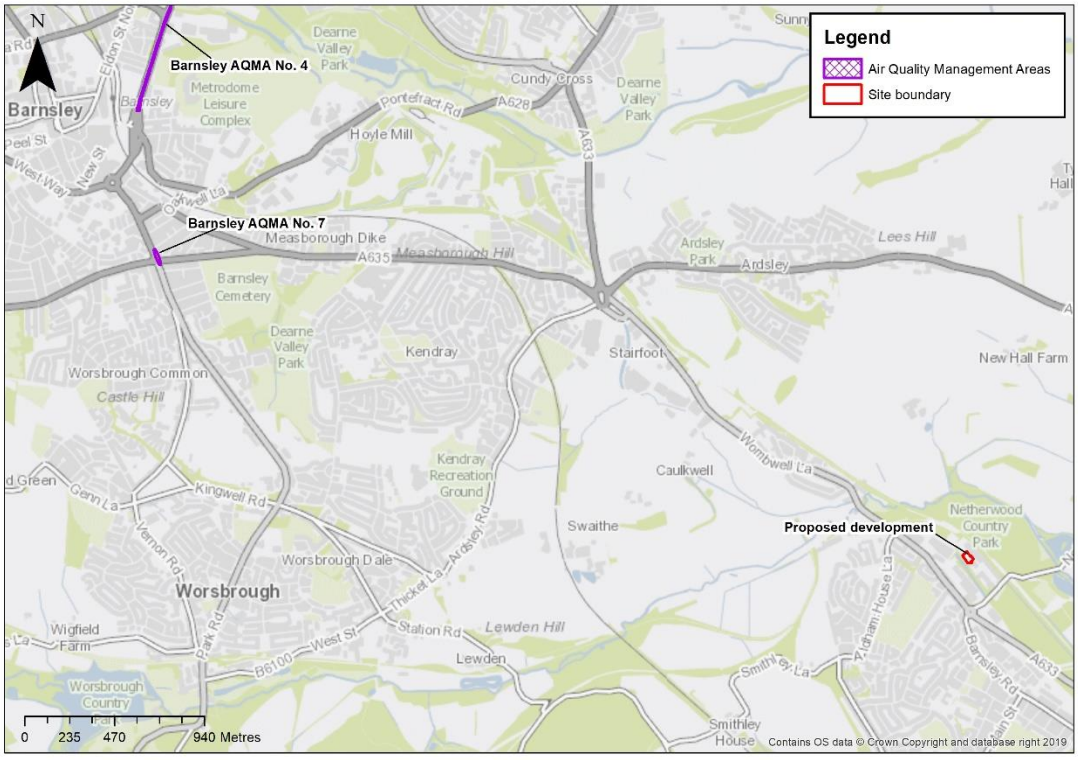
4.1 Overview

Information on air quality within the UK can be obtained from a variety of sources including local authorities, national network monitoring sites and other published sources. The primary sources of data examined in this assessment are from BMBC[34] and Defra[35]. The most recent full year of monitoring data available is for 2018.

4.2 Local Authority Review and Assessment

Six AQMAs have been declared by BMBC for exceedances of the annual NO_2 objective, all of which are designated due to emissions from road traffic. The nearest AQMA to the proposed development (Barnsley AQMA No.7) is located approximately 4.5km north west. This AQMA was declared in August 2012 for exceedances of the annual mean NO_2 objective and covers the southbound carriageway of the A61 Sheffield Road, adjacent to the A6133 Cemetery Road Junction. The remaining AQMAs in Barnsley have also all been declared for exceedances of the annual mean NO_2 objective. The locations of nearby AQMAs is presented in Figure 6 below.

Figure 6: Nearby AQMA locations



[34] Barnsley Metropolitan Borough Council, 2019. 2019 Air Quality Annual Status Report.

[35] Department for Environment, Food and Rural Affairs (2019), Monitoring networks. Available at: https://uk-air.defra.gov.uk/networks

4.2.1 Local Authority monitoring

4.2.1.1 Automatic monitoring

BMBC undertakes air quality monitoring of NO_2 at three automatic monitoring stations. The closest representative automatic site is the Barnsley Gawber site, which is an urban background site approximately 7.4km north west of the proposed development. This is also a Defra Automatic Urban Rural Network (AURN) monitoring station. The concentrations monitored at this site between 2016 and 2018 are presented below in Table 8 and indicates compliance with the annual and hourly air quality objectives.

Table 8: Automatic monitoring results

Site Name	Site Type	Distance to site (km)	National Grid Reference (X,Y)	NO_2 concentration (µg/m^3)					
				Annual mean			Hours greater than the 1-hour NO_2 objective [(a)]		
				2016	2017	2018	2016	2017	2018
Barnsley Gawber	Urban background	7.4	432525, 407475	**19**	16	16	2	4	0

Source: Defra UK-air website
Note: Date capture >99%
(a) 200 µg/m3, 18 hours allowed

4.2.1.2 Diffusion tube monitoring

BMBC undertakes diffusion tube monitoring at 55 locations across the borough. The majority of these monitoring sites are located at kerbside or roadside location adjacent to busy A roads or motorways and therefore are not considered representative of the proposed development (which is approximately 150m away from the nearest A road). The closest diffusion tube site (DT46) is a roadside monitoring site 2km north west of the proposed development. Monitored concentrations between 2016 and 2018 for this site are presented in Table 9.

The concentrations monitored at this site indicate some recent exceedances of the annual NO_2 objective. However, this is due to the close proximity of this diffusion tube to the road (less than 1m). When concentrations are corrected for distance to represent relevant exposure, such as the façades of peoples' houses, concentrations at this site are below the objective.

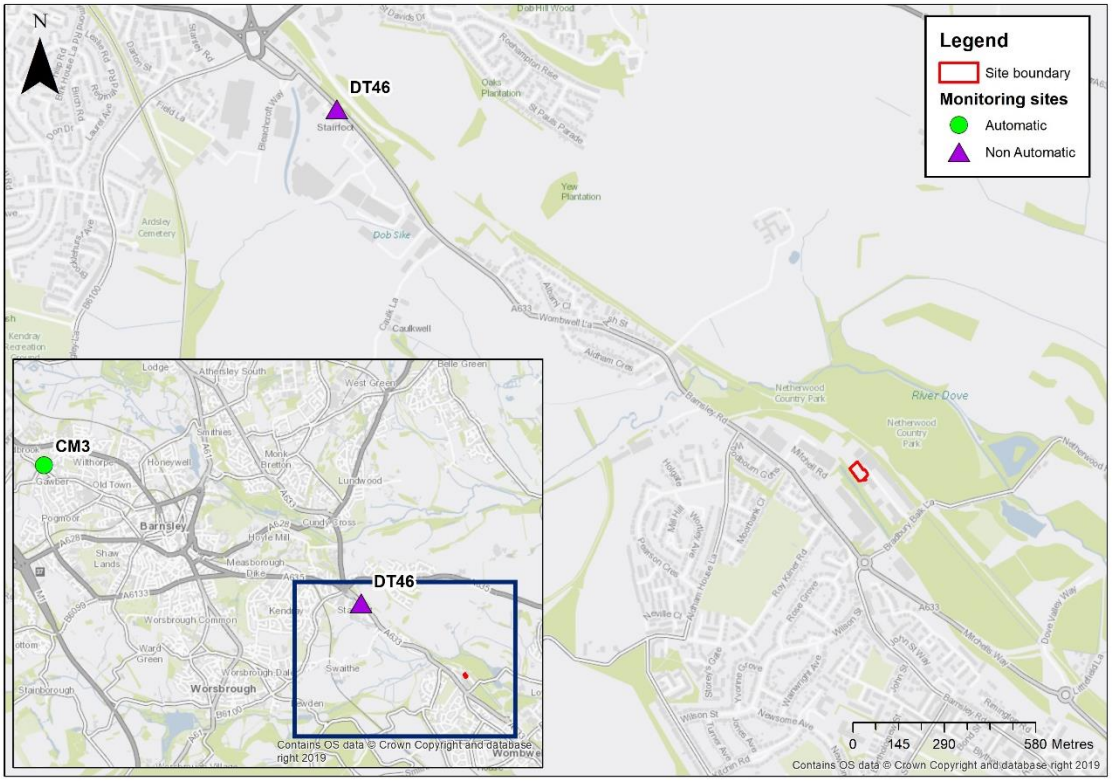
Figure 7 present the location of the automatic and diffusion tube monitoring sites in relation to the proposed development.

Table 9: BMBC diffusion tube monitoring results

Site Name	Site ID	Site Classification	National Grid Reference		Annual mean NO_2 concentration µg/m^3 *		
			X	Y	2016	2017	2018
Near to supermarket site, Wombwell Lane	46	Kerbside	437554	405291	46.7 (36.6)	48.1 (36.4)	38.4 (30.2)

Source: BMBC 2019, 2018, 2017
Note: Data capture was >92% in all years. Bias adjustment factors are: 2016=0.94, 2017 = 1.03, 2018=0.95.
* Value in brackets () represents the distance corrected concentration

Figure 7: Nearby monitoring locations



Due to the close proximity of monitoring site 46 to the proposed development and because it is located on the same road (A633) as receptors 1 to 5, the 2018 distance corrected concentration at this monitoring site has been used to represent the worst-case long-term AC at modelled receptors 1 to 5 (see Section 3.3.2.9 for details).

4.2.2 Defra projected background concentrations

Defra provides estimates of background pollution concentrations for NO_X and NO_2 across the UK for each one kilometre grid square for every year from 2017 to 2030. Future year projections have been developed from the base year of the background maps, which is currently 2017. The maps include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2017 UK monitoring data.

The background concentrations for the 1km grid square containing the proposed development for the opening year of 2020 are presented in Table 10. The data shows background concentrations are below the relevant objectives.

Table 10: Defra projected background concentrations for proposed development in 2020 (µg/m^3)

1km Grid Square Location (OS Grid Reference)	NO_x	NO_2
423500, 322500	13.3	9.9

Source: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017

For this assessment, Defra background concentrations have been used to represent the long-term ambient concentrations at gridded and some discrete human health receptors (see Section 3.3.2.9 for details). The concentrations used correspond to the background concentrations for the grid square the receptor is located within.

5 Potential impacts

5.1 Overview

This section provides details of the likely impacts predicted to occur as a result of the proposed development from the construction phase (construction dust) and the operation phase (combustion plant emissions).

5.2 Construction phase

The magnitude and sensitivity descriptors that have been applied to assess the overall effect of the construction phase are presented in Appendix A. Table 11 presents a summary of the dust emission magnitude assigned to each construction activity based on these descriptors.

Table 11: Dust emission magnitude

Activity	Dust emission magnitude	Justification
Demolition	N/A	No demolition is associated with the proposed development
Earthworks	N/A	No earthworks are associated with the proposed development
Construction	Small	Total building volume will be less than 25,000m^3 (concrete bases for equipment and approximately 90m^3 for one switchroom building). No sand blasting, crushing or concrete batching. Construction duration is estimated to be up to six months.
Trackout	Small	Less than 10 outward HDV movements per day for up to three months. Roads used by vehicles will be paved.

Table 12 presents the sensitivity of the area to effects caused by construction activities and is based on the criteria presented in Table 19 to Table 21 within Appendix A. Figure 8 and Figure 9 presents the dust assessment buffers.

There are no ecological designated sites within 50m of the site entrance or the routes used by construction vehicles on the public highway up to 500m from the site entrance. The nearest dust-sensitive ecological designation is the Worsborough Country Park LNR, which is located 3km west of the proposed development. Therefore, the impact of construction dust on ecological receptors has not been considered as the receptors are outside the applicable screening distances.

Table 12: Area sensitivity

Activity	Dust soiling		Health effects of PM_{10}	
	Sensitivity	Comment	Sensitivity	Comment
Demolition	N/A	The closest high sensitivity receptor (residential dwelling) is between 100-350m from the proposed development site boundary.	N/A	Background annual PM_{10} concentration at proposed development site in 2019 is 10.3µg/m^3. The closest high sensitivity receptor (residential dwelling) is between 100-350m from the proposed development site boundary.
Earthworks	N/A		N/A	
Construction	Low		Low	
Trackout	Low	There are 1-10 low sensitivity receptors located within 20m of the trackout route up to 50m from the site entrance.	Low	Background annual PM_{10} concentration at proposed development site in 2019 is 10.3µg/m^3. There are 1-10 low sensitivity receptors located within 20m of the trackout route up to 50m from the site entrance.

The overall risk of receptors to dust soiling effects and PM_{10} effects are presented in Table 13. Risk is based on the criteria presented in Table 22 to Table 25 within Appendix A.

Table 13: Summary of the risk of construction effects

Activity	Dust soiling effects	PM_{10} effects
Demolition	N/A	N/A
Earthworks	N/A	N/A
Construction	Negligible	Negligible
Trackout	Negligible	Negligible

Dust soiling effects and PM_{10} effects are defined as having a 'Negligible' risk without mitigation. Mitigation measures appropriate for the proposed development have been presented in Section 6. These measures should be incorporated within the Construction Environmental Management Plan (CEMP) to further reduce the risk.

Figure 8: Construction dust assessment buffers (construction only)

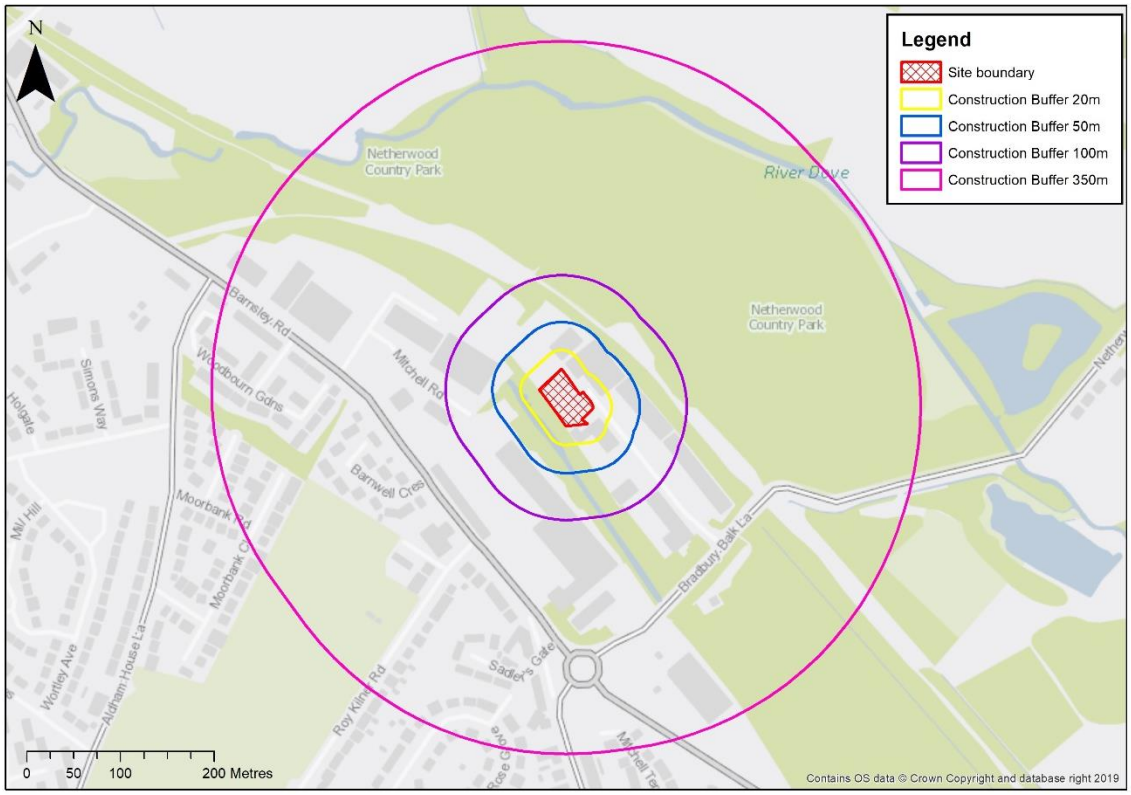
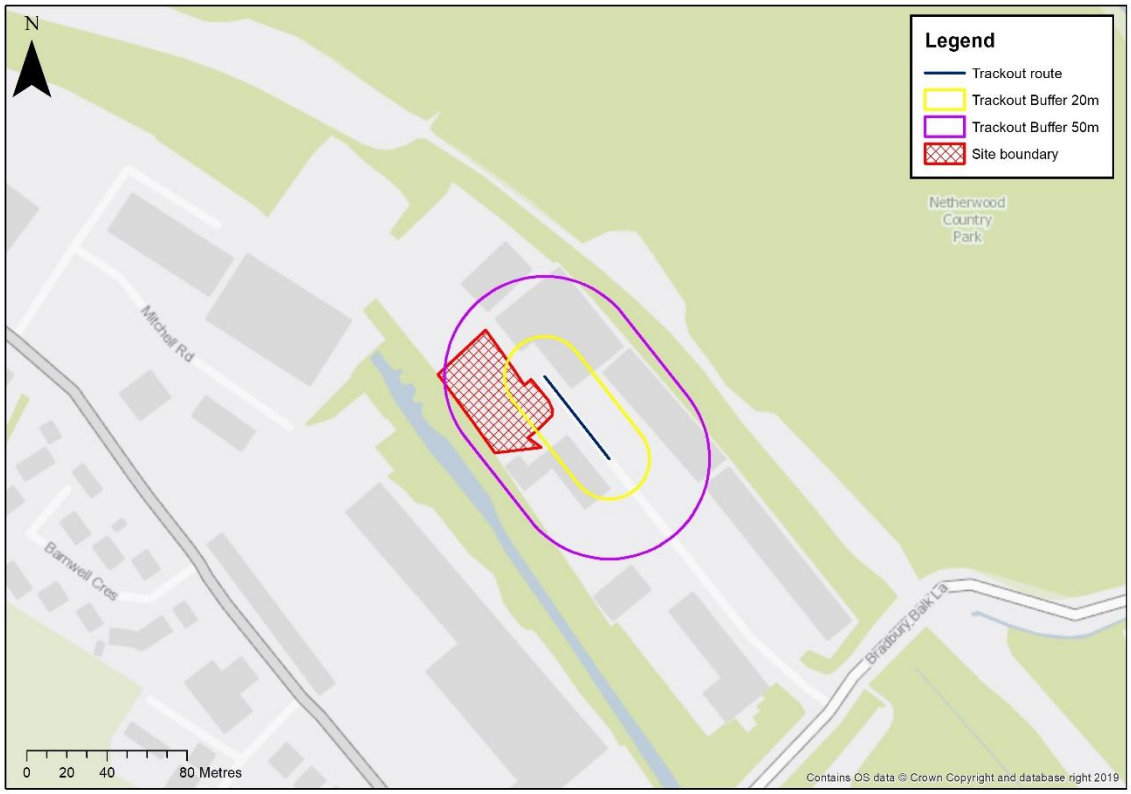


Figure 9: Construction dust assessment buffers (trackout)



5.3 Operation phase – dispersion modelling

The results from the atmospheric dispersion modelling undertaken are presented below. The hourly PCs and PECs presented below are highly conservative as they assume continuous operation of the proposed development. However, the proposed development could operate for up to 6,188 hours a year (and in reality it is expected to operate for less than this). The annual NO_2 concentrations have therefore been scaled down based on these proposed maximum hours of operation but the same has not be done for hourly NO_2 concentrations to allow consideration of impacts associated with the worst-case meteorological conditions.

The results from the sensitivity test on the effect of the acoustic fence on atmospheric dispersion is presented in Appendix C.

5.3.1 Gridded receptors

The maximum annual and hourly (99.79th percentile) NO_2 pollutant concentrations predicted at offsite locations across the modelled grid are presented in Table 14. The modelled annual and hourly NO_2 PCs are predicted to be greater than 10% of the AQALs. In accordance with IAQM/EPUK guidance[36], the maximum impacts are described as "moderate" as the PECs are below the respective air quality objectives (75% or less of the AQAL for the annual average, 76-94% of the AQAL for the hourly average).

Contour plots have been produced to determine the geographic extent over which air quality impacts occur to help assess significance.

Table 14: Maximum offsite NO_2 predicted environmental concentrations (PECs) (µg/m^3) – Gridded receptors

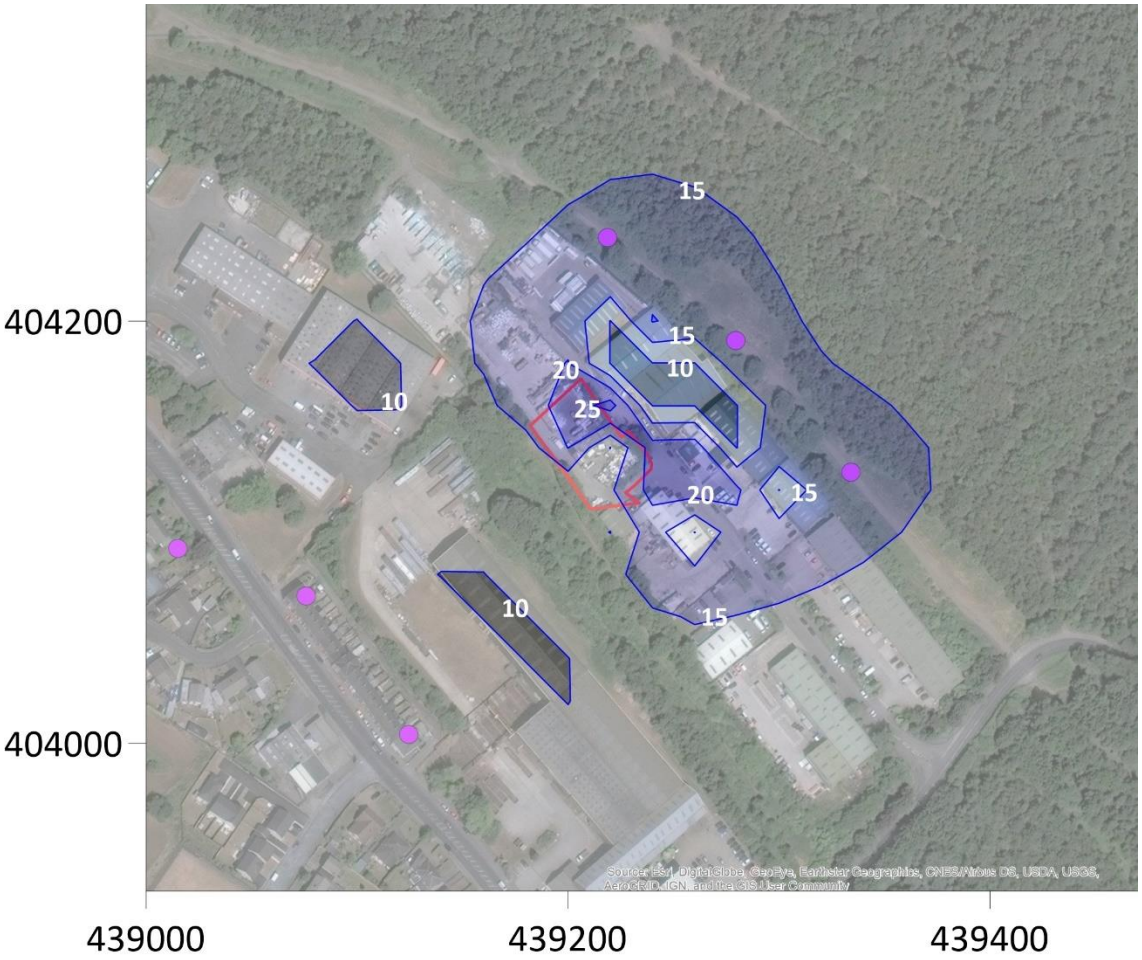
Averaging period	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact descriptor
99.79 %'ile of hourly averages	168.8	84.4	19.8	188.6	94.3	200	Moderate
Annual average	17.3	43.4	9.9	27.3	68.1	40	Moderate

Notes: AC= Ambient Concentration (Defra background concentration) PC = Process Contribution
PEC = Predicted Environmental Concentration (AC+PC=PEC)
AQAL = Air quality assessment level, equivalent to the ambient air quality objectives

Figure 10 and Figure 11 present contour plots of the annual and hourly NO_2 PECs in the worst-case meteorological years. These contours demonstrate that the air quality impacts from the proposed development are highly localised close to the perimeter of the proposed development. The maximum PECs are found onsite or to the north/east of the proposed development, within the car park for a neighbouring warehouse or on industrial land with no public access. At these locations of maximum impact, there would be no relevant public exposure and therefore the air quality objectives would not be applicable (see Table 2). Within the Netherwood Country Park (the closest area of relevant exposure for the hourly NO_2 objective), the contours demonstrate a maximum hourly PEC of between 80-120µg/m^3.

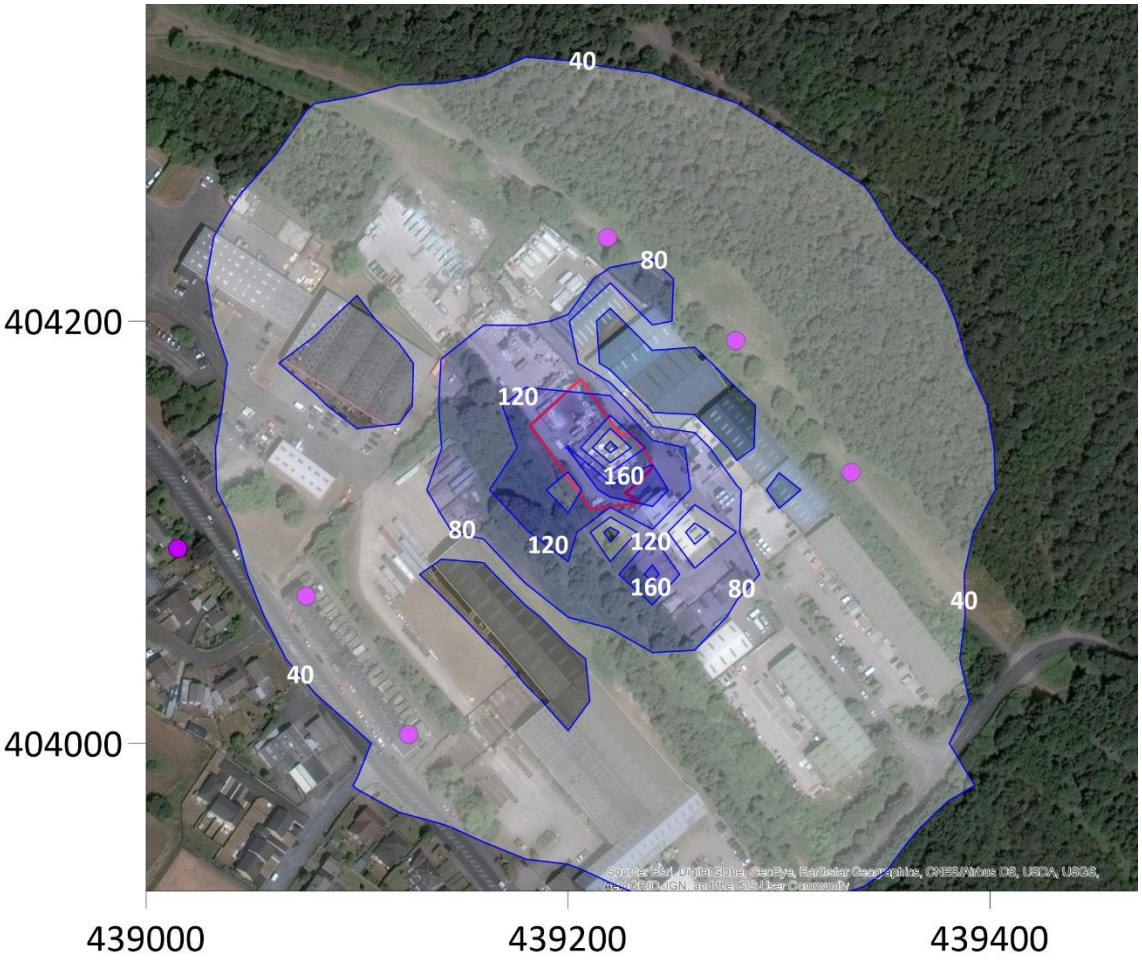
[36] Environmental Protection UK and Institute of Air Quality Management (January 2017), 'Land-Use Planning and Development Control: Planning for Air Quality' version 1.2

Figure 10: Annual NO_2 Predicted Environmental Concentration (PEC) (µg/m^3) – Project only



Notes: Results presented for the worst case meteorological year of 2017. Contour interval = 5µg/m^3. Minimum contour= 10µg/m^3, maximum contour = 25µg/m^3. Proposed development outlined in red. Defra background concentrations have been assumed for all gridded receptors.

Figure 11: Hourly (99.79th percentile) NO_2 Predicted Environmental Concentration (PEC) (µg/m³)



Notes: Results presented for the worst case meteorological year of 2017. Contour interval = 40µg/m³. Minimum contour= 40µg/m³, maximum contour = 160µg/m³. Proposed development outlined in red. Defra background concentrations have been assumed for all gridded receptors.

The impact of the proposed development at gridded receptors is therefore concluded to be not significant as no exceedances of the air quality objectives are predicted. The maximum modelled concentrations also cover a relatively small area where there is no relevant public exposure.

As the maximum PCs are found very close to the proposed development site boundary, the emissions to air from the proposed development are expected to have de minimis impact on the nearest AQMA (which is approximately 4.5km to the north west).

5.3.2 Discrete receptors

The hourly (99.79th percentile) and annual PCs and PECs at the discrete human health receptors are summarised in Table 15 and Table 16.

The greatest increase in hourly mean NO_2 pollutant concentrations is predicted at Receptor 7 (Netherwood Country Park), where the increase in concentrations is described as “moderate”. The other modelled receptors within the Netherwood Country Park area experience a “moderate” impact, as well as two residential receptors (receptors 1 and 2). The remaining

modelled receptors experience a “slight” or “negligible” impact, which is not considered significant in accordance with IAQM/EPUK guidance[37].

The impact on hourly NO_2 concentrations will likely be lower as the assessment has assumed continuous operation to coincide with the worst-case meteorological conditions and the plant will only operate a maximum of 6,188 hours per year which is highly unlikely.

However, even when assuming continuous operation with the worst-case meteorological conditions, no exceedances of the hourly (99.79th percentile) air quality objective is predicted.

The impact of the proposed development on annual NO_2 concentrations at all discrete receptors is described as “slight” or “negligible” and therefore is also considered not significant. No exceedances of the annual air quality objectives are predicted at discrete receptors as a result of the proposed development.

While there are “moderate” increases in hourly NO_2 concentrations at some discrete receptors when assuming continuous operation, there are no exceedance of the annual or hourly air quality objectives. The impact of the proposed development on discrete receptors is therefore considered to be not significant.

Table 15: Hourly mean NO_2 predicted pollutant concentrations (µg/m^3)

Receptor	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact
1	24.3	12.1	60.4	84.7	42.3	200	Moderate
2	22.9	11.4	60.4	83.3	41.6	200	Moderate
3	16.4	8.2	60.4	76.8	38.4	200	Slight
4	13.3	6.6	60.4	73.7	36.8	200	Slight
5	12.6	6.3	60.4	73.0	36.5	200	Slight
6	6.1	3.1	19.8	25.9	13.0	200	Negligible
7	47.6	23.8	19.8	67.4	33.7	200	Moderate
8	45.3	22.6	19.8	65.1	32.5	200	Moderate
9	35.8	17.9	19.8	55.6	27.8	200	Moderate
10	14.3	7.1	22.6	36.9	18.5	200	Slight

Notes: AC= Ambient Concentration (2018 distance corrected concentration for DT46 (2xlong-term concentration as short-term) used for receptors 1-5, Defra background concentrations used for receptors 6-10); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); AQAL = Air quality assessment level, equivalent to the ambient air quality objectives

[37] Environmental Protection UK and Institute of Air Quality Management (January 2017), ‘Land-Use Planning and Development Control: Planning for Air Quality’ version 1.2

Table 16: Annual mean NO_2 predicted pollutant concentrations (µg/m³)

Receptor	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact
1	1.5	3.6	30.2	31.7	79.1	40	Slight
2	1.5	3.7	30.2	31.7	79.2	40	Slight
3	1.0	2.4	30.2	31.2	77.9	40	Slight
4	0.7	1.6	30.2	30.9	77.1	40	Slight
5	0.9	2.3	30.2	31.1	77.8	40	Slight
6	0.9	2.4	9.9	10.8	27.1	40	Negligible
7[(a)]	-	-	-	-	-	-	-
8[(a)]	-	-	-	-	-	-	-
9[(a)]	-	-	-	-	-	-	-
10[(a)]	-	-	-	-	-	-	-

Notes: AC= Ambient Concentration (2018 distance corrected concentration for DT46 used for receptors 1-5, Defra background concentrations used for receptor 6); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); AQAL = Air quality assessment level, equivalent to the ambient air quality objectives

[(a)] Annual objective would not apply at these locations and therefore have not been presented

6 Mitigation

6.1 Overview

This section presents the proposed mitigation to reduce the potential impacts associated with the construction and operation phases.

6.2 Construction phase

The construction activities are predicted to have a 'negligible' risk in terms of dust soiling and PM_{10} effects with no mitigation in place. Possible best practice mitigation measures for the proposed development as outlined in guidance from the IAQM are presented below.

6.2.1 General

- Display the name and contact details of person(s) accountable for air quality and dust issues on the application site boundary
- Display head or regional office contact information
- Record all dust and air quality complaints, identify causes and take appropriate action and record measures to reduce emissions. Make complaints log available to the Local Authority when asked
- Undertake daily on-site and off-site inspection where receptors are nearby to monitor dust
- Carry out regular site inspections, record inspection results, and make an inspection log available to the local authority when asked
- Record any exceptional incidents that cause dust and or air emissions, either on or off site and the actions taken to resolve in the log book
- Increase the frequency of site inspections by the person accountable for air quality and dust issue on site when activities with a potential to produce dust are being carried out during dry or windy conditions
- Plan site layout so that machinery and dust causing activities are away from receptors, as far as is possible
- Erect solid screens or barriers around dusty activities or the application site boundary that are at least as high as any stockpiles on site. Keep clean using wet methods
- Avoid site run-off of water or mud. A record of any site run off should be kept and actions to prevent reoccurrence
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques
- Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate
- Use enclosed chutes and conveyors and covered skips
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment where appropriate
- Ensure equipment is readily available on site to clean any dry spillages
- No burning of waste
- Ensure all vehicles switch off engines when stationary - no idling vehicles

- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable

6.2.2 Trackout

- Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport

6.3 Operation phase

As the proposed development is not anticipated to result in a significant impact on air quality, no additional mitigation is required. However, MPR will apply for a Medium Combustion Plant/Specified Generator Permit from the Environment Agency prior to operation which requires that the proposed development be operated in such a way that would limit the air quality risk to the surrounding environment. For example, the proposed development will be required to have an Environmental Management System in place, will be restricted on the total hours of operation and stack emission testing will need to be undertaken to confirm compliance with the applicable emission limits.

7 Summary

This report provides an assessment of the following key impacts associated with the proposed development:

- Construction phase: nuisance, loss of amenity and health impacts caused by construction dust on sensitive receptors
- Operation phase: impacts from combustion plant emissions from the operation of the proposed development.

A qualitative assessment of construction dust effects has been undertaken for the proposed development. There is predicted to be a 'negligible' risk of dust creating nuisance and/or loss of amenity and of PM_{10} leading to adverse health effects (without mitigation), which is predicted not to be significant. However, mitigation measures have been recommended to minimise the impact associated with construction dust.

Modelled results of the operation phase show that changes in NO_2 concentrations at some sensitive receptors will be "moderate" in accordance with the EPUK/IAQM guidance adopted for this assessment. However, the proposed development is not expected to result in exceedances of the ambient air quality objectives and the maximum impacts occur in area where there is little or no relevant exposure. Therefore, the impact of the proposed development on air quality is considered to be 'not significant'.

The proposed development is not considered to conflict with any national, regional or local planning policy within BMBC.

Appendices

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A. Construction dust

Table 17: Determination of Dust Raising Magnitude

Source	Large	Medium	Small
Demolition	Total building volume > 50,000m3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities > 20m above ground	Total building volume 20,000m3 - 50,000m3, potentially dusty construction material, demolition activities 10-20m above ground level	Total building volume <20,000m3, construction material with low potential for dust release (e.g .metal cladding or timber), demolition activities <10m above ground, demolition during wetter months
Earthworks	Total site area >10,000m2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes	Total site area 2,500m2 – 10,000m2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonne – 100,000 tonne	Total site area <2,500m2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000tonne, earthworks during wetter months
Construction	Total building volume >100,000m3, piling, on site concrete batching; sandblasting	Total building volume 25,000m3 – 100,000m3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000m3, construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m	25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m	<25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m

Source: IAQM

Table 18: Receptor Sensitivity

Source	High	Medium	Low
Sensitivities of people to dust soiling effects	Users can reasonably expect an enjoyment of a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks (See	Users would expect a to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative examples include parks and places of work.	The enjoyment of amenity would not reasonably be expected (See note A); or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or Property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples include playing fields,

Source	High	Medium	Low
	note B) and car showrooms.		farmland (unless commercially-sensitive horticultural), footpaths, short term car parks (See note B) and roads.
Sensitivities of people to the health effects of PM10	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day - See note C) Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	Locations where the people exposed are workers (See note D), and exposure is over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM10, as protection is covered by Health and Safety at Work legislation.	Locations where human exposure is transient (See note E) Indicative examples include public footpaths, playing fields, parks and shopping streets.
Sensitivities of receptors to ecological effects (See note F)	Locations with an international or national designation and the designated features may be affected by dust soiling; or Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain (See note G). Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. • Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features.

A The public's expectations will vary depending on the existing dust deposition in the area

B Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

C This follows Defra guidance as set out in LAQM.TG(16).

D Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM_{10}. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

E There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health effects, albeit less certain.

F A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

G Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.

Table 19: Sensitivity of the area to dust soiling effects on people and property

Receptor Sensitivity	Number of Receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 20: Sensitivity of the area to human health effects

Receptor Sensitivity	Annual Mean PM10 Concentration	Number of Receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24µg/m3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 21: Sensitivity of the area to ecological effects

Receptor Sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 22: Risk of Dust Effects - Demolition

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Low Risk

Table 23: Risk of Dust Effects - Earthworks

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 24: Risk of Dust Effects - Construction

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 25: Risk of Dust Effects – Trackout

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

B. Consultation with BMBC

C. Sensitivity test – acoustic fence

A sensitivity test has been undertaken to determine the effect that a 5m high acoustic fence surrounding the engines could have on atmospheric dispersion and the concentrations modelled at receptors. The approach and results for this sensitivity test are presented below.

C.1 Method

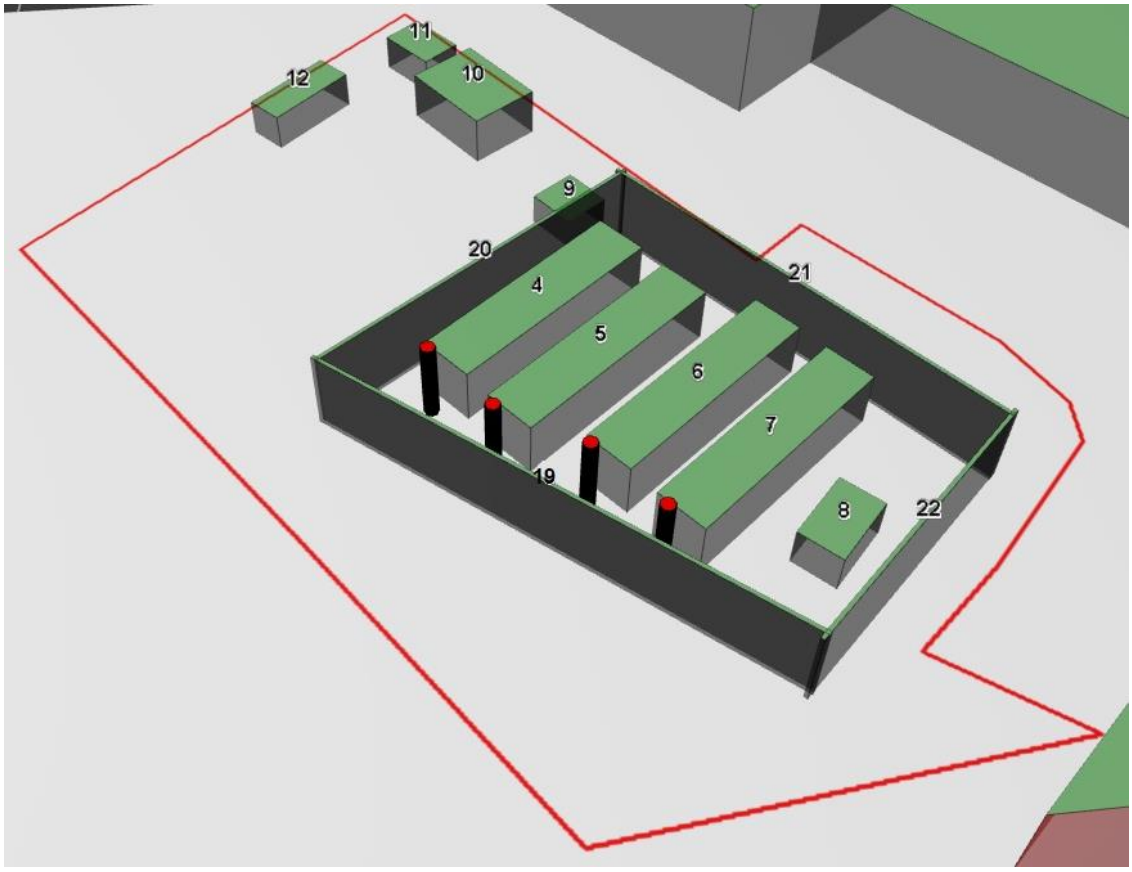
The same model, receptors and method as described in Section 3.3.2 have been used for this sensitivity test. The only change to the methodology is that four buildings have been added to the model to simulate the presence of an acoustic fence. This method to model acoustic fences is recommended by CERC.

The dimensions of the acoustic fence "buildings" are presented below in Table 26. For this sensitivity test, it has been assumed that the width of the fence will be 0.2 metres.

Table 26: Acoustic dimensions used within the assessment

Number	Name	X (m)	Y (m)	Height (m)	Length (m)	Width (m)	Angle (°)
19	Acoustic 1	439211	404126	5	28.5	0.2	130
20	Acoustic 2	439209	404142	5	22.0	0.2	54
21	Acoustic 3	439225	404138	5	0.2	26.0	51
22	Acoustic 4	439227	404123	5	0.2	17.0	138

Figure 12: Acoustic fence layout



Note: Proposed development boundary outlined in red. Description of building numbers below 20 are presented in section 3.3.2.2

C.2 Results

The results from the sensitivity test are presented below. As within the main assessment, the annual NO_2 concentrations have been scaled down based on the proposed maximum hours of operation (6188/8760). The same approach has not been applied for hourly NO_2 concentrations to allow consideration of impacts associated with the worst-case meteorological conditions. Therefore, the hourly PCs and PECs presented below are highly conservative as they assume continuous operation of the proposed development all year round.

C.2.1 Gridded receptors

The maximum annual and hourly (99.79th percentile) NO_2 pollutant concentrations predicted at offsite locations across the modelled grid are presented in Table 14. The modelled annual and hourly NO_2 PCs are predicted to be greater than 10% of the AQALs. In accordance with IAQM/EPUK guidance[38], the maximum annual impact is described as “moderate” as the PEC is below the respective air quality objectives (75% or less of the annual AQAL). The maximum

[38] Environmental Protection UK and Institute of Air Quality Management (January 2017), ‘Land-Use Planning and Development Control: Planning for Air Quality’ version 1.2

hourly impact is described as “substantial” as the PEC is above the respective air quality objective (110% or more of the hourly AQAL).

Contour plots have therefore been produced to determine the geographic extent over which air quality impacts occur to help assess significance by understanding if there is relevant exposure where there are exceedances.

Table 27: Maximum offsite NO_2 predicted environmental concentrations (PECs) (µg/m³) – Gridded receptors

Averaging period	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact descriptor
99.79 %'ile of hourly averages	206.6	103.3	19.8	226.4	113.2	200	Substantial
Annual average	18.2	45.5	9.9	28.1	70.3	40	Moderate

Notes: AC= Ambient Concentration (Defra background concentration) PC = Process Contribution
PEC = Predicted Environmental Concentration (AC+PC=PEC)
AQAL = Air quality assessment level, equivalent to the ambient air quality objectives

Figure 10 and Figure 11 present contour plots of the annual and hourly NO_2 PECs in the worst-case meteorological years. These contours demonstrate that the air quality impacts from the proposed development are highly localised close to the perimeter of the site.

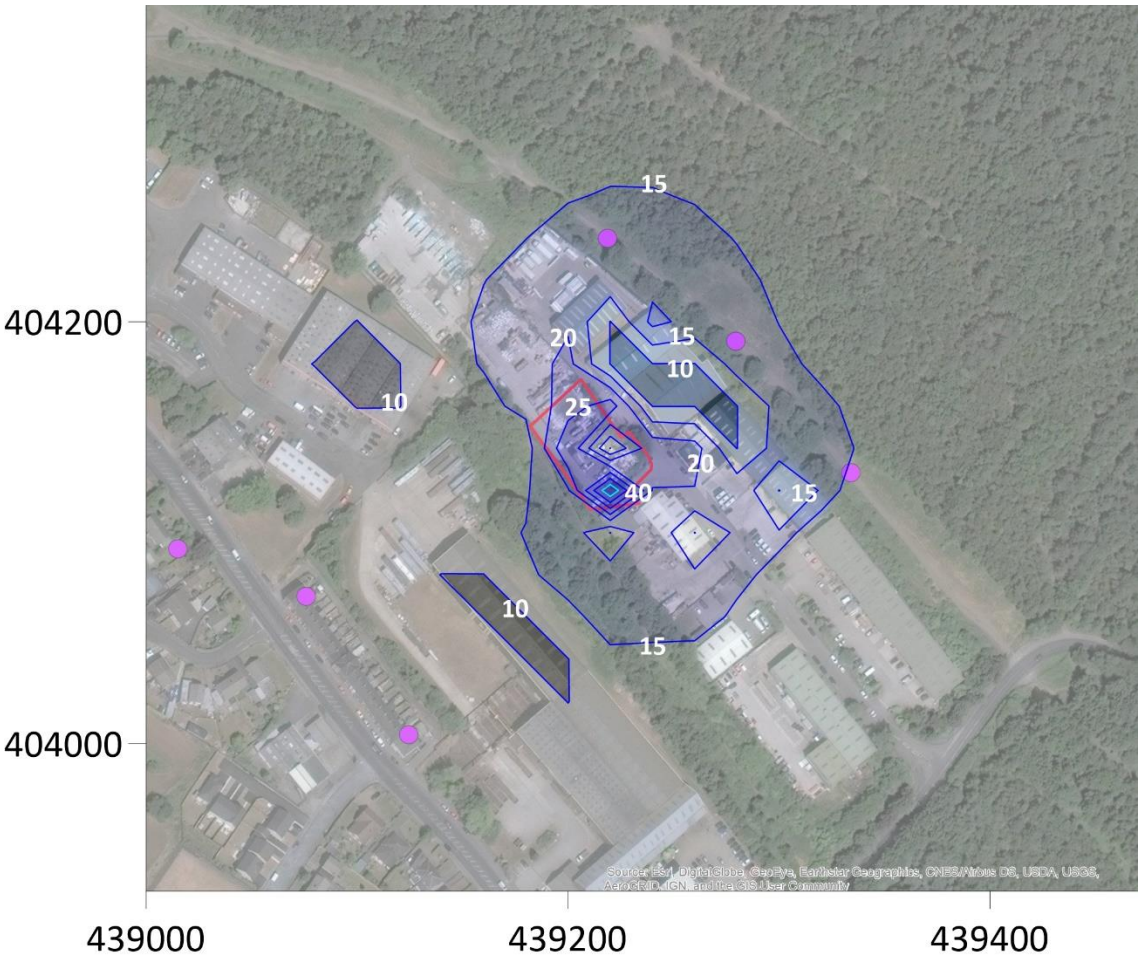
The maximum annual PECs are found onsite and on the north eastern boundary of the proposed development, within the car park for a neighbouring warehouse. At these locations of maximum impact, there would be no relevant public exposure and therefore the air quality objectives would not apply (see Table 2). The impact of the proposed development on annual NO_2 concentrations at gridded receptors is therefore concluded to be not significant as no exceedances of the air quality objectives are predicted and the maximum impacts occur in areas where there is no relevant public exposure.

The maximum hourly PCs are found to the south of the proposed development, within an area of woodland bordering the Mitchells Industrial Park. At this location, the highest PEC modelled is greater than 200µg/m^3, but only occurs at one gridded receptor. While the public would have access to this area as there is a public footpath nearby, although the predicted area of exceedance does not encroach onto the footpath. it is not expected that in the location where the PEC is greater than 200µg/m^3, a member of the public “might reasonably be expected to spend one hour or longer” (as per Defra TG16). This is because this area is not a park/general amenity area, but a cut-through from Bradbury Balk Lane to the Netherwood Country Park. Within the Netherwood Country Park (the closest area of relevant exposure for the hourly NO_2 objective), the contours demonstrate a maximum hourly PEC of between 80-120µg/m^3.

In the worst-case meteorological year, the number of hours where the maximum hourly PEC was greater than 200µg/m^3 is 21 hours. This is three hours more than the 18 hours allowed under the air quality objectives. Considering the conservative assumptions used in the assessment, such as continuous operation all year, and emissions used assume the maximum permissible concentrations emitted for all hours of operation, it is unlikely that there would be an exceedance. Therefore, considering there is no representative exposure at the worst point of impact and operational impacts will be much lower than predicted the impact at gridded receptors is considered to be insignificant with respect to hourly NO_2 concentrations.

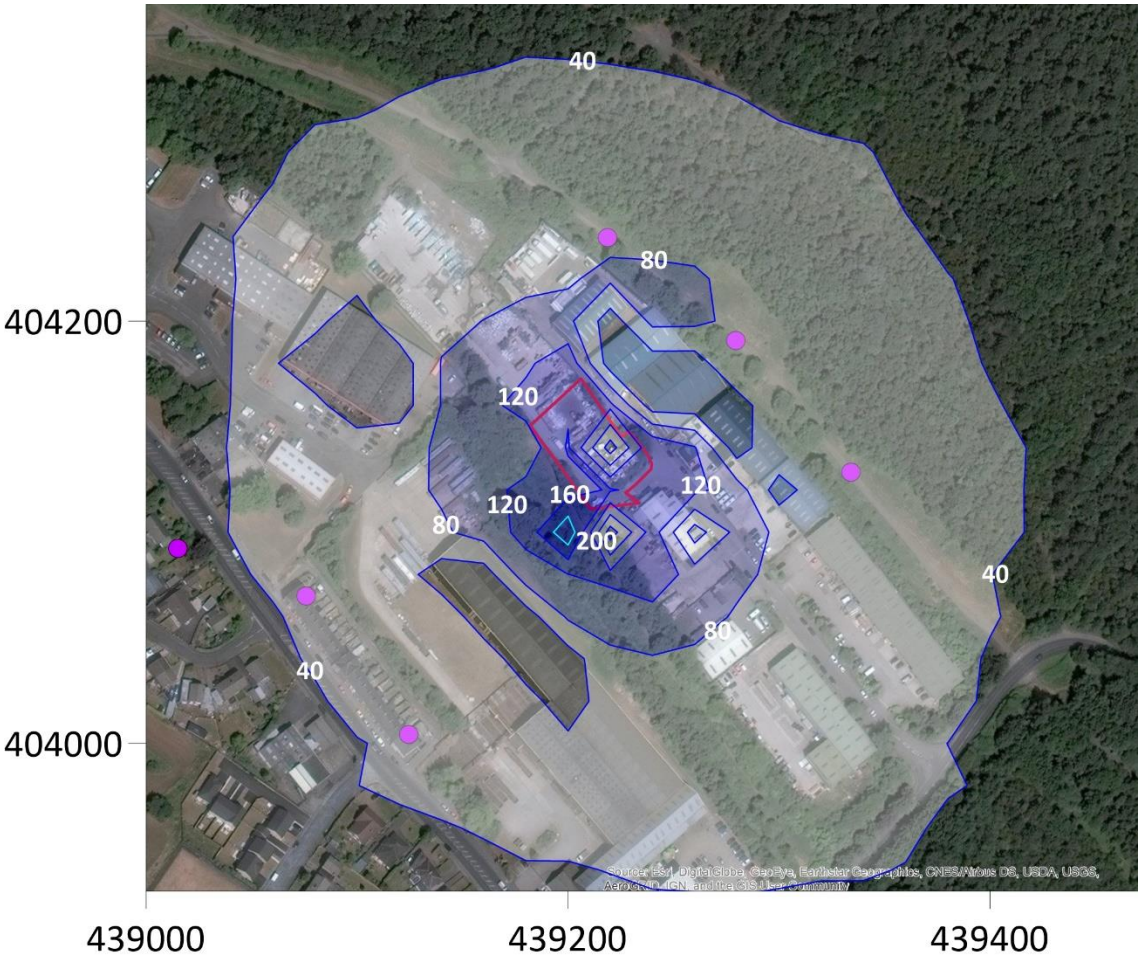
As the maximum PCs are found very close to the proposed development site boundary, the emissions to air from the proposed development are expected to have de minimis impact on the nearest AQMA (which is approximately 4.5km to the north west).

Figure 13: Annual NO_2 Predicted Environmental Concentration (PEC) (µg/m^3) – Project with acoustic fences



Notes: Results presented for the worst case meteorological year of 2018. Contour interval = 5µg/m^3. Minimum contour= 10µg/m^3, maximum contour = 40µg/m^3. Concentrations greater than 40µg/m^3 are shown in light blue. Proposed development outlined in red. Defra background concentrations have been assumed for all gridded receptors.

Figure 14: Hourly (99.79th percentile) NO_2 Predicted Environmental Concentration (PEC) (µg/m³)



Notes: Results presented for the worst case meteorological year of 2017. Contour interval = 40µg/m³. Minimum contour= 40µg/m³, maximum contour = 200µg/m³. Concentrations greater than 200µg/m³ are shown in light blue. Proposed development outlined in red. Defra background concentrations have been assumed for all gridded receptors.

C.2.2 Discrete receptors

The hourly (99.79th percentile) and annual PCs and PECs at the discrete human health receptors are summarised in Table 15 and Table 16.

The greatest increase in hourly mean NO_2 pollutant concentrations is predicted at Receptor 7 (Netherwood Country Park), where the increase in concentrations is described as “moderate”. The other modelled receptors within the Netherwood Country Park area also experience a “moderate” impact, as well as two residential receptors (receptors 1 and 2). The remaining modelled receptors experience a “slight” or “negligible” impact, which is not considered significant in accordance with IAQM/EPUK guidance[39].

However, even when assuming continuous operation with the worst-case meteorological conditions, no exceedances of the hourly (99.79th percentile) air quality objective is predicted at discrete receptors.

[39] Environmental Protection UK and Institute of Air Quality Management (January 2017), ‘Land-Use Planning and Development Control: Planning for Air Quality’ version 1.2

The impact of the proposed development on annual NO_2 concentrations at all discrete receptors is described as “slight” or “negligible” and therefore is also considered not significant. No exceedances of the annual air quality objectives are predicted at discrete receptors as a result of the proposed development.

While there are “moderate” increases in hourly NO_2 concentrations at some discrete receptors when assuming continuous operation, there are no exceedance of the annual or hourly air quality objectives. The impact of the proposed development on discrete receptors is therefore considered to be not significant.

Table 28: Hourly mean NO_2 predicted pollutant concentrations (µg/m³)

Receptor	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact
1	25.1	12.6	60.4	85.5	42.8	200	Moderate
2	23.2	11.6	60.4	83.6	41.8	200	Moderate
3	16.7	8.4	60.4	77.1	38.6	200	Slight
4	13.8	6.9	60.4	74.2	37.1	200	Slight
5	12.7	6.3	60.4	73.1	36.5	200	Slight
6	6.2	3.1	19.8	26.0	13.0	200	Negligible
7	55.6	27.8	19.8	75.4	37.7	200	Moderate
8	54.0	27.0	19.8	73.8	36.9	200	Moderate
9	40.5	20.3	19.8	60.3	30.2	200	Moderate
10	13.9	6.9	22.6	36.5	18.3	200	Slight

Notes: AC= Ambient Concentration (2018 distance corrected concentration for DT46 (2xlong-term concentration as short-term) used for receptors 1-5, Defra background concentrations used for receptors 6-10); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); AQAL = Air quality assessment level, equivalent to the ambient air quality objectives

Table 29: Annual mean NO_2 predicted pollutant concentrations (µg/m³)

Receptor	Max PC	Max PC as % of AQAL	AC	Max PEC	Max PEC as % of AQAL	AQAL	Impact
1	1.5	3.7	30.2	31.7	79.2	40	Slight
2	1.5	3.8	30.2	31.7	79.3	40	Slight
3	1.0	2.4	30.2	31.2	77.9	40	Slight
4	0.7	1.7	30.2	30.9	77.2	40	Slight
5	0.9	2.4	30.2	31.1	77.9	40	Slight
6	0.9	2.4	9.9	10.8	27.1	40	Negligible
7[(a)]	-	-	-	-	-	-	-
8[(a)]	-	-	-	-	-	-	-
9[(a)]	-	-	-	-	-	-	-
10[(a)]	-	-	-	-	-	-	-

Notes: AC= Ambient Concentration (2018 distance corrected concentration for DT46 used for receptors 1-5, Defra background concentrations used for receptor 6); PC = Process Contribution; PEC = Predicted Environmental Concentration (AC+PC=PEC); AQAL = Air quality assessment level, equivalent to the ambient air quality objectives
[(a)] Annual objective would not apply at these locations and therefore have not been presented

C.2.3 Summary sensitivity test findings

The findings from this sensitivity test are largely the same as within the main assessment. As demonstrated in Table 16, the inclusion of an acoustic fence results in de minimis increases in annual and hourly concentrations at discrete receptors compared to modelling without an acoustic fence.

While there is a greater increase in hourly concentrations at gridded receptors, resulting in a "substantial" impact at one gridded receptor, there is no relevant public exposure at this gridded receptor and therefore the impact is still considered to be 'not significant' and is based on a series of conservative assumptions that would not be fully realised during the operation of the proposed development.

Table 30: NO_2 predicted environment concentrations (PEC) modelled at discrete receptors with and without an acoustic fence (µg/m³)

	Hourly mean NO_2			Annual mean NO_2		
Receptor	Max PEC without acoustic fence	Max PEC with acoustic fence	% change	Max PEC without acoustic fence	Max PEC with acoustic fence	% change
1	84.7	85.5	1.0	31.7	31.7	0.1
2	83.3	83.6	0.4	31.7	31.7	0.1
3	76.8	77.1	0.4	31.2	31.2	0.1
4	73.7	74.2	0.8	30.9	30.9	<0.1
5	73.0	73.1	0.1	31.1	31.1	<0.1
6	25.9	26.0	0.2	10.8	10.8	<0.1
7[(a)]	67.4	75.4	11.9	-	-	-
8[(a)]	65.1	73.8	13.3	-	-	-
9[(a)]	55.6	60.3	8.4	-	-	-
10[(a)]	36.9	36.5	-1.1	-	-	-

Notes: [(a)] Annual objective would not apply at these locations and therefore have not been presented