Air Quality Assessment:
Houghton Main Energy Centre, Barnsley

November 2018

Experts in air quality management & assessment

Document Control

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed development of an energy recovery facility ("Energy Centre") using primarily Refuse Derived Fuel (RDF) as its feedstock at Houghton Main in Barnsley. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Enzygo Ltd.

1.2 The proposed Energy Centre will process up to a maximum of 260,000 tpa of RDF to generate electricity.

1.3 The proposed Energy Centre is located to the east of Barnsley within the Barnsley Metropolitan Borough boundary. The Council has declared a number of Air Quality Management Areas (AQMAs) due to concentrations of nitrogen dioxide exceeding the national air quality objective. All the AQMAs are in Barnsley town centre and the proposed Energy Centre is more than 5 km from the nearest AQMA.

1.4 During the construction phase, dust emissions have the potential to impact upon local receptors and this has been assessed. The main pollutants of concern related to construction activities are dust and PM_{10}. Emissions from on-site plant and vehicles have not been assessed, as experience suggests they are unlikely to have a significant impact (Moorcroft and Barrowcliffe et al, 2017).

1.5 During the operational phase, emissions to air from the main stack in the process building have been assessed. These emissions have potential air quality impacts in terms of human health and ecosystems.

1.6 In relation to human health, consideration has been given to a comprehensive range of pollutants that may be emitted. The list is taken from the Industrial Emissions Directive (IED), to which the Energy Centre will have to conform for environmental permitting purposes. The pollutants that have been assessed are:

- nitrogen oxides
- total dust (as PM_{10} and $PM_{2.5}$)
- carbon monoxide (CO)
- TOC;
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);

- trace metals; and
- dioxins and furans.

1.7 In addition to the assessment of impacts to human health, the potential air quality impacts on sensitive ecosystems have also been addressed. There are no European designated sensitive ecosystems (Special Protection Areas (SPAs), Special Areas of Conservation (SCAs) or Ramsar sites) within 10 km of the proposed Energy Centre; however, there is a nationally designated Site of Special Scientific Interest (SSSI), a local nature reserve (LNR) and a number of Local Wildlife Sites (LWS), Ancient Woodland (AW) and Restored Ancient Woodland (RAW) sites that have been identified within 2 km of the development, which have the potential to be affected by emissions from the proposed Energy Centre. In addition, the Council has advised that a new SSSI may be declared close to the proposed site boundary; at present, precise details, such as the location and boundary of the proposed SSSI, and the reasons for the designation, are unavailable. The Carlton Main Brickworks SSSI has been designated for its geological interest, and is therefore not sensitive to air pollution, however, the LWSs, AW and RAW may be sensitive to changes in pollutant concentrations brought about by the operation of the proposed Energy Centre. These sites are shown in Figure 1 and define the extent of the study area. The relevant pollutants with the potential to affect sensitive ecosystems are:

- nitrogen oxides (NOx);
- ammonia (NH3);
- sulphur dioxide (SO2);
- hydrogen fluoride (HF);
- nutrient nitrogen deposition (which is contributed to by NOx and NH3 emissions); and
- acid deposition (which is contributed to by NOx, NH3, SO2 and HCl emissions).

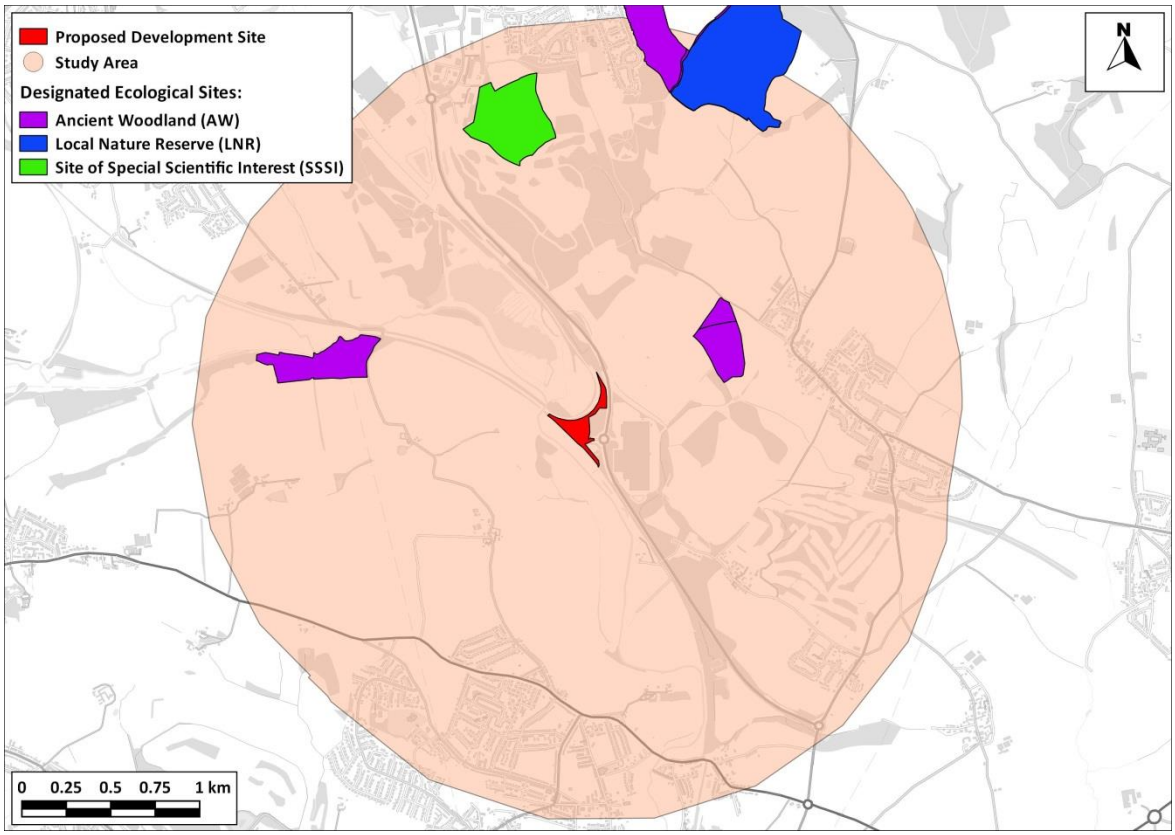

Figure 1: Study Area and Ecological Sites within 2 km of the Development Site.

1.8 The proposed development will increase the traffic flows on local roads, emissions from which may impact on air quality in the local area. These changes in traffic flows have, however, been screened out as *insignificant* using the criteria presented within the EPUK/IAQM guidance on planning for air quality (Moorcroft and Barrowcliffe et al, 2017).

1.9 This guidance states that air quality impacts of traffic related sources should be considered if:

- *"the development will lead to a change in Light Duty Vehicle flows of more than 100 Average Daily Traffic (AADT) within or adjacent to an AQMA or more than 500 AADT elsewhere;*
- *the development will lead to a change in Heavy Duty Flows (HDV) of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere."*

1.10 The Transport Strategy estimates that there will be 546 weekly HGV movements generated by the proposed development once operational. This is equivalent to an AADT (Annual Average Daily Traffic flow) of 78 movements per day. Since the site is not within or adjacent to any Air Quality Management Areas (AQMAs) the increase in HGV flows is below the threshold of 100 movements

per day, and a quantitative assessment is not required, and it is concluded that the road traffic impacts will be not significant. Although it is sometimes necessary to consider traffic emissions in combination with stack emissions, the proposed development will be accessed by the A6195 to the north and south, and both routes allow access to the nearest major roads (the A628 and A635) without passing near to any of the sensitive residential receptors identified in this assessment. It is therefore judged that road traffic emissions do not need to be considered further.

1.11 This report describes baseline local air quality conditions in 2017, and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.12 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with Barnsley Metropolitan Borough Council.

2 Policy Context and Assessment Criteria

European Legislation

European Framework Directive on Ambient Air Quality and Cleaner Air for Europe, May 2008

2.1 The European Union has set limit values (concentrations which must not be exceeded) for seven key air pollutants, nitrogen dioxide, particulates (as PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), benzene, carbon monoxide (CO), and lead (Pb). These limit values are set out in the EU Framework Directive (2008/50/EC, 2008). Achievement of these values is a national obligation and was required by 2010 for nitrogen dioxide and benzene, 2015 for $PM_{2.5}$, and 2005 for all other pollutants.

European Waste Framework Directive, November 2008

2.2 The Waste Framework Directive (2008/98/EC, 2008) sets out the EU member state obligations to the planning, operation and management of waste sites and processes. With respect to air quality, the Directive states:

"Member States shall take the necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment and, in particular:

a) without risk to water, air, soil, plants or animals;

b) without causing nuisance through noise or odours; and

c) without adversely affecting the countryside or places of special interest."

European Industrial Emissions Directive, December 2010

2.3 The Industrial Emissions Directive (IED) (2010/75/EU, 2010) brings together seven existing directives, including the Waste Incineration Directive, into one piece of legislation. The IED outlines total emission limit values (ELVs) for a number of pollutants typically emitted during the combustion of waste. These are nitrogen oxides and nitrogen dioxide, NO, total dust, HCl, HF, SO_2, organic substances, trace metals, and dioxins and furans.

European Policies to Protect Sensitive Ecosystems

2.4 European Council Directive 92/43/EEC (The Council of the European Communities, 1992) on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires member states to introduce a range of measures for the protection habitats and species. The Conservation of Habitats and Species Regulations (The Air Quality Standards Regulations 2010

(No. 1001), 2010), transposes the Directive into law in England and Wales. The Regulations require the Secretary of State to provide the European Commission with a list of sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs); with these classified under the Council Directive 79/409/EEC on the Conservation of Wild Birds (the "Birds Directive") (The European Parliament and the Council of the European Union, 2009). These sites form a network termed "Natura 2000".

2.5 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

2.6 In addition to SACs and SPAs, some internationally important UK sites are designated under the Ramsar Convention. Originally intended to protect waterfowl habitat, the Convention has broadened its scope to cover all aspects of wetland conservation.

2.7 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on the European site. Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the development will adversely affect the integrity of the site.

National Legislation

The Environmental Permitting Regulations in England and Wales, 2016

2.8 The Environmental Permitting Regulations (2016) set the legislative background for environmental permitting in England and Wales. The regulations include a commitment to minimising emissions to air from permitted processes, and include obligations of compliance with all legislated emissions limits for permitted processes, including the IED emission limits for processes involving the combustion of waste.

The Waste (England and Wales) Regulations 2011, March 2011

2.9 The Waste Framework Directive (2008/98/EC, 2008) and its obligations, including those on air quality, are transposed in English law by The Waste (England and Wales) Regulations (2011).

The UK Air Quality Strategy, 2007

2.10 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key

air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Air Quality (England) Regulations, 2000 and Air Quality (England) (Amendment) Regulations 2002

2.11 Some of the objectives set out in the UK Air Quality Strategy are for the use of local authorities as part of the LAQM regime, and these are set out in regulations (The Air Quality (England) Regulations 2000 Statutory Instrument 928, 2000) and (The Air Quality (England) (Amendment) Regulations 200, Statutory Instrument 3043, 2002).

Air Quality Standards Regulations, 2010

2.12 The air quality limit values set out in EU Directive (2008/50/EC, 2008) are transposed in English law by the Air Quality Standards Regulations (2010). This imposes duties on the Secretary of State relating to achieving the limit values.

Draft Clean Air Strategy 2018

2.13 Defra launched a consultation on a new Clean Air Strategy (Defra, 2018a) in May 2018. The draft strategy sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. Responses to the consultation will be used to inform the final UK Clean Air Strategy and detailed National Air Pollution Control Programme to be published by March 2019.

National Policies to Protect Ecosystems

2.14 Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act (1949), SSSIs have been re-notified under the Wildlife and Countryside Act (1981). Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way Act (2000) (the "CROW" act). If a development is "*likely to damage*" a SSSI, the CROW act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW act also provides protection to local nature conservation sites, which can be particularly

important in providing 'stepping stones' or 'buffers' to SSSIs and European sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

National Planning Policies

National Planning Policy Framework, 2018

2.15 The National Planning Policy Framework (NPPF) (2018) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which is an environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.16 To prevent unacceptable risks from air pollution, the NPPF states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality".

and

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".

2.17 More specifically on air quality, the NPPF makes clear that:

"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".

2.18 The NPPF is supported by Planning Practice Guidance (PPG) (DCLG, 2018), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*". The PPG makes clear that *"Air quality can also affect biodiversity and may therefore impact on our international obligation under the Habitats Directive".* In addition, the PPG makes clear that *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

2.19 The PPG states that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)".

2.20 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality"*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".*

Local Planning Policies

Barnsley Local Development Framework Core Strategy

2.21 Consultation on the Proposed Main Modifications to the Publication Draft of the new Barnsley Local Plan ended in August 2018 (Barnsley MBC, 2016). The new Local Plan sets out the Council's strategic vision, and priorities for housing, employment and commercial development, including transport infrastructure and protection of the local environment. Until the Local Plan is adopted, 'saved' policies from the Unitary Development Plan (UDP) will continue to form part of the policy context for planning decisions, together with the adopted Core Strategy, Joint Waste Plan and current national planning policies.

2.22 Within the adopted Core Strategy (Barnsley MBC, 2011) there are two policies pertaining to air quality and pollution:

"CSP40 Pollution Control and Protection

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."

2.23 Core policy CSP 41 also relates to air quality specifically within Air Quality Management Areas:

"CSP 41 Development in Air Quality Management Areas

Development 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), or that any such harmful effects can be mitigated against. We will only allow residential development in air quality management areas, where the developer provides an assessment that shows living conditions will be acceptable for future residents. We will only allow development in air quality management areas 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."

Barnsley, Doncaster and Rotherham Joint Waste Plan

2.24 The Barnsley, Doncaster and Rotherham Joint Waste Plan (Barnsley MBC, 2012) sets out the overall approach to managing waste across Barnsley, Doncaster and Rotherham for 15 years from publication in 2012. The Waste Plan provides guidance to waste management development, sets out a strategic approach to waste management in the boroughs, and incorporates a number of planning policies relating to waste management, which are integrated in the Barnsley Local Development Framework. One such policy (WCS6) relates to emission of dust and odour and states:

"Policy WCS6: General Considerations for All Waste Management Proposals

A. Proposals for waste development will only be permitted within Barnsley, Doncaster and Rotherham provided they can demonstrate how they:

…

9) provide adequate means of controlling noise, vibration, glare, dust, litter, odour and vermin and other emissions (e.g. greenhouse gases and leachate) so as to avoid adverse effects on

the amenity of the immediate and surrounding environment and human health, both during and after operations;"

Air Quality Action Plans

National Air Quality Action Plan

2.25 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017a). Alongside a package of national measures, the Plan requires those English Local Authorities (or the GLA in the case of London Authorities) that are predicted to have exceedances of the limit values beyond 2020 to produce local action plans by December 2018. These plans are undertaken in stages (the initial Stage of which was to be completed by the end of March 2018) and must have measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a Clean Air Zone (CAZ). There is currently no practical way to take account of the effects of the national Plan in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.26 The Barnsley Air Quality Action Plan (Barnsley MBC, 2017) details measures to be taken to improve air quality in the Borough. This is targeted at the Borough's six AQMAs. The Borough's AQMAs are declared along busy roads where road traffic emissions are the principal pollution source. The Action Plan measures are therefore focussed upon reducing road traffic emissions, and only contains a two actions relevant to industrial pollution sources:

"8 – Control over emissions from Part B and A2 processes, and act as consultees for Part A1 processes.

Continuing control over those industrial processes which require an environmental permit ensures that air emissions are kept at a legislative minimum or below…"consideration has been given Barnsley MBC will continue to provide comprehensive control over emissions from Part B and A2 processes, and act as consultees to the Environment Agency for part A1 processes.

"9 – Enforcement of the Clean Air with regards to industrial smoke

Continuing control of industrial air emissions."

Guidance Notes

Environment Agency H1 Environmental Risk Assessment Guidance Note, 2011

2.27 The Environment Agency's 'Air Emissions Risk Assessment' (Environment Agency, 2018) provides methods for quantifying the air quality effects of industrial emissions. It contains long-term and short-term Assessment Levels for releases to air derived from a number of published UK and international sources.

2.28 In addition, the Environment Agency's Interim Guidance Note for Metals provides guidance for applicants for environmental permits on how to consider emissions of Group III metals from Energy Recovery Facilities (Environment Agency, 2016).

Assessment Criteria

Criteria to Protect Human Health

2.29 Table 1 sets out the Environmental Assessment Levels (EALs) for human health used in this study. The EALs for nitrogen dioxide and PM_{10} are AQOs, which were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ AQO is to be achieved by 2020. Where there is no AQO, the Environment Agency's Assessment Levels have been used as EALs.

2.30 The EALs apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the EAL. Defra explains where the AQOs apply in its Local Air Quality Management Technical Guidance (Defra, 2016) and the Environment Agency applies the same approach with its Assessment Levels. Annual mean EALs apply anywhere with residential exposure. The 24-hour objective for PM_{10} is taken to apply at residential properties as well as in the gardens of residential properties. The EALs for periods of 8 hours or less have been taken to potentially apply anywhere within the study area, even though, in practice, members of the public would need to be regularly exposed in a non-occupational setting for the averaging period of the EAL.

2.31 The IED specifies a maximum emission of Total Organic Carbon (TOC). In order to assess the potential emissions of TOCs, a worst-case approach has been taken of assuming that all TOCs are Volatile Organic Compounds (VOCs); and that all VOCs are both benzene and 1,3 butadiene with respect to annual mean concentrations. This situation could not happen in practice and provides an extremely conservative assessment.

2.32 There are no assessment criteria for dioxins and furans. The World Health Organisation (WHO, 2000) provides an indicator for the air concentrations above which it considers it necessary to identify and control local emission sources; this value is 0.3 pg/m^3 (300 fg/m^3) and has been used as an EAL in this assessment.

2.33 Table 1 shows that 18 exceedances of 200 µg/m^3 as a 1-hour mean nitrogen dioxide concentration are allowed before the objective is exceeded. For a typical year with complete data capture, the 19th highest hour is represented by the 99.79th percentile of 1-hour mean concentrations. Thus, comparing the 99.79th percentile of 1-hour mean concentrations with the 200 µg/m^3 standard shows whether the 1-hour mean nitrogen dioxide objective would be exceeded. Similarly, the 90.4th percentile of 24-hour mean PM_{10} concentrations represents the 36th highest 24-hour period, the 99.7th percentile of 1-hour mean SO_2 concentrations represents the 25th highest hour, the 99.9th percentile of 15-minute SO_2 concentrations represents the 36th highest 15-minute period, and the 99.18th percentile of 24-hour mean SO_2 concentrations represents the 4th highest 24-hour period.

Table 1: Relevant Air Quality Objectives and Environmental Assessment Levels for the Protection of Human Health

Pollutant	Averaging Period	Concentration (µg/m^3)	Number of periods allowed to exceed per year	AQO	EAL
Nitrogen dioxide	Annual	40	n/a	X	
	1 hour	200	18	X	
PM_{10}	Annual	40	n/a	X	
	24 hours	50	35	X	
$PM_{2.5}$ [a]	Annual	25	n/a	X	
SO_2	24 hours	125	3	X	
	1 hour	350	24	X	
	15 minutes	266	35	X	
CO	8 hour rolling mean	10 (mg/m^3)	n/a	X	
HF	Annual	16	n/a		X
	1 hour	160	n/a		X
HCl	Annual mean	20			X [c]
	1 hour	750	n/a		X
Benzene	Running annual mean	16.25	n/a	X	
	Annual mean	5 [b]	n/a	X	
Cadmium	Annual	0.005	n/a	X	
Thallium	Annual	1	n/a		X [c]
	1hour	30	n/a		X [c]
Mercury	Annual	0.25	n/a		X
	1hour	7.5	n/a		X

Pollutant	Averaging Period	Concentration (µg/m^3)	Number of periods allowed to exceed per year	AQO	EAL
Antimony	Annual	5	n/a		X
	1hour	150	n/a		X
Arsenic	Annual	0.003	n/a		X
Chromium (III)	Annual	5	n/a		X
	1hour	150	n/a		X
Chromium (VI)	Annual	0.0002	n/a		X
	1hour	15	n/a		X [c]
Cobalt	Annual	1	n/a		X [c]
	1hour	30	n/a		X [c]
Copper	Annual	10	n/a		X
	1hour	200	n/a		X
Lead	Annual	0.25	n/a	X	
Manganese	Annual	0.15	n/a		X
	1hour	1,500	n/a		X
Nickel	Annual	0.02	n/a	X	
Vanadium	Annual	5	n/a		X

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it. The EU limit value is the same, but is to be met by 2015.

[b] TOC assessed against the AQO for benzene.

[c] Long- and short-term EALs for thallium and cobalt, the long-term EAL for HCl and the short-term EAL for chromium (VI) has been calculated from the exposure limits in EH4024 and converted to the respective EAL using guidance in H1 (Environment Agency, 2010).

Criteria to Protect Ecological Sites

2.34 Objectives for the protection of vegetation and ecosystems have been set by the UK Government. They are the same as the EU limit values. The limit values and objectives only apply a) more than 20 km from an agglomeration (about 250,000 people), and b) more than 5 km from Part A industrial sources, motorways and built up areas of more than 5,000 people.

2.35 Critical levels and critical loads are the ambient concentrations and deposition fluxes below which significant harmful effects to sensitive ecosystems are unlikely to occur. Some of the critical levels are set at the same concentrations as the objectives, but do not have the same legal standing. Typically, the potential for exceedances of the critical levels and critical loads is considered in the context of the level of protection afforded to the ecological site as a whole. For example, the level of protection afforded to an internationally-designated site (such as an SAC) is significantly greater

than that afforded to a local nature reserve; reflecting the relative sensitivity of the sites as well as their perceived ecological value.

2.36 The Air Pollution Information System (APIS) database (APIS, 2018) has been searched to obtain critical levels and critical loads. Where APIS does not provide critical levels for a given pollutant, they have been taken from Table 7 of the EA's H1 guidance (Environment Agency, 2018). For ammonia and sulphur dioxide, there are more stringent critical levels which only apply for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity. In order to provide a worst-case assessment, these more stringent critical levels have been used even though they may not apply. Different critical loads are available for different habitats; and in the case of acidity, different locations. For the local sites, no detailed information about the types of habitats present is available and so critical loads for the full range of different habitats that might be present have been reviewed. The relevant critical levels and critical loads are set out in Table 2.

2.37 The approach currently recommended by APIS for assessing acid deposition only refers to nitrogen and sulphur. In order to account for the acidifying input from hydrogen chloride, the sum of nitrogen, sulphur and chlorine acidity has been assessed directly against the 'S_{max}' values from APIS. This provides a conservative assessment.

Table 2: Vegetation and Ecosystem Critical Levels [a, b]

Pollutant and Averaging Period	Species / Habitat	EAL
Annual Mean NH_3	All higher plants	3 µg/m^3
	Sensitive lichen communities	1 µg/m^3
Annual Mean NOx	All sensitive communities	30 µg/m^3
24-hour Mean NOx	All sensitive communities	75 µg/m^3
Annual Mean SO_2	All higher plants	20 µg/m^3
	Sensitive lichen communities	10 µg/m^3
Daily Mean HF	All sensitive communities	5 µg/m^3
Weekly Mean HF	All sensitive communities	0.5 µg/m^3
Nutrient Nitrogen Critical Loads	Restored Ancient Woodland [c]	10 kg-N/ha/yr
	Local Wildlife Sites [d]	20 kg-N/ha/yr
Acid Critical Loads [e]	Ancient Woodland and Restored Ancient Woodland and Local Nature Reserve [c]	1.17 keq/ha/yr

[a] Taken from (APIS, 2018) and from Table B4 of the EA's H1 (Environment Agency, 2010).

[b] No data available for Hayes Point to Bendrick Road SSSI and therefore the critical loads for Neutral Grassland have been applied to this habitat.

[c] Based on Broadleaved, Mixed and Yew Woodland habitats.

[d] Based on Neutral Grassland habitats.

[e] APIS advises that where the total acid nitrogen deposition is greater than the N_{min}, the sum of acid nitrogen and sulphur deposition should be compared against the N_{max} value. In this assessment, the sum of acid nitrogen, sulphur and chlorine deposition has been compared with the N_{max} value. This is more conservative than the approach recommended by APIS.

Construction Dust Criteria

2.38 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (IAQM)[1] (2016) has been used. Full details of this approach are provided in Appendix A1.

Descriptors for Air Quality Impacts and Assessment of Significance

Operational Air Quality Criteria Issued by the Environment Agency

2.39 The Environment Agency has adopted criteria (Environment Agency, 2018) that allow health-related Process Contributions (PCs[2]), and those contributions to national or international ecological sites, to be screened out as not significant regardless of the baseline environmental conditions. The emissions from a process can be considered to be not significant if:

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

2.40 It should be recognised that these criteria determine when an impact can be screened out as insignificant. They do not imply that impacts will necessarily be significant above one or both of these criteria, merely that there is a potential for significant impacts to occur that should be considered using a detailed assessment methodology, such as a detailed dispersion modelling study (as has been carried out for this project in any event), and taking into account background concentrations.

2.41 The next step in the Environment Agency's screening process for long-term contributions is to add the process contribution (PC) to the local background concentration to calculate the predicted environmental concentration (PEC). For short-term contributions the PC is compared against the

[1] The IAQM is the professional body for air quality practitioners in the UK.

[2] The PC is the contribution of the process without consideration of existing baseline levels.

short-term environmental standard minus twice the long-term background concentration. The emissions are insignificant if:

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

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

2.43 For the assessment of trace metals, the Environment Agency's Interim Guidance Note for Metals (Environment Agency, 2012) has been used. The guidance note strictly only applies to Group III metals in stack emissions, but the approach has been used for all metals. It provides a three step approach to the assessment, which is outlined below:

- Step 1 – Screening Scenario: Model predictions assume each metal is emitted at the maximum IED Emission Limit Value (ELV) of 0.5 mg/Nm^3 as a worst-case. Assessment of the impact is then made against the following parameters:
  - Long-term PC <1% or short-term PC <10% of the AQO or EAL; or
  - Long-term and short-term Predicted Environmental Concentration (PEC)[3] < 100% of the AQO or EAL (taking likely modelling uncertainties into account).
- Step 2 – Worst Case Scenario Based on Currently Operating Plant: Where the Step 1 screening criteria set out in the guidance are not met, an emission concentration equal to 1/9th of the ELV has been assumed and assessment made against the same criteria specified for Step 1.
- Step 3: If the screening criteria are not met in Step 2, typical emission concentrations for energy from waste plants have been used, as specified in the guidance.

2.44 In terms of locally-designated ecological sites (as opposed to those with national or European designation), the Environment Agency discounts the possibility of significant effects where the PC is less than 100% of the long-term or short-term EAL (Environment Agency, 2018).

2.45 It should also be noted that the previously mentioned EPUK and IAQM guidance does not apply to nature conservation sites, thus the use of the Environment Agency guidance is most appropriate for assessing impacts on ecosystems.

[3] PEC = PC + Background Concentration

Operational Air Quality Criteria Issued by the IAQM and EPUK

2.46 To accompany the assessment using the Environment Agency screening criteria, a separate analysis has also been carried out for annual mean NO_2 and PM_{10} concentrations following guidance developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017). These criteria provide a means of describing the annual mean impacts of any type of scheme and are not specifically designed for industrial developments. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A2. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A3.

Operational Air Quality Criteria Used in this Assessment

2.47 As a first step, the assessment has considered the predicted PCs using the following criteria:

- Is the long-term (annual mean) PC less than 1% (0.5% for nitrogen dioxide and particulate matter) of the long-term environmental standard?; and
- Is the short-term (24-hour mean or shorter) PC less than 10% of the short-term environmental standard?

2.48 Where both of these criteria are met, the impacts are negligible and thus not significant. Where these criteria are breached, a more detailed assessment, considering total concentrations, has been undertaken.

Construction Dust Significance

2.49 Guidance from IAQM (2016) is that, with appropriate mitigation in place, the effects of construction dust will be 'not significant'. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be 'not significant'.

3 Assessment Approach

Existing Conditions

3.1 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2018d). Local sources have also been identified through discussion with Barnsley Metropolitan Borough Council, as well as through examination of the Council's Air Quality Review and Assessment reports.

3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the national pollution maps published by Defra (2018c). These cover the whole of the UK on a 1x1 km grid.

3.3 Exceedances of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra (2017b) as part of its 2017 Air Quality Plan for the baseline year 2015 and for the future years 2017 to 2030. These maps are used by the UK Government, together with the results from national Automatic Urban and Rural Network (AURN) monitoring sites that operate to EU data quality standards, to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2018e), which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

Construction Impacts

3.4 The construction dust assessment considers the potential for impacts within 350 m of the planning boundary; or within 50 m of roads used by construction vehicles. The assessment methodology is that provided by IAQM (2016). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A1 explains the approach in more detail.

Operational Impacts

Sensitive Locations

3.5 In terms of the potential air quality impacts of emissions from the proposed Energy Centre main stack, pollutant concentrations have been modelled for a number of discrete receptor locations which represent human health exposure, including the nearest residential properties, as well as for local sensitive ecosystems. The modelling has been based on 2017, as this is the latest year of available monitoring data.

3.6 Ten existing residential properties have been identified as receptors for the assessment, as well as three receptors at the adjacent industrial warehouse building. An additional 15 receptor locations have been identified as receptors which represent the local nearby sensitive ecosystems. These locations are shown in Figure 2. Receptors 1-10 are residential properties and are considered relevant exposure to both long-term and short-term objectives/EALs. Receptors 11-13 are the neighbouring industrial warehouse and are not relevant exposure to the air quality objectives; however, for information as the nearest neighbour to the scheme, these receptors have been considered with respect to the short-term objectives/EALs. The sensitive ecological sites are represented by receptors A-O. Receptors A-F represent existing designated sites and Receptors G-O represent possible locations within a future designation advised by Barnsley MBC (see paragraph 1.7). The boundary of this possible SSSI is unknown and therefore receptors have been positioned at various locations in areas which could form part of the designated ecosystem.

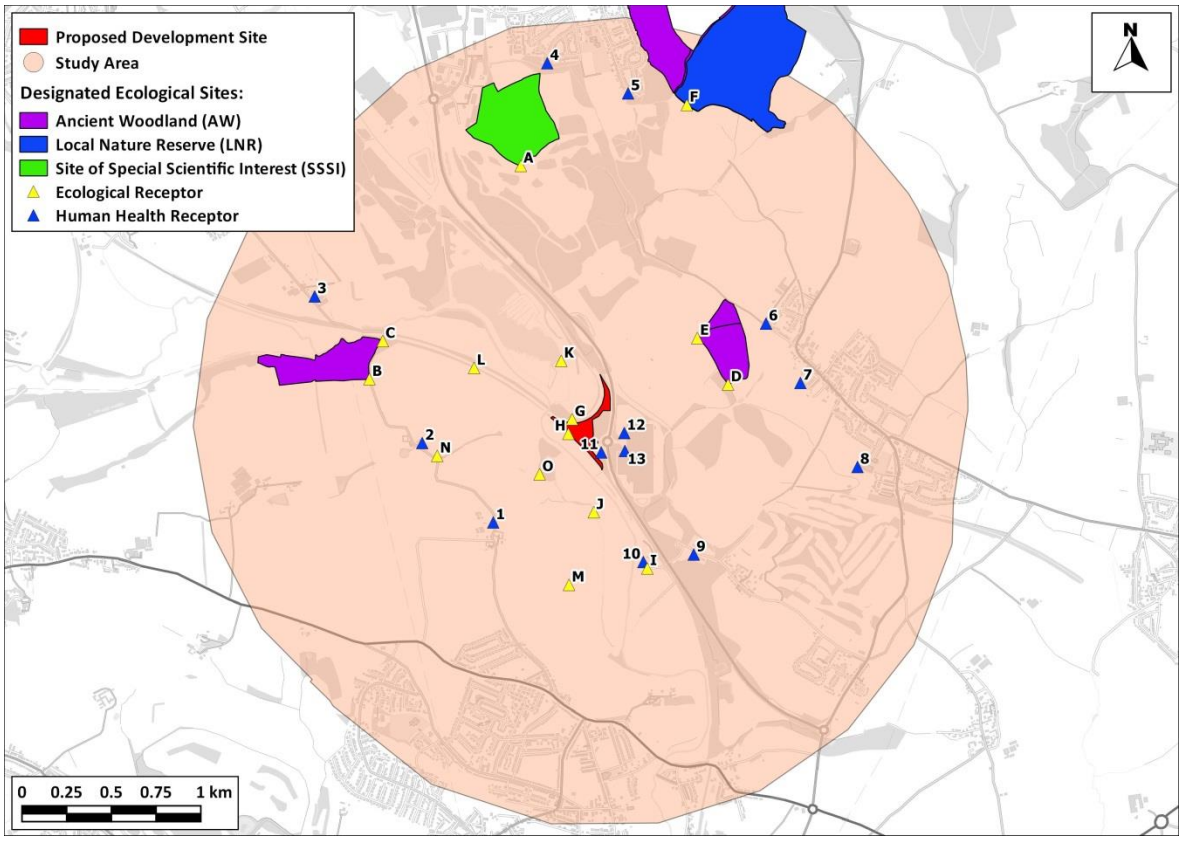

Figure 2: Receptor Locations

Modelling Methodology

3.7 The dispersion of emissions from the proposed Energy Centre main stack has been modelled using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer.

Stack Emissions

3.8 The model input parameters for the main stack have been provided by the Applicant. The emissions limits for the proposed Energy Centre, as provided by the Applicant, are presented in Table 3.

Table 3: Emission Concentration Limits from the Proposed Energy Centre

Pollutant	Emission Concentration (mg/Nm^3)
Total dust	15
Total Organic Carbon (TOC)	15
Hydrogen chloride (HCl)	15
Hydrogen fluoride (HF)	1.5
Sulphur dioxide (SO_2)	75
Nitrogen Oxides (NOx)	300
Carbon monoxide (CO)	75
Ammonia (NH_3)	5
Group 1 metals [c d]	0.05
Group 2 metals [c e]	0.05
Group 3 metals [c f]	0.5
Dioxins and furans [g]	1×10^{-7}

[a] 100^{th} percentile of half-hourly average concentrations in any 24-hour period

[b] 100^{th} percentile of ten-minute average CO concentrations

[c] Average over a sample period between 30 minutes and 8-hours

[d] Cadmium (Cd) and Thallium (Tl)

[e] Mercury (Hg)

[f] Antimony (Sb), Arsenic (As), Lead (Pb), chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V)

[g] I-TEQ (Toxic Equivalent)

3.9 In addition to emission concentrations, the Applicant has also provided data on volumetric flow rates, as well as the stack exit velocity at actual release conditions and stack dimensions. This information has been provided for 'normal' operating conditions. The information provided by the operator and values calculated are set out in the top section of Table 4.

3.10 The emission rates used in the modelling have been calculated based on emission limits provided in Table 3 combined with the release conditions set out in the top section of Table 4. The bottom section of Table 4 shows how the emission rates entered into the dispersion model have been calculated from these emission limits.

Table 4: Emission Parameters for the Proposed Energy Centre

Stack Parameters	Annual Average Conditions	
Actual Exit Velocity (m/s)	17.8	
Efflux Actual Volume Rate (Nm^3/s)	75.0	
Exhaust Temperature (^oC)	146	
Water volume (%)	15.0%	
Oxygen by dry volume (%)	9.7%	
Efflux Normalised Volume Rate (Nm^3/s): 273K, 1 Atmosphere, dry gas, 11% O_2.	40.6	
Stack Internal Diameter (m)	2.32	
Stack Height Above Ground-Level (m)	45	
Stack Location (O.S. x,y)	441548.3, 406443.7	
Pollutant	**Calculation**	**Emissions (g/s) [a]**
Nitrogen Oxides	300 x 40.6 / 1,000	12.2
PM_{10}	15 x 40.6 / 1,000	0.6
SO_2	75 x 40.6 / 1,000	3.0
CO	75 x 40.6 / 1,000	3.0
TOC	15 x 40.6 / 1,000	0.6
HCl	15 x 40.6 / 1,000	0.6
HF	1.5 x 40.6 / 1,000	0.06
Cd and TI	0.05 x 40.6 / 1,000	0.002
Hg	0.05 x 40.6 / 1,000	0.002
Group III metals [b]	0.5 x 40.6 / 1,000	0.02
NH_3	5 x 40.6 / 1,000	0.2
Dioxins and furans	0.0000001 x 40.6 / 1,000	4.1×10^{-9}
Chromium VI	0.00013 x 40.6 / 1,000	5.3×10^{-6} (High)
	0.000035 x 40.6 / 1,000	1.4×10^{-6} (Mid)
	0.0000023 x 40.6 / 1,000	9.3×10^{-8} (Low)

[a] Rounded values are presented here but unrounded values were input into the model.

[b] Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V

Post-Processing

3.11 ADMS-5 has been run to predict the contribution of the proposed facility to annual mean concentrations of the pollutants for which there are annual mean objectives and EALs in Table 1, as well as to the maximum 1-hour mean for the pollutants with 1-hour objectives, 99.79th percentiles of 1-hour mean nitrogen oxides concentrations, 90th percentiles of 24-hour mean PM_{10} concentrations, 99.7th percentiles of 1-hour mean sulphur dioxide concentrations, 99.9th percentiles of 15-minute sulphur dioxide concentrations and 99.18th percentiles of 24-hour mean sulphur dioxide concentrations.

3.12 The approach recommended by the EA (Environment Agency, 2005) has been used to predict annual mean nitrogen dioxide concentrations and 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations. This assumes that:

- Annual mean nitrogen dioxide = Annual mean nitrogen oxides process contribution (PC) x 0.7; and
- 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.79th percentiles of 1-hour mean nitrogen oxides PC x 0.35.

3.13 Deposition of pollutants to ecosystems has not been calculated within the dispersion model. Instead, deposition has been calculated from the predicted ambient concentrations using the deposition velocities for forest taken from AQTAG06 (Environment Agency, 2011):

- NO_2 – 0.003 m/s
- NH_3 – 0.03 m/s
- SO_2 – 0.024 m/s
- HCl – 0.06 m/s

3.14 These velocities are for deposition to forest, which is considered appropriate for the predominantly woodland habitats in the ecologically sensitive areas included in this assessment. The velocities are applied simply by multiplying the predicted pollutant concentration ($\mu g/m^3$) by the velocity (m/s) to predict a deposition flux ($\mu g/m^2/s$). Subsequent calculations required to present the data as kg/ha/yr of nitrogen or sulphur and as keq/ha/yr for acidity follow basic chemical and mathematical rules[4].

Assessment Scenarios

3.15 Predictions of nitrogen dioxide concentrations have been carried out for 2017, the most recent year for which a full set of monitoring data was available at the time the assessment was carried out.

[4] For example, 1 kg N/ha/yr = 0.071 keq/ha/yr

For the purposes of impact description, predictions have been made assuming both that the development does proceed (with development), and does not proceed (without development).

Meteorology

3.16 Five years of hourly-sequential data (2011 to 2015 inclusive) from the meteorological station located at Robin Hood Airport have been used in the assessment as a sensitivity test to account for the variable effects of meteorology on pollutant dispersion. Appendix A4 provides a wind-rose for each meteorological dataset, and outlines the other meteorological parameters required for the modelling (such as surface roughness etc.). The maximum predicted PCs during any year have been reported.

Building Wake Effects

3.17 ADMS-5 has the ability to simulate the entrainment of exhaust plumes into the wake of nearby buildings. In order to ensure that the worst-case building configuration was covered, modelling has been carried out for two alternative building configurations: 1) no buildings included in the model; and 2) all buildings over 2 m high included in the model, with the main building included as the main building.

3.18 The results of the worst-case impacts from either scenario have been used within this report. Figure 3 shows the buildings that were included in the modelling.

Figure 3: Modelled Buildings and Stack Location (Red Dot)

Terrain Effects

3.19 The effects of local terrain have been included within the model based on OS Terrain 50 data. The model has been run once with local terrain, and once without local terrain. The maximum process contribution from all of the model scenarios (with and without buildings and terrain) has been used in the results processing.

4 Site Description and Baseline Conditions

4.1 The Houghton Main Energy Centre site is in a rural setting on land adjacent to the A6195, approximately 4 km east of Barnsley. There is an existing ASOS distribution warehouse facility to the east of the application site, and a small industrial unit to the south.

Industrial sources

4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2018d) website did not identify any significant industrial or waste management sources that are likely to affect the study area, in terms of air quality.

Air Quality Review and Assessment

4.3 Barnsley Metropolitan Borough Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. The Council has declared a number of AQMAs for exceedances of the annual mean nitrogen dioxide objective. The AQMAs are associated with busy arterial roads and junctions close to Barnsley town centre. The declared AQMAs are shown in Figure 4. The development site is not near to any of these AQMAs.

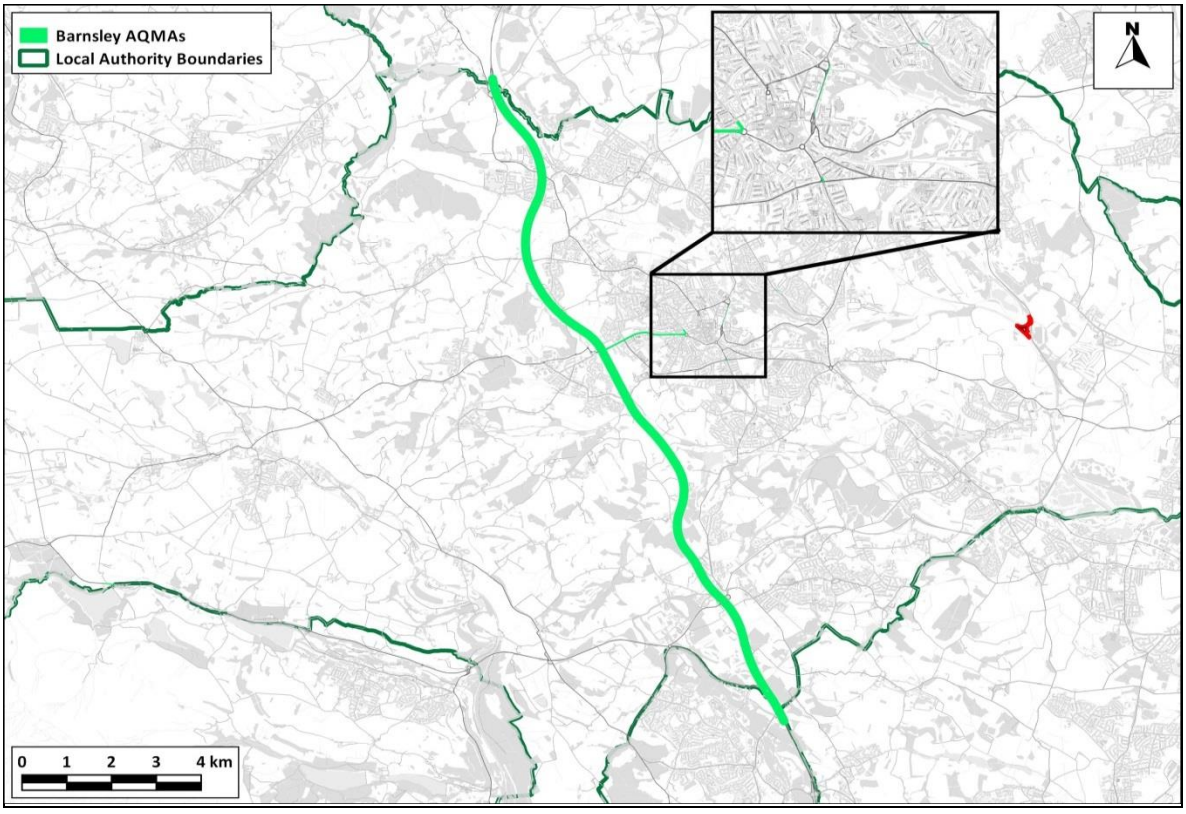

Figure 4: Declared AQMAs

Local Air Quality Monitoring

4.4 Barnsley Metropolitan Borough Council operates three automatic monitoring sites within its area. Automatic monitor CM1 measures PM_{10}, monitor CM2 measures nitrogen dioxide, and CM3 measures nitrogen dioxide and sulphur dioxide. The Council also operates a large number of nitrogen dioxide monitoring sites using diffusion tubes. Monitoring sites are either within Barnsley or Royston, but none are in close proximity to the proposed development.

4.5 Analysis of nitrogen dioxide measurements published in Barnsley Council's latest air quality annual status report (Barnsley MBC, 2018) shows there has been a downward trend in annual mean nitrogen dioxide concentrations in the borough since 2014.

Exceedances of EU Limit Value

4.6 There are no AURN monitoring sites within the study area (2 km) with which to identify exceedances of the annual mean nitrogen dioxide limit value. Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2017b), which are used to report exceedances of the limit value to the EU, and which have been updated to support the 2017 Air Quality Plan, do not identify any exceedances within the study area in 2015

Background Concentrations and Fluxes

National Background Pollution Maps

4.7 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2017 (Table 5) from background pollutant maps published by Defra (Defra, 2018b). The background concentrations are all well below the objectives.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2017 (µg/m^3)

Year	2017	Objective
NOx	16.4 – 20.5	30
NO_2	12.3 – 15.0	40
PM_{10}	12.1 – 15.8	40
$PM_{2.5}$	7.8 – 9.6	25
SO_2 [a]	5.8	20
CO [a]	0.3	10,000

[a] Background concentrations are based on the 2001 base year. No later year is available.

Trace Metals

4.8 Defra has undertaken monitoring of trace elements at a number of locations in the UK since 1976 as part of the UK Urban and Rural Heavy Metals Monitoring Networks. The network was consolidated to 24 sites in 2014, none of which are in close proximity to the proposed development. The nearest stations are at Runcorn and Sheffield, but these are sites close to major industrial operations. To provide an indication of trace metal concentrations in the study area, measured concentrations at the two nearest rural monitoring sites in the UK Urban and Rural Heavy Metals Monitoring Networks (Eskdalemuir and Fenny Compton) in 2017 are summarised in Table 6. All concentrations of measured pollutants are well below the relevant EALs.

Table 6: Trace Metal Background Concentrations, 2017 (µg/m^3)

Monitoring Location	Eskdalemuir	Fenny Compton	Average [a]	Annual Mean EAL (see Table 1)
Location Type	**Rural**	**Rural**		
Antimony	Not Measured			5
Arsenic (As)	0.00015	0.00087	0.00051	0.003
Cadmium (Cd)	0.00002	0.00013	0.00008	0.005
Chromium (Cr) [b]	0.00108	0.00112	0.00110	5
Cobalt (Co)	0.00002	0.00005	0.00004	1
Copper (Cu)	0.00066	0.00266	0.00166	10
Lead (Pb)	0.00097	0.00559	0.00328	0.3
Manganese (Mn)	0.00089	0.00242	0.00165	0.2
Mercury (Hg)	Not Measured			0.3
Nickel (Ni)	0.00031	0.00041	0.00036	0.02
Thallium (TI)	Not Measured			1
Vanadium (V)	0.00035	0.00059	0.00047	5

[a] The average background concentration has been derived from the two rural background sites located nearest to the proposed development site.

[b] The background concentration for chromium is total chromium. It is assumed that 20 % of total chromium is chromium VI in accordance with the EA's Interim Guidance Note for Metals (Environment Agency, 2012).

Dioxins and Furans

4.9 Monitoring of PCDD/Fs (dioxins and furans) is currently carried out by Defra at six locations in the UK (Auchencorth Moss, Hazelrigg, High Muffles, London, Manchester and Weybourne). To provide an indication of the range of PCDD/Fs concentrations that occur in the UK, a summary of the annual mean concentrations measured between 2014 and 2016 is presented in Table 7. The average concentration measured in Manchester, the nearest site to the proposed development, from 2014 to 2016, is 11.7 fg/m^3. This average is assumed to be representative of the baseline dioxin and furan concentration in the study area.

Table 7: UK PCDD/Fs Concentrations (fg/m^3)[a]

Site	2014	2015	2016	Average
Auchencorth	<0.1	<0.1	0.2	0.1
Hazelrigg	2.6	5.3	4.6	4.2
High Muffles	1.4	0.5	3.7	1.9
London	2.9	5.5	24.3	10.9
Manchester	17.0	6.0	12.3	11.7
Weybourne	1.6	1.4	5.7	2.9

[a] 1,000,000,000 fg = 1 µg

Benzene, HCl, HF and Ammonia

4.10 Defra monitors benzene at a site in Barnsley Gawber, which is operated as part of the Non Automatic Hydrocarbon Network (NAHN). The measured concentration for 2017 has been used in this assessment.

4.11 Defra measures background HCl concentrations at a number of UK sites as part of the Acid Gas and Aerosols Network (AGANET). The nearest site to the proposed development is Ladybower; data for 2015 (the latest year for which results are available) has been used in this assessment.

4.12 Defra also monitors background ammonia concentrations at Ladybower as part of the National Ammonia Monitoring Network (NAMN); data for 2017 have been used for this assessment.

4.13 There is currently no UK monitoring of HF, and no background data are available.

4.14 The background concentrations of benzene, HCl and ammonia used in this assessment are summarised in Table 8.

Table 8: Annual Mean Background Pollutant Concentrations for Benzene, HCl and NH^3

Pollutant	Background Concentration (µg/m³)	EAL
Benzene	0.49	**5**
HCl	0.23	**20**
NH^3	0.66	**3**
HF	-[a]	**16**

[a] No UK monitoring for HF from which to obtain a background concentration.

Background Deposition and Acidity

4.15 Background nitrogen deposition fluxes to the local wildlife sites have been taken from the APIS website (APIS, 2018), where they are reported as a three-year average (2014-2016). Background nutrient and acid nitrogen deposition rates both exceeded the critical loads in this period.

Table 9: Estimated Annual Mean Background Nitrogen and Acid Deposition

Site	Nutrient Nitrogen Deposition (keq/ha/yr)		Total Acid Deposition (keq/ha/yr)	
	Background Deposition	Critical Load	Background Deposition	Critical Load
Woodland	**36.4**	**10**	**3.05**	**1.17**

5 Construction Phase Impacts

5.1 The construction works may give rise to a risk of dust impacts during earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway.

5.2 There are receptors within the distances set out in the guidance (see Appendix A1), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

Demolition

5.3 There is no requirement for demolition on site.

Earthworks

5.4 The characteristics of the soil at the development site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2018), as set out in Table 10. Overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 10: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Shallow - Deep
Soil Parent Material Grain Size	Mixed (Argillaceous [a] – Arenaceous [b])
European Soil Bureau Description	Mudstone and Sandstone
Soil Group	Medium to Heavy
Soil Texture	Clayey Loam [d] to Sandy Loam

[a] grain size < 0.06 mm.

[b] grain size 0.06 – 2.0 mm.

5.5 The application area extends across approximately 29,000 m^2,although the facility footprint is significantly smaller; most of this will be subject to earthworks. The earthworks will last around 6-12 months and dust will arise mainly from the vehicles travelling over unpaved ground and from the handling of dusty materials. Most of the earthworks will, though, involve the removal of subsoil, which will largely be damp and not prone to creating dust. Based on the example definitions set out in Table A1.1, the dust emission class for earthworks is considered to be *medium*.

Construction

5.6 Construction will involve the erection of a main Energy Centre building and small number of auxiliary buildings and structures. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials, and from the cutting of concrete. The construction will take place over a 2-year period. Based on the example definitions set out in Table A1.1, the dust emission class for construction is considered to be *medium*.

Trackout

5.7 The number of vehicles accessing the site, which may track out dust and dirt is currently unknown, but given the size of the site it is likely that there will be no more than 50 outward bound heavy vehicle movements per day. Based on the example definitions set out in Table A1.1, the dust emission class for trackout is considered to be *medium.*

5.8 Table 11 summarises the dust emission magnitude for the proposed development.

Table 11: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	None
Earthworks	Medium
Construction	Medium
Trackout	Medium

Sensitivity of the Area

5.9 This assessment step combines the sensitivity of individual receptors to dust effects, with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

5.10 The IAQM guidance explains that residential properties are 'high' sensitivity receptors to dust soiling, while the nearby industrial units and their car parks are a 'medium' sensitivity receptor (Table A1.2). There are no residential properties within 350m of the planning boundary, however the neighbouring warehouse and associated ASOS buildings are within 150 m of the planning boundary. Using the matrix set out in Table A1.3, the area surrounding the onsite works is of 'low' sensitivity to dust soiling (see Figure 5).

Figure 5: 20 m and 350 m Distance Bands around Site Boundary

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5.11 Table 11 shows that dust emission magnitude for trackout is 'medium' and Table A1.3 thus explains that there is a risk of material being tracked 200 m from the site exit. For a conservative assessment, it has been assumed that all possible routes could be affected. There are no residential properties within 50 m of the roads along which material could be tracked. The southwest corner of the main ASOS building, however, is within 20 m of the edge of the roads, and may be affected by dust soiling. Using the matrix set out in Table A1.3, the area surrounding the roads which construction vehicles may use is of 'medium' sensitivity to dust soiling (see Figure 6).

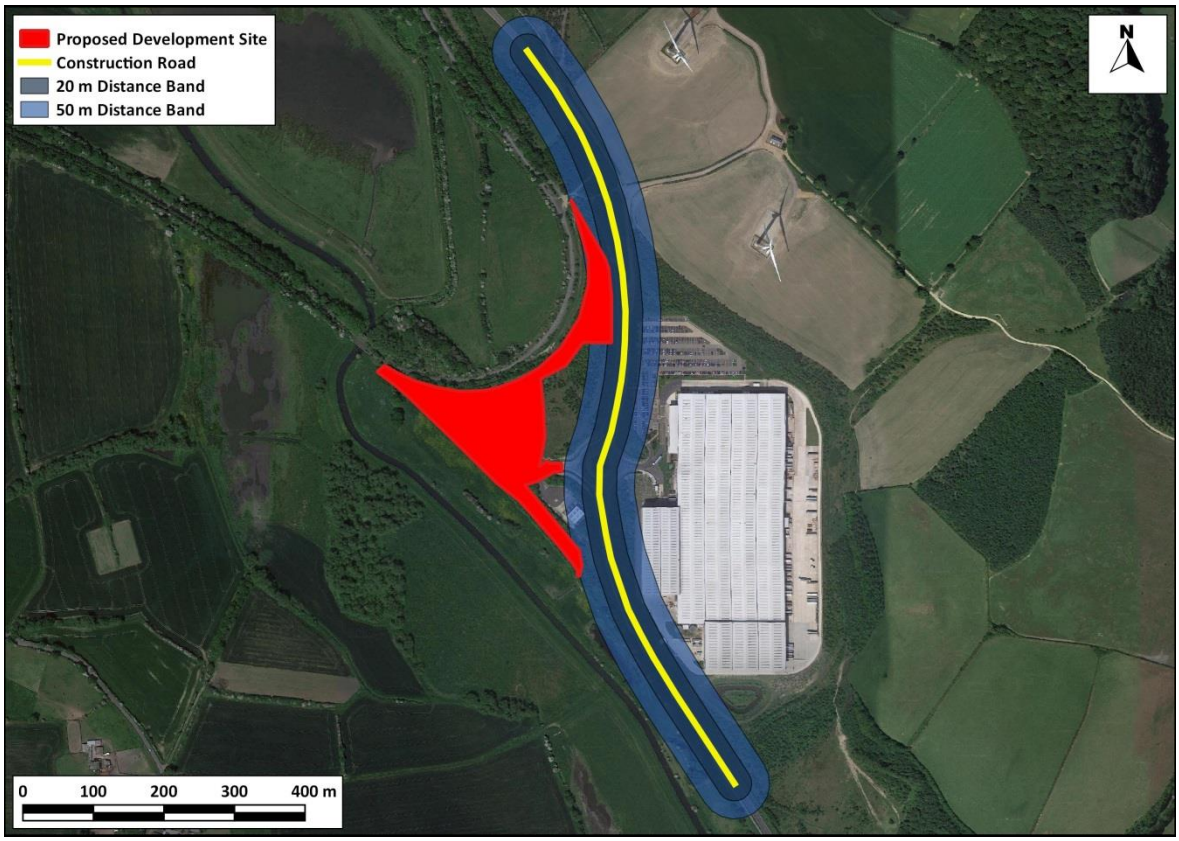

Figure 6: 50 m Distance Bands around Roads Used by Construction Traffic

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Sensitivity of the Area to any Human Health Effects

5.12 There are no residential properties within 350 m of the proposed development. Places of work are classified as being of 'medium' sensitivity to human health effects. The matrix in Table A1.4 in Appendix A1 requires information on the baseline annual mean PM_{10} concentration in the area. The existing annual mean PM_{10} concentration is best described by the background concentration predicted by Defra's background maps (12 – 14 µg/m³) since the site is well away from any main roads. Using the matrix in Table A1.4 in Appendix A1, the areas surrounding the onsite works and roads along which material may be tracked from the site are of 'low' sensitivity to human health effects.

Sensitivity of the Area to any Ecological Effects

5.13 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of the planning boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

5.14 Table 12 summarises the sensitivity of the area around the proposed construction works.

Table 12: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	Low Sensitivity	Medium Sensitivity
Human Health	Low Sensitivity	Low Sensitivity

Risk and Significance

5.15 The dust emission magnitudes in Table 11 have been combined with the sensitivities of the area in Table 12 using the matrix in Table A1.6 in Appendix A1, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 13. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 7 (step 3 of the assessment procedure).

Table 13: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition	None	None
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Negligible

5.16 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, detailed in Appendix A5, the IAQM guidance is clear that the residual effect will normally be 'not significant' (IAQM, 2016).

6 Operational Phase Impact Assessment

6.1 Concentrations have been predicted at thirteen locations representing the nearest existing human health exposure, at ground level (1.5 m above ground) and first floor level (4.5 m above ground) for each receptor location. Fifteen additional receptor locations have been modelled to represent the nearby sensitive ecosystems.

6.2 For consideration of concentrations in relations to the short-term objective, it has been assumed that the plant will run at continuous operation and at full (100%) load.

Initial Screening assessment

Health

6.3 The predicted maximum PCs have been compared with the Environment Agency screening criteria. The conclusions based on the screening criteria for the PCs are set out in Table 14.

Table 14: Maximum Predicted PCs in the Study Area (µg/m³)

Pollutant	Time Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Nitrogen dioxide	Annual	0.84	40	2.1	Yes
	1 hour	29.1	200	14.5	Yes
PM_{10}	Annual	0.06	40	0.1	No
	24 hours	0.5	50	1.1	No
$PM_{2.5}$ [a]	Annual	0.06	25	0.2	No
SO_2	24 hours	9.5	125	7.6	No
	1 hour	20.4	350	5.8	No
	15 minutes	22.5	266	8.5	No
CO	8 hour rolling mean	19.8	10000	0.2	No
HF	Annual	0.006	16	0.04	No
	1 hour	0.46	160	0.3	No
HCl [c]	Annual mean	0.06	20	0.3	No
	1 hour	4.6	750	0.6	No
TOC as Benzene [b]	Annual mean	0.6	5	1.2	Yes
Cadmium	Annual	0.0002	0.005	4.0	Yes
Thallium [c]	Annual	0.0002	1	0.02	No
	1hour	0.015	30	0.1	No
Mercury	Annual	0.0002	0.25	0.1	No
	1hour	0.015	7.5	0.2	No
Antimony	Annual	0.002	5	0.04	No
	1hour	0.15	150	0.1	No
Arsenic	Annual	0.002	0.003	66.5	Yes
Chromium (III)	Annual	0.002	5	0.04	No
	1hour	0.15	150	0.1	No
Chromium (VI) [c]	Annual	0.002	0.0002	998	Yes
	1hour	0.15	15	1.0	No
Cobalt [c]	Annual	0.002	1	0.2	No
	1hour	0.15	30	0.5	No

Pollutant	Time Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Copper	Annual	0.002	10	0.02	No
	1hour	0.15	200	0.1	No
Lead	Annual	0.002	0.25	0.8	No
Manganese	Annual	0.002	0.15	1.3	Yes
	1hour	0.15	1500	0.01	No
Nickel	Annual	0.002	0.02	10.0	Yes
Vanadium	Annual	0.002	5	0.04	No
Ammonia	Annual	0.02	180	0.01	No
	1hour	1.54	2,500	0.1	No
Dioxins and Furans	Annual	1.01E-09	0.0000003	0.3	No

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

[b] TOC assessed against the AQO for benzene.

[c] Long- and short-term EALs for thallium and cobalt, the long-term EAL for HCl and the short-term EAL for chromium (VI) has been calculated from the exposure limits in EH4024, and converted to the respective EAL using guidance in H1 (Environment Agency, 2010).

6.4 The predicted impacts exceed the screening criteria for a number of pollutants and therefore require further detailed assessment. Detailed assessment is required for nitrogen dioxide, TOC, cadmium, arsenic, chromium (VI), manganese and nickel.

6.5 No further assessment is required for those pollutants which do not exceed the screening criteria as these are considered to be *insignificant*.

Ecosystem

6.6 The predicted nitrogen oxide, sulphur dioxide, hydrogen fluoride and ammonia concentrations and rates of nutrient and acid nitrogen deposition associated with emissions from the plant have been compared with the Environment Agency screening criteria. The screening criteria for locally designated sites allows for an addition of 100% of the EAL. The conclusions from the screening criteria are set out in Table 15.

Table 15: Maximum Predicted PCs to Sensitive Habitats in the Study Area

Pollutant	Time Period	Maximum PC (µg/m³)	EAL	% of EAL	Detailed Assessment Required
Nitrogen Oxides	Annual	3.1	30	13.9	No
	24-hour mean	93.9	75	125	Yes
Sulphur Dioxide	Annual	0.77	20	3.8	No
Hydrogen Fluoride	24-hour mean	0.47	5	9.4	No
	Weekly mean	0.47[a]	0.5	93.9	No
Ammonia	Annual	0.05	1	5.1	No
Nutrient Nitrogen Deposition Rate	Annual	0.58	10	5.8	No
Total Acid Deposition Rate	Annual	0.04	1.17	3.5	No

[a] Weekly mean HF has not been modelled, so 24-hour mean concentration has been used for screening as a worst-case assumption.

6.7 The predicted impacts exceed the screening criterion for 24-hour mean NOx concentrations, which therefore requires further detailed assessment.

6.8 The predicted impacts for all other pollutants (annual mean NOx, SO_2, HF, ammonia, nutrient nitrogen deposition and total acid deposition) do not exceed the screening criteria. Further detailed assessment is not required for these pollutants and the potential impacts are considered to be *insignificant*.

Detailed Assessment

Nitrogen Dioxide

6.9 The impacts on nitrogen dioxide cannot be immediately discounted as insignificant, since the annual mean PC is more than 1% of the objective and the 99.8th percentile of 1-hour mean PC is more than 10% of the objective.

6.10 The maximum predicted PC to annual mean and short-term (as the 99.79th percentile of 1-hour means) nitrogen dioxide concentrations are set out in Table 16. For the annual mean objective, the table shows the worst-case prediction at any of the receptors relevant for the annual mean (Receptor 1-10), while for the 1-hour objective, the table shows the worst-case prediction across all the receptors (Receptors 1-13).

6.11 Table 16 also sets out the maximum PEC for annual mean and 99.8th percentile of 1-hour mean nitrogen dioxide concentrations at any of the receptors. The maximum PECs are both well below the relevant objectives.

Table 16: Maximum PCs and PECs for Nitrogen Dioxide (µg/m^3)

Objective/EAL		PC	Background[a]	PEC	PEC as a % of EAL
Annual Mean	40	0.84	15.0	15.8	39.5
1-hour mean (99.79th percentile)	200	29.2	30.0	59.2	29.6

[a] See Table 5.

6.12 Table 17 sets out the PCs, PECs and impact descriptors for the annual mean nitrogen dioxide objective at each of the sensitive receptor locations. The impact descriptors are derived using the impact matrix set out in EPUK/IAQM guidance (as presented in Appendix A2).

6.13 The impacts on nitrogen dioxide concentrations are thus considered *insignificant*.

Table 17: Annual Mean Nitrogen Dioxide Impact Descriptors

Location	Without Scheme (µg/m^3)	Annual Mean PC (µg/m^3)	With Scheme (µg/m^3)	% Change	Impact Descriptor
Receptor 1	15.0	0.70	15.7	1.7	Negligible
Receptor 2	15.0	0.45	15.5	1.1	Negligible
Receptor 3	15.0	0.15	15.2	0.4	Negligible
Receptor 4	15.0	0.36	15.4	0.9	Negligible
Receptor 5	15.0	0.47	15.5	1.2	Negligible
Receptor 6	15.0	0.84	15.8	2.1	Negligible
Receptor 7	15.0	0.67	15.7	1.7	Negligible
Receptor 8	15.0	0.59	15.6	1.5	Negligible
Receptor 9	15.0	0.54	15.5	1.3	Negligible
Receptor 10	15.0	0.65	15.6	1.6	Negligible

TOC as Benzene

6.14 The impacts on the annual mean TOC concentrations cannot be immediately discounted as insignificant, since the maximum annual mean PC is more than 1% of the relevant EAL (the national air quality objective for benzene is applied as the relevant EAL in this assessment).

6.15 The maximum predicted PC to annual mean TOC concentrations is set out in Table 18. The table shows the worst-case prediction at any of the receptors relevant for the annual mean (Receptor 1-10). Table 18 also sets out the maximum PEC for annual mean TOC concentrations. The maximum PEC is well below the relevant EAL.

Table 18: Maximum PCs and PECs for TOC (as Benzene) (µg/m^3)

Objective/EAL		PC	Background [a]	PEC	PEC as a % of EAL
Annual Mean	5	0.06	0.49	0.55	11

[a] See Table 8.

6.16 Table 19 sets out the PCs, PECs and impact descriptors for the annual mean benzene objective at each of the sensitive receptor locations. The impact descriptors are derived using the impact matrix set out in EPUK/IAQM guidance (as presented in Appendix A2). All of the impacts are negligible.

Table 19: Annual Mean TOC (as Benzene) Impact Descriptors

Location	Without Scheme (µg/m^3)	Annual Mean PC (µg/m^3)	With Scheme (µg/m^3)	% Change	Impact Descriptor
Receptor 1	0.49	0.05	0.54	1.0	Negligible
Receptor 2	0.49	0.03	0.52	0.6	Negligible
Receptor 3	0.49	0.01	0.50	0.2	Negligible
Receptor 4	0.49	0.03	0.52	0.5	Negligible
Receptor 5	0.49	0.03	0.52	0.7	Negligible
Receptor 6	0.49	0.06	0.55	1.2	Negligible
Receptor 7	0.49	0.05	0.54	1.0	Negligible
Receptor 8	0.49	0.04	0.53	0.8	Negligible
Receptor 9	0.49	0.04	0.53	0.8	Negligible
Receptor 10	0.49	0.05	0.54	0.9	Negligible

Trace Metals

Group I Metals

6.17 The impacts on the annual mean concentration of cadmium cannot be immediately discounted as insignificant, since the annual mean PC is more than 1% of the objective.

6.18 The maximum predicted PC to annual mean cadmium concentrations is set out in Table 20. The table shows the worst-case prediction at any of the receptors relevant for the annual mean (Receptor 1-10). Table 20 also sets out the maximum PEC for annual mean concentration. The maximum PEC is well below the relevant EAL.

6.19 The Cadmium PEC is less than 100% of the EAL, therefore the impacts are considered to be *insignificant.*

Table 20: Maximum PEC for Cadmium

Metal	EAL	PC (µg/m^3)	Background (µg/m^3)[a]	PEC (µg/m^3)	PEC as a % of EAL
Cadmium	0.005	0.0002	0.00008	0.0003	5.6

[a] See Table 6.

Group III Metals

6.20 The assessment of trace metals follows the recommended methodology described by the Environment Agency in its Guidance to Applicants on Impacts for Group 3 Metals, V.3, September 2012. The methodology set out in the EA guidance, describes a three-step approach to the assessment of trace metals in stack emissions, as detailed in the Assessment Criteria section.

Step 1: Screening Scenario

6.21 On the basis of initial screening of the PCs (see Table 14), further assessment is required for long-term concentrations of arsenic, chromium (VI), manganese and nickel. The impacts from all other trace metals, for long-term and short-term concentrations, are considered to be *insignificant.*

6.22 The PECs for the trace metals that could not be initially screened out are shown in Table 21. Using the screening criteria for the PEC lead, manganese and nickel can also be considered *insignificant,* since the PECs are less than 70% of the EAL. Assessment of arsenic and chromium VI must proceed to Step 2.

Table 21: Group III Metals Assessment Step 1: Emissions at 100% IED Emission Limit

Metal	EAL	PC (µg/m^3)	Background (µg/m^3) [a]	PEC (µg/m^3)	PEC as a % of EAL
Arsenic	0.003	0.002	0.0005	0.0025	**83.5**
Chromium (VI)	0.0002	0.002	0.0002	0.0022	**1098.1**
Manganese	0.15	0.002	0.0017	0.0024	2.4
Nickel	0.02	0.002	0.0004	0.0025	11.8

[a] See Table 6.

Step 2 – Worst Case Scenario Based on Currently Operating Plant

6.23 Step 2 of the EA's Guidance Note for Metals advises that modelling be undertaken assuming that each component group III metal is emitted as an equal portion of the total metals emission level. The model has thus been run assuming that arsenic and chromium (VI) emissions are 1/9th (11.1%) of the total IED group III metals emission limit respectively (as there are a total of 9 group III metals). The results of Step 2 of the assessment for arsenic and chromium (VI) emissions is presented in Table 22.

6.24 The PEC for chromium (VI) exceeds the EAL. It is therefore necessary to proceed to Step 3 for chromium (VI). In terms of arsenic, the PEC is less than 70% of the EAL therefore the impacts of arsenic can be considered *insignificant*.

Table 22: Group III Metals Assessment Step 2: Emissions at 1/9th IED Emission Limit

Metal	EAL	PC (µg/m^3)	Background (µg/m^3)	PEC (µg/m^3)	PEC as a % of EAL
Arsenic	0.003	0.0002	0.0005	0.0007	24.4
Chromium (VI) [c]	0.0002	0.0002	0.0002	0.0004	**210.9**

Step 3: Typical Operational Emissions

6.25 The Environment Agency's group 3 metals guidance includes a summary of emissions monitoring data from 20 municipal waste to energy facilities, which shows the maximum, minimum and mean emissions concentrations of the group 3 metals. For chromium, the guidance includes emissions for total chromium, as well as the fraction of total chromium that is chromium (VI), which is based on speciation analysis of Air Pollution Control (APC) residues from the same municipal waste to energy facilities. The minimum and maximum emissions concentrations of total chromium and fractions for chromium (VI) obtained from the EA guidance note, are presented in Table 23.

Table 23: Measured Concentrations in Emissions and Group 3 Fractions of Chromium at 20 Municipal Waste to Energy facilities between 2007 and 2009

Pollutant	Concentration (mg/Nm^3)		Fraction of Group III (%)	
	Minimum	Maximum	Minimum	Maximum
Total Chromium	0.0004	0.0521	0.08	10.4
Chromium (VI)	2.3 x 10^{-6}	1.3 x 10^{-4}	n/a	n/a

6.26 Step 3 of the group 3 metals assessment is to use the emission rates presented in Table 23 to determine PCs for chromium (VI). Table 24 sets out the maximum PC and PEC for chromium (VI) using the maximum emission concentration presented in Table 23. The final predicted maximum chromium (VI) PC is less than 1% of the long-term EAL. On this basis, the effects from long-term emissions of chromium (VI) are therefore considered to be *insignificant*. Although the final PEC for chromium (VI) is above the EAL, this is due to the assumed background concentration being above the EAL. The background is based on a total chromium measurement and is therefore likely to be overstated. It is unlikely that chromium (VI) concentrations in the study area exceed the EAL.

Table 24: Predicted Long-term PC and PEC of Chromium (VI) Using the Maximum Emissions (Step 3)

Metal	EAL	PC (µg/m^3)	PC as a % of EAL	Background (µg/m^3) [a]	PEC (µg/m^3)	PEC (µg/m^3)
Chromium (VI)	0.0002	5.2 x 10^{-7}	0.26	0.0002	0.0002	100.3

[a] The chromium background concentration (see Table 6) has been apportioned 80% Cr (III), 20% Cr (VI) in accordance with the EA's Interim Guidance Note for Metals (Environment Agency, 2012).

Dioxins and Furans

6.27 The maximum predicted dioxin and furan PC at specific receptor locations is 0.4 fg/m^3 (see Table 14). This is well below the WHO indicator concentration (300 fg/m^3) above which it would be considered necessary to identify and control emissions. The average background PCDD/Fs concentration at the nearest monitoring station, located in Manchester, is 11.7 fg/m^3 (see Table 7). Adding the PC to the background gives a total PEC of 12.1 fg/m³, which is only 4% of the WHO indicator.

6.28 There are no assessment criteria for dioxins and furans. When compared with the average background concentration measured in Manchester and the WHO indicator, the effect of the proposed development is considered to be *insignificant.*

Nitrogen Oxides

6.29 The impacts on nitrogen oxides cannot be immediately discounted as insignificant, since the 24-hour mean PC is more than 100% of the critical level.

6.30 Table 25 sets out the maximum PC for 24-hour mean nitrogen oxides concentrations at each of the ecosystem receptors.

Table 25: Annual Mean Nitrogen Dioxide Impact Descriptors

Location	Designated Site	24-hr Mean NOx PC (µg/m³)	PC as % of Critical Level	Critical Level
Receptor A	Carlton Main Brickworks SSSI	8.9	11.8	75
Receptor B	Ancient Woodland	13.2	17.6	75
Receptor C	Ancient Woodland	14.6	19.4	75
Receptor D	Ancient Woodland	14.1	18.9	75
Receptor E	Ancient Woodland	19.3	25.8	75
Receptor F	West Haigh Wood LNR	6.1	8.1	75
Receptor G	Possible future designation	93.9	125.1	75
Receptor H	Possible future designation	48.3	64.4	75
Receptor I	Possible future designation	15.7	20.9	75
Receptor J	Possible future designation	28.4	37.9	75
Receptor K	Possible future designation	33.5	44.6	75
Receptor L	Possible future designation	30.3	40.4	75
Receptor M	Possible future designation	15.8	21.1	75
Receptor N	Possible future designation	25.6	34.1	75
Receptor O	Possible future designation	51.8	69.1	75

6.31 The results show that at all existing designations, the PC is well below 100% of the Critical Level and can therefore be discounted as insignificant.

6.32 In terms of the proposed SSSI, the 24-hour mean nitrogen oxides PC is predicted to be greater than 100% of the Critical Level at Receptor G. This is located on the boundary of the proposed development as shown in Figure 2. The results in Table 25 demonstrate that at other receptors chosen to represent the proposed SSSI (including Receptor H which is also on the boundary of the proposed development) 24-hour mean nitrogen oxides PCs are below the Critical Level. It is likely that the area affected by PCs that exceed the Critical Level will be very small.

6.33 It is not known if Receptor G will fall within the boundary of any future designated site, and it is not known whether this site will have any features that are sensitive to nitrogen. It is therefore unlikely that the PC of the proposed development on 24-hour mean nitrogen oxides concentrations will lead to any significant effects.

Uncertainty in Modelling Predictions

6.34 There are many components that contribute to the uncertainty of modelling predictions. The ADMS-5 model used in this assessment is dependent upon the data that have been input, which will have inherent uncertainties associated with them. In order to account for this uncertainty, conservative and worst-case assumptions have been made where required. In particular, by assessing the Energy Centre operating continuously at full capacity, and by using emission concentrations, which will be set at and regulated as maximum emissions, meaning that the plant will likely operate well below these emissions levels much of the time.

6.35 Additional steps have also been taken to account for model uncertainty, including the use of five years of meteorological data, and testing the model with and without the influence of building wake effects. In both cases, the worst-case (highest) modelled concentrations have been presented in this assessment for robustness.

Significance of Operational Air Quality Impacts

6.36 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A2.

6.37 More specifically, the judgement that the air quality effects will be 'not significant' takes account of the assessment that:

- the impacts of emissions from the proposed Energy Centre on human health receptors has been demonstrated to be not significant; and
- the impacts of emissions from the proposed Energy Centre on sensitive ecological receptors has been demonstrated to be not significant.

7 Mitigation

Construction Impacts

7.1 Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby sensitive receptors.

7.2 The site has been identified as a *Low* Risk site as set out in Table 13. Comprehensive guidance has been published by IAQM (IAQM, 2016), and on monitoring during earthworks and construction (IAQM, 2018). This reflects best practice experience and has been used, together with the professional experience of the consultant and the findings of the dust impact assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A5.

7.3 The mitigation measures should be written into a dust management plan (DMP).

7.4 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to dampen down the material. There should not be any excess to potentially contaminate local watercourses.

Operational Impacts

7.5 The Energy Centre will include all necessary emissions abatement and continuous emissions monitoring (CEMS) to ensure that the installation complies with the emission limits set out in Table 3. This will be a requirement within the Environmental Permit that must be issued and regulated by the Environment Agency in order for the facility to operate. No additional mitigation measures are proposed for the development.

8 Residual Impacts and Effects

Construction

8.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be 'not significant'. The mitigation measures set out in Section 7 are based on the IAQM guidance. With these measures in place and effectively implemented the residual effects are judged to be not significant.

Operation

8.2 The residual impacts will be the same as those identified in the Section 6 (paragraph 6.36). The overall operational air quality impacts of the development are judged to be not significant.

9 Conclusions

9.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be *insignificant*.

9.2 The operational impacts of increased traffic have been discounted as *insignificant* based on a comparison of the incremental change to flows in relation to established screening criteria.

9.3 The operational impacts of the emissions to air from the Energy Centre have been shown to be *insignificant* in relation to human health. Where pollutants could not be screened out based on their PC being less than 1% (for long-term impacts) or 10% (for short-term impacts) of the objective/EAL, the total PEC has been shown to be well below the objective/EAL. Where annual mean objectives have been assessed, the EPUK descriptors have been used to describe the impacts. All annual mean impacts are considered to be *negligible.* Overall, the impacts on human health receptors are considered to be *insignificant*.

9.4 The operational impacts of the emissions have been shown to be *insignificant* at the sensitive ecological sites. All pollutants were screened out based on their PC being less than 100% of the objective/EAL/critical level, with the exception of the PC for 24-hour nitrogen oxides at a receptor on the boundary of the proposed development, which may be declared as a designated site in the future. Given the uncertainty regarding the status and location of this proposed SSSI, it is unlikely there would be a significant effect.

10 References

2008/50/EC (2008) *European Framework Directive on Ambient Air Quality and Cleaner Air for Europe*.

2008/98/EC (2008) *European Waste Framework Directive*.

2010/75/EU (2010) *Industrial Emissions (Integrated Pollution Prevention and Control) (Recast)*.

APIS (2018) *APIS*, [Online], Available: www.apis.ac.uk.

Barnsley MBC (2011) *Barnsley Local Development Framework: Core Strategy*.

Barnsley MBC (2012) *Barnsley, Doncaster and Rotherham Joint Waste Plan*.

Barnsley MBC (2016) *Local Plan Publication Draft 2016*.

Barnsley MBC (2017) *Air Quality Action Plan*.

Barnsley MBC (2018) *2018 Air Quality Annual Status Report*.

British Geological Survey (2018) *UK Soil Observatory Map Viewer*, [Online], Available: http://mapapps2.bgs.ac.uk/ukso/home.html.

Countryside and Rights of Way Act 2000 (2000), HMSO.

DCLG (2018) *Planning Practice Guidance*, [Online], Available: http://planningguidance.planningportal.gov.uk/blog/guidance/.

Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Defra.

Defra (2016) *Review & Assessment: Technical Guidance LAQM.TG16 February 2018 Version*, Defra, Available: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf.

Defra (2017a) *Air quality plan for nitrogen dioxide (NO2) in the UK*, Available: https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017.

Defra (2017b) *2017 NO2 projections data (2015 reference year)*, Available: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data.

Defra (2018a) *Clean Air Strategy 2018 (Draft)*, Available: https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/.

Defra (2018b) *Defra Air Quality Website*, [Online], Available: http://www.defra.gov.uk/environment/quality/air/airquality/.

Defra (2018c) *Local Air Quality Management (LAQM) Support Website*, [Online], Available: http://laqm.defra.gov.uk/.

Defra (2018d) *UK Pollutant Release and Transfer Register*, [Online], Available: http://prtr.defra.gov.uk/map-search.

Defra (2018e) *UK Ambient Air Quality Interactive Map*, [Online], Available: https://uk-air.defra.gov.uk/data/gis-mapping.

Environment Act (1995), HMSO.

Environment Agency (2005) *Conversion Ratios for NOx and NO2*, [Online], Available: .

Environment Agency (2010) *Horizontal Guidance Note H1 – Annex (f)*, [Online], Available: www.environment-agency.gov.uk.

Environment Agency (2011) *AQTAG06 - Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air*.

Environment Agency (2012) *Guidance to Applicants on Impact Assessment for Group 3 Metals - V.3 September 2012*.

Environment Agency (2016) *Guidance on Assessing Group 3 Metal Stack Emissions from Incinerators - V.4*.

Environment Agency (2018) *Air Emissions Risk Assessment*, [Online], Available: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

Environmental Permitting Regulations (2016) *The Environmental Permitting Regulations in England and Wales*.

IAQM (2016) *Guidance on the Assessment of Dust from Demolition and Construction v1.1*, Available: http://iaqm.co.uk/guidance/.

IAQM (2018) *Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites*, Available: www.iaqm.co.uk/guidance.html.

Ministry of Housing, Communities and Local Government (2018) *National Planning Policy Framework*, Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/607721169 50.pdf.

Moorcroft and Barrowcliffe et al (2017) *Land-Use Planning & Development Control: Planning For Air Quality v1.2*, IAQM, London, Available: http://iaqm.co.uk/guidance/.

National Parks and Access to the Countryside Act (1949), Available: https://www.legislation.gov.uk/ukpga/Geo6/12-13-14/97.

Natural Environment and Rural Communities Act (2006), HMSO.

The Air Quality (England) (Amendment) Regulations 200, Statutory Instrument 3043 (2002), HMSO.

The Air Quality (England) Regulations 2000 Statutory Instrument 928 (2000), HMSO.

The Air Quality Standards Regulations 2010 (No. 1001) (2010), HMSO.

The Council of the European Communities (1992) *European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora*, Available: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043.

The European Parliament and the Council of the European Union (2009) *Directive 2009/147/EC of the European Parliament and of the Council*, Available: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147.

The Waste (England and Wales) Regulations (2011).

WHO (2000) *World Health Organisation, Air quality Guidelines for Europe (Second Edition)*.

Wildlife and Countryside Act (1981), HMSO.

11 Glossary

AADT	Annual Average Daily Traffic
ADMS-5	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
CHP	Combined Heat and Power
CO	Carbon Monoxide
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDF	Local Development Framework
µg/m^3	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter

$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
SO_2	Sulphur Dioxide
SPG	Supplementary Planning Guidance
SPD	Supplementary Planning Document
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEOM	Tapered Element Oscillating Microbalance
TOC	Total Organic Compounds
VCM	Volatile Correction Model
VOC	Volatile Organic Compounds

12 Appendices

A1 Construction Dust Assessment Procedure

A1.1 The criteria developed by IAQM (2016) divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A1.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A1.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A1.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A1.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A1.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A1.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table A1.1.

Table A1.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, 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 >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A1.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

A1.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table A1.2. These receptor sensitivities are then used in the matrices set out in Table A1.3, Table A1.4 and Table A1.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A1.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table A1.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A1.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix A5.

STEP 4: Determine Significant Effects

A1.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant'.

A1.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A1.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect 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 a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect 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	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that 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	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM10
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	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	Special Areas of Conservation with dust sensitive features
Medium	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	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A1.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [5]

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

[5] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A1.4: Sensitivity of the Area to Human Health Effects

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A1.5: 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 A1.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A2 EPUK & IAQM Planning for Air Quality Guidance

A2.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

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

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

Recommended Best Practice

A2.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

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

A2.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A2.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;

- Wherever possible, new developments should not create a new “street canyon”, as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A2.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

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

A2.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to

offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

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

Screening

Impacts of the Local Area on the Development

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

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

Impacts of the Development on the Local Area

A2.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A2.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or

- the development will have a centralised energy facility or other centralised combustion process.

A2.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

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

A2.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A2.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

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

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

A2.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

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

A2.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

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

A2.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Impact Descriptors and Assessment of Significance

A2.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

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

Impact Descriptors

A2.16 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A2.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A2.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[a] Values are rounded to the nearest whole number.

[b] This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A2.17 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant

effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and

- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A2.18 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A2.19 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A3.

A3 Professional Experience

Stephen Moorcroft, BSc (Hons) MSc DIC MIEnvSc MIAQM CEnv

Mr Moorcroft is a Director of Air Quality Consultants, and has worked for the company since 2004. He has over thirty-five years' postgraduate experience in environmental sciences. Prior to joining Air Quality Consultants, he was the Managing Director of Casella Stanger, with responsibility for a business employing over 100 staff and a turnover of £12 million. He also acted as the Business Director for Air Quality services, with direct responsibility for a number of major Government projects. He has considerable project management experience associated with Environmental Assessments in relation to a variety of development projects, including power stations, incinerators, road developments and airports, with particular experience related to air quality assessment, monitoring and analysis. He has contributed to the development of air quality management in the UK, and has been closely involved with the LAQM process since its inception. He has given expert evidence to numerous public inquiries, and is frequently invited to present to conferences and seminars. He is a Member of the Institute of Air Quality Management.

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is an Associate Director with AQC, with twelve years' experience in the field of air quality including the detailed assessment of emissions from road traffic, airports, heating and energy plant, and a wide range of industrial sources including the thermal treatment of waste. He has experience in ambient air quality monitoring for numerous pollutants using a wide range of techniques and is also competent in the monitoring and assessment of nuisance odours and dust. Mr Caird has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Dr Frances Marshall, MSci PhD

Dr Marshall is a Consultant with AQC, having joined the company in September 2016. She is currently gaining experience of undertaking air quality assessments, including the use of dispersion modelling. Prior to joining AQC, Frances spent four years carrying out postgraduate research into atmospheric aerosols at the University of Bristol.

Full CVs are available at www.aqconsultants.co.uk.

A4 Wind Roses

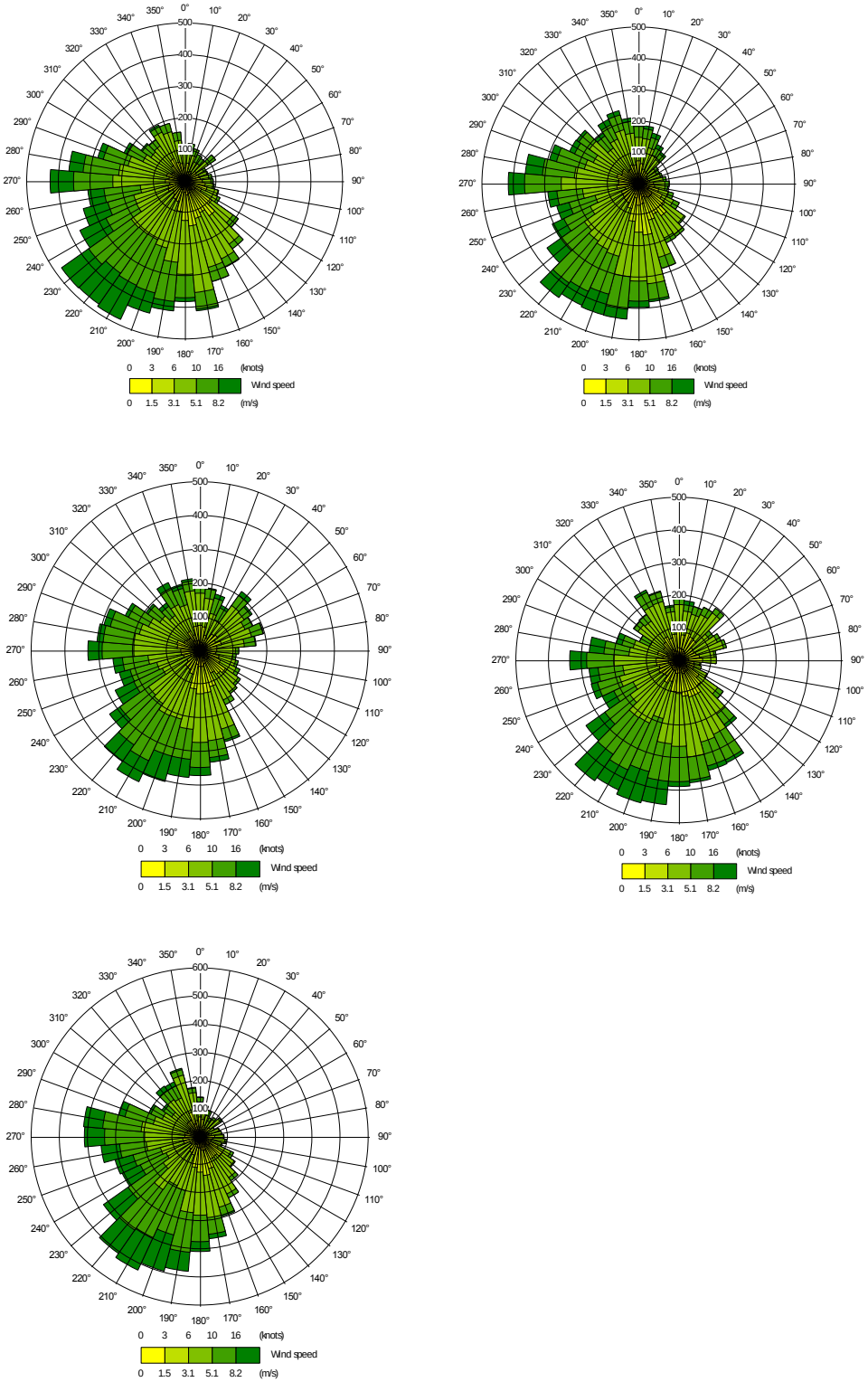

Figure A4.1: Figure Wind Roses for Robin Hood Airport 2011-2015

Table A4.1: Meteorological Data entered into Model.

Magnitude of Change	Development site	Meteorological site
Surface Roughness (m)	0.2	0.2
Surface albedo	Model default (0.23)	Model default (0.23)
Min MO length (m)	1	30
Priestly-Taylor parameter	Model default (1)	Dispersion site value

A5 Construction Mitigation

A5.1 The following is a set of measures that should be incorporated into the specification for the works, this includes both 'highly recommended' and 'desirable' measures for a low risk site:

Communications

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
- display the head or regional office contact information.

Dust Management Plan

- A Construction Environmental Management Plan (CEMP) has been approved by the Council.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked; and
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book.

Monitoring

- Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust. Record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked; and
- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed, or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off their 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; and
- impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- 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, 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 wherever appropriate; and

- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible; and
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- avoid dry sweeping of large areas; and
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. This will include keeping the joint access road to the neighbouring ASOS site clean.