Air Quality CONSULTANTS

Air Quality Assessment: Host Technology EfW, Hownsgill Industrial Estate, Consett

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed Host Technology Energy from Waste (EfW) plant ("the proposed development" or "the proposed facility"), located at Hownsgill Industrial Estate in Consett, County Durham. The assessment has been carried out by Air Quality Consultants on behalf of Project Genesis.

1.2 The proposed development will have a 15 MW_{th} capacity (3.48 MW_e), enabling it to process up to 60,000 tonnes of non-hazardous Refuse Derived Fuel (RDF) per year from various commercial and industrial waste sources/suppliers. It will also provide a source of heat and power to current and future commercial and industrial operations in the Hownsgill Industrial Estate.

1.3 The proposed development is located to the southwest of the town of Consett, within the local authority area of County Durham. Durham County Council has declared two Air Quality Management Areas (AQMAs), in the city of Durham and Chester-le-Street, due to exceedances of the annual mean nitrogen dioxide (NO_2) objective. The proposed development is located more than 15 km from both of these AQMAs, and will not significantly affect air quality within them.

1.4 During the construction phase, there is potential for construction activities to impact upon existing local receptors, and this has been assessed. The main pollutants of concern relating to construction activities are dust and PM_{10}. Emissions from on-site plant and vehicles during the construction phase have not been assessed, as 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, as well as those from the backup gas-fired boilers and emergency diesel generator, have been assessed. In relation to human health, consideration has been given to a comprehensive range of pollutants that may be emitted, as defined in the Industrial Emissions Directive (IED), to which the facility will have to conform for the purposes of environmental permitting. These pollutants are:

- nitrogen dioxide (NO_2)
- total dust (PM_{10} and $PM_{2.5}$);
- carbon monoxide (CO);
- volatile organic compounds (VOCs)
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- ammonia (NH_3);

- dioxins and furans (PCDD/F);
- polyaromatic hydrocarbons (PAH) as benzo[a]pyrene (B[a]P);
- polychlorinated biphenyls (PCBs);
- the following trace metals:
  - cadmium (Cd);
  - thallium (Tl);
  - mercury (Hg)
  - antimony (Sb);
  - arsenic (As);
  - lead (Pb);
  - chromium (Cr);
  - cobalt (Co);
  - copper (Cu);
  - manganese (Mn);
  - nickel (Ni); and
  - vanadium (V).

1.6 In addition to the assessment of impacts to human health, the potential air quality impacts on sensitive ecological habitats have also been addressed. The North Pennine Moors, a European designated Special Area of Conservation (SAC) and Special Protection Area (SPA), is located within 10 km of the proposed development, and has the potential to be affected by emissions from the facility. There are also a number of Ancient Woodland (AW) and Local Nature Reserve (LNR) sites identified within 2 km of the proposed development, which have also been assessed. These distance thresholds are those recommended by the Environment Agency. These sites are shown in Figure 1. The pollutants relevant to sensitive ecosystems are:

- nitrogen oxides (NOx);
- ammonia (NH_3);
- sulphur dioxide (SO_2);
- hydrogen fluoride (HF);
- nutrient nitrogen deposition (to which NOx and NH_3 emissions contribute); and
- acid deposition (to which NOx, NH_3, SO_2 and HCl emissions contribute).

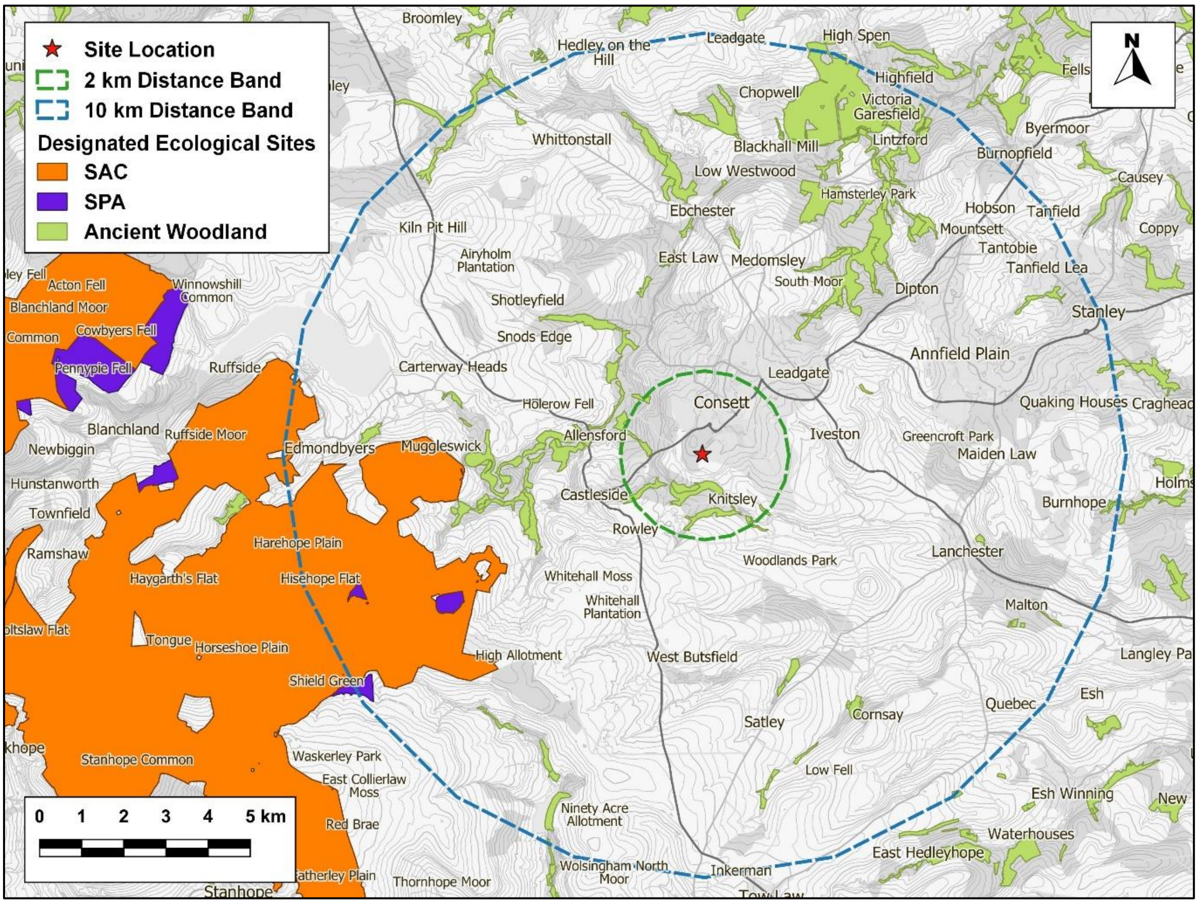

Figure 1: Study Area and Ecological Sites within 2 km and 10 km of the Proposed Development

1.7 Furthermore, the proposed development will also lead to changes in vehicle flows on local roads, which may impact on air quality at existing receptors along the local road network. The main air pollutants of concern relating to road traffic are NO_2 and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.8 This report describes existing local air quality conditions and the predicted impacts of the proposed development on air quality in the future, where relevant comparing scenarios where the proposed development does, or does not proceed. It has been prepared taking into account all relevant local and national guidance and regulations.

2 Policy Context

2.1 The United Kingdom formally left the European Union (EU) on 31 January 2020; until the end of 2020 there will be a transition period while the UK and EU negotiate additional arrangements. During this period EU rules and regulations will continue to apply to the UK. All European legislation referred to in this report is written into UK law and will remain in place beyond 2020, unless amended, although there is uncertainty at this point in time as to who will enforce the requirements of some of this legislation.

Policy for the Protection of Human Health

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

2.2 The European Union has set limit values (concentrations which must not be exceeded) for a range of key air pollutants, which are set out in the EU Framework Directive 2008/50/EC (The European Parliament and the Council of the European Union, 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 2008

2.3 The Waste Framework Directive (The European Parliament and the Council of the European Union, 2008) sets out the EU member state obligations for 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 2010

2.4 The Industrial Emissions Directive (IED) (The European Parliament and the Council of the European Union, 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.

The Environmental Permitting (England and Wales) Regulations 2016

2.5 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.

2.6 In January 2019, amendments to the Permitting Regulations were laid before Parliament, with the changes coming into force following the exit from the European Union as The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations (2019). The changes mostly relate to terminology, and clarification on who the competent authority is.

The Waste (England and Wales) Regulations 2011

2.7 The Waste Framework Directive (The European Parliament and the Council of the European Union, 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

2.8 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 (AQS) and objectives (AQO) 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

2.9 Some of the AQOs set out in the UK Air Quality Strategy are for the use of local authorities as part of the LAQM, which are set out in the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

Air Quality Standards Regulations 2010

2.10 The air quality limit values set out in EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) are transposed into English law by the Air Quality Standards Regulations (2010). This imposes duties on the Secretary of State in achieving the limit values set out in the directive.

Clean Air Strategy 2019

2.11 The Clean Air Strategy (Defra, 2019) 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. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Policy for the Protection of Sensitive Ecosystems

European Policies

2.12 The “Habitats Directive” (The Council of the European Communities, 1992) requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (2017) transpose the Directive into UK law. They 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 the latter classified under the “Birds Directive” (The European Parliament and the Council of the European Union, 2009), which is implemented in UK law through the Conservation of Habitats and Species Regulations (2010). These sites form a network termed “Natura 2000”.

2.13 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.

2.14 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.

2.15 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 Policies

2.16 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 Policy

2.17 The National Planning Policy Framework (NPPF) (2019a) 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 (Paragraph 8c) 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".

2.18 To prevent unacceptable risks from air pollution, Paragraph 170 of 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".

2.19 Paragraph 180 states:

"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".

2.20 More specifically on air quality, Paragraph 180 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".

2.21 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019b), 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 Limit Values. 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, or where the need for emissions reductions has been identified".

2.22 The PPG also states that:

"Air quality considerations may also be relevant to obligations and policies relating to the conservation of nationally and internationally important habitats and species".

2.23 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

2.24 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*". 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"*.

2.25 Regarding the need for an air quality assessment, the PPG states that:

"Whether 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 have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity".

2.26 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

2.27 Regarding sites that will operate under an Environmental Permit, PPG states that:

"It is not necessary for air quality assessments that support planning applications to duplicate aspects of air quality assessments that will be done as part of non-planning control regimes, such as under Environmental Permitting Regulations".

2.28 The PPG 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 will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".

Local Planning Policy

Local Plan

2.29 The County Durham Plan (Durham County Council, 2020) was adopted in 2020 and guides planning and development in the county up to 2035. Policy 31 concerns amenity and pollution, and states:

"Development will be permitted where it can be demonstrated that there will be no unacceptable impact, either individually or cumulatively, on health, living or working conditions or the natural environment and that can be integrated effectively with any existing business and community facilities. The proposal will also need to demonstrate that future occupiers of the proposed development will have acceptable living and/or working conditions. Proposals which will have an unacceptable impact such as through overlooking, visual intrusion, visual dominance or loss of light, noise or privacy will not be permitted unless satisfactory mitigation measures can be demonstrated whilst ensuring that any existing business and/or community facilities do not have any unreasonable restrictions placed upon them as a result.

Development which has the potential to lead to, or be affected by, unacceptable levels of air quality, inappropriate odours, noise and vibration or other sources of pollution, either individually or cumulatively, will not be permitted including where any identified mitigation cannot reduce the impact on the environment, amenity of people or human health to an acceptable level."

2.30 The Plan also contains policies concerning the development and management of minerals and waste facilities. Policy 61 concerns the location of new waste facilities deals with the potential impact on designates sites and areas, and states:

"Proposals for new or enhanced waste management facilities will be permitted where they will assist the efficient collection, recycling and recovery of waste materials and they:

a. are located outside and do not adversely impact upon the setting or integrity of internationally, nationally and locally designated sites and areas;…"

Air Quality Action Plans

2.31 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018a) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a CAZ. There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement 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.

2.32 There are no Local Quality Action Plans relevant to the study area.

Guidance Notes

Waste Incineration Best Available Techniques (BAT) Reference Document

2.33 A new Waste Incineration Best Available Techniques (BAT) Reference Document (hereafter referred to as "the BREF") was published in December 2019 (European Commission, 2019), and sets out new BAT-associated emission levels (BAT-AELs) that the proposed facility will be required to meet.

Environment Agency Air Emissions Risk Assessment

2.34 The Environment Agency's 'Air Emissions Risk Assessment' guidance (Environment Agency, 2016a) 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.

2.35 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, 2016b).

Health and Safety Executive Workplace Exposure Limits

2.36 The Health and Safety Executive's EH40/2005 Workplace Exposure Limits document (HSE, 2005) contains a list of the workplace exposure limits for substances hazardous to health. For pollutants assessed in this report which have no AQO or EALs, the occupational exposure emissions limits in EH40 have been used, following the advice set out in the EA's Air Emissions Risk Assessment guidance.

3 Assessment Criteria

Criteria to Protect Human Health

3.1 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 was to be achieved by 2020. Where there is no AQO, the Environment Agency's Assessment Levels have been used as EALs.

3.2 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, 2018b), 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.

3.3 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.

3.4 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.

3.5 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 mean	40	N/A	X	
	1-hour mean	200	18	X	
Fine Particles (PM_{10})	Annual mean	40	N/A	X	
	24-hour mean	50	35	X	
Fine Particles ($PM_{2.5}$) [a]	Annual mean	25	N/A	X	
SO_2	24-hour mean	125	3	X	
	1-hour mean	350	24	X	
	15-minute mean	266	35	X	
CO	8-hour rolling mean	10,000	N/A	X	
HF	Annual mean	16	N/A		X
	1-hour mean	160	N/A		X
HCl	Annual mean	20	N/A		X [b]
	1-hour mean	750	N/A		X
Benzene	Running annual mean	16.25	N/A	X	
	Annual mean	5 [c]	N/A	X	
1,3-butadiene	Annual mean	2.25 [c]	N/A	X	
Cadmium	Annual mean	0.005	N/A	X	
Thallium	Annual mean	1	N/A		X [b]
	1-hour mean	30	N/A		X [b]
Mercury	Annual mean	0.25	N/A		X
	1-hour mean	7.5	N/A		X
Antimony	Annual mean	5	N/A		X
	1-hour mean	150	N/A		X
Arsenic	Annual mean	0.003	N/A		X
Lead	Annual mean	0.25	N/A	X	
Chromium (III)	Annual mean	5	N/A		X
	1-hour mean	150	N/A		X
Chromium (VI)	Annual mean	0.0002	N/A		X
	1-hour mean	15	N/A		X [b]
Cobalt	Annual mean	1	N/A		X [b]
	1-hour mean	30	N/A		X [b]
Copper	Annual mean	10	N/A		X

Pollutant	Averaging Period	Concentration (µg/m^3)	Number of Periods Allowed to Exceed per Year	AQO	EAL
	1-hour mean	200	N/A		X
Manganese	Annual mean	0.15	N/A		X
	1-hour mean	1,500	N/A		X
Nickel	Annual mean	0.02	N/A	X	
Vanadium	Annual mean	5	N/A		X
	1-hour mean	1	N/A		X
NH_3	Annual mean	180	N/A		X
	1-hour mean	2500	N/A		X
PCDD/F	Annual mean	0.0000003	N/A		X
PAH (as B[a]P)	Annual mean	0.00025	N/A	X	
PCBs	Annual mean	0.2	N/A		X
	1-hour mean	6	N/A		X

[a] The $PM_{2.5}$ objective, which was 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 was to be met by 2015.

[b] Long- and short-term EALs for thallium and cobalt, the long-term EAL for HCl and the short-term EAL for chromium (VI) have been calculated from the exposure limits in EH40/2005 and converted to the respective EAL using guidance in H1 (Environment Agency, 2010).

[c] TOCs assessed against the EALs for benzene and 1,3-butadiene, since these are the most stringent EALs for any VOC.

Criteria to Protect Vegetation and Ecosystems

3.6 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.

3.7 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 SPA or 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.

3.8 The Air Pollution Information System (APIS) database (APIS, 2020) 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, 2016a). 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.

3.9 Critical loads for the North Pennine Moors SAC/SPA are defined by APIS; the lowest critical load for any species within the habitat has been used as the EAL. For local sites within 2 km of the facility, no detailed information about the types of habitats present is available, and so critical loads have been determined from the assumed habitat. For acid deposition, no critical loads have been set for the assumed habitat of the local sites, and it can therefore be reasonably assumed that the habitats are not susceptible to acid deposition. Relevant critical levels and critical loads are set out in Table 2.

Table 2: Environmental Assessment Levels (Critical Levels and Critical Load) for Vegetation and Ecosystems [a]

Pollutant and Averaging Period	Species/Habitat	EAL
Annual Mean NOx	All sensitive communities	30 µg/m^3
24-hour Mean NOx	All sensitive communities	75 µg/m^3
Annual Mean NH_3	All higher plants	3 µg/m^3
	Lichens and bryophytes	1 µg/m^3
Annual Mean SO_2	All higher plants	20 µg/m^3
	Lichens and bryophytes	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 Load	North Pennine Moors SAC/SPA	5 kgN/ha/yr
	Ancient Woodland [d]	10 kgN/ha/yr
Acid Deposition Critical Load	North Pennine Moors SAC/SPA	0.491 keq/ha/yr

a Taken from APIS (2020) and from Table B4 of the EA's H1 Guidance (Environment Agency, 2010).

b This is the worst-case critical level to assess against. IAQM guidance (IAQM, 2019) states that a suitable 24-hour mean NOx critical level to assess against is 200 µg/m^3.

c Minimum location-specific critical loads as defined by APIS (2020).

d Based on Broadleaved, Mixed and Yew Woodland habitats.

Screening Criteria for Road Traffic

3.10 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[1] recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality impacts. The approach first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-

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

residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment.

3.11 The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. The screening thresholds inside an AQMA are a change in flows of more than 25 heavy duty vehicles or 100 light duty vehicles per day; outside of an AQMA the thresholds are 100 heavy duty vehicles or 500 light duty vehicles. Where these criteria are exceeded, a detailed assessment is likely to be required, although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative"*, and *"it may be appropriate to amend them on the basis of professional judgement"*.

Construction Dust Criteria

3.12 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by IAQM (2016) has been used. Full details of this approach are provided in Appendix A1.

Assessment of Significance

Construction Dust Significance

3.13 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'.

Operational Air Quality Criteria Issued by the Environment Agency

3.14 The Environment Agency has adopted criteria (Environment Agency, 2016a) 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, 8-hour and 24-hour mean) process contribution is <10% of the short-term environmental standard.

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

3.15 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, 2016a).

3.16 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 pollutant concentrations.

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

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

3.18 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.

3.19 For the assessment of trace metals, the Environment Agency's Guidance Note for Metals (Environment Agency, 2016b) 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 BREF Emission Limit Value (ELV) of 0.3 mg/Nm^3 as a worst-case[3]. 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 PEC <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

3 The BREF-EAL of 0.3 mg/Nm^3 has been used in preference to the IED ELV, since the plant will need to comply with the more stringent emission limits.

the maximum measured concentration of the pollutant as per the EA guidance has been assumed, and an 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.

3.20 The IAQM has recently issued guidance on assessing air quality impacts on designated conservation sites (IAQM, 2019) which is consistent with the Environment Agency guidance used here.

Operational Air Quality Criteria Issued by the IAQM and EPUK

3.21 While the Environment Agency's criteria are more relevant to this Proposed Development given that the site will be permitted and regulated by the Environment Agency, consideration has also been given to the EPUK/IAQM guidance document aimed specifically at planning applications.

3.22 The approach developed jointly by EPUK & IAQM (Moorcroft and Barrowcliffe et al, 2017) is that any change in concentration smaller than 0.5% of the long-term environmental standard will be negligible, regardless of the existing air quality conditions. Where the change in concentration represents more than 0.5% of the standard, existing conditions are taken into consideration when describing the impacts. This is more stringent than the Environment Agency screening criterion of 1% set out above, but the guidance was not specifically designed for industrial developments, being more relevant to considering impacts on the primary pollutants associated with road traffic emissions, nitrogen dioxide and particulate matter, thus it is considered more appropriate to use the Environment Agency criterion for other pollutants.

3.23 The impact descriptors determined using the EPUK/IAQM guidance 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, as shown in Table 3.

Table 3: EPUK/IAQM Air Quality Impact Descriptors for Individual Receptors [a]

Long-Term Average Concentration at Receptor In Assessment Year [b]	Change in concentration relative to AQO				
	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.

3.24 The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A2.

Approach Used in this Assessment

3.25 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, in line with the EPUK/IAQM guidance) 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?

3.26 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. The more detailed assessment uses the EPUK/IAQM approach for nitrogen dioxide and the Environment Agency's criteria for all other pollutants.

4 Assessment Approach

Existing Conditions

4.1 Existing sources of emissions and baseline air quality conditions 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, 2020a);
- local sources have been identified through examination of Durham County Council's Air Quality Review and Assessment reports;
- 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 Defra's background maps (Defra, 2020b), which cover the whole of the UK on a 1x1 km grid. Background concentrations for nitrogen oxides, nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been derived from the 2018-based background maps, whilst those for sulphur dioxide, benzene, CO and 1,3-butadiene have been derived from the 2001-based maps, which are the most recent for these pollutants. The background annual mean nitrogen oxides and nitrogen dioxide maps for 2019 have been calibrated against concurrent measurements from national monitoring sites (AQC, 2020). The calibration factor calculated has then been applied to future year backgrounds;
- background nitrogen deposition fluxes to the ecological sites have been taken from the APIS website (APIS, 2020) and represent 3-year averages for the period 2016-2018; and
- whether or not there are any exceedances of the annual mean EU limit value for nitrogen dioxide in the study area has been identified using the maps of roadside concentrations published by Defra (2020c) (2020d). 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, 2020d), which are available for the years 2009 to 2018, show no exceedances of the limit values anywhere in the UK in 2018.

Construction Impacts

4.2 The construction dust assessment considers the potential for impacts within 350 m of the site 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

Screening of Road Traffic Impacts

4.3 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 3.11. Where impacts can be screened out, there is no need to progress to a more detailed assessment. Consideration has also been given to the potential cumulative impacts of development-generated road traffic emissions alongside those from the main stack and supplementary boilers within the proposed development.

Sensitive Locations

4.4 Concentrations have been modelled across a 10 km x 10 km model domain, with the stack at the centre. Concentrations have been predicted over this area using nested Cartesian grids. These grids have a spacing of 5 m x 5 m within 200 m of the facility, 25 m x 25 m within 1 km of the facility, 50 m x 50 m within 2 km of the facility, 250 m x 250 m within 2.5 km of the facility, and 500 m x 500 m within 5 km of the facility. The extent of the gridded area is shown in Figure 2, with all gridded receptors modelled at a height of 1.5 m to represent ground-floor level concentrations.

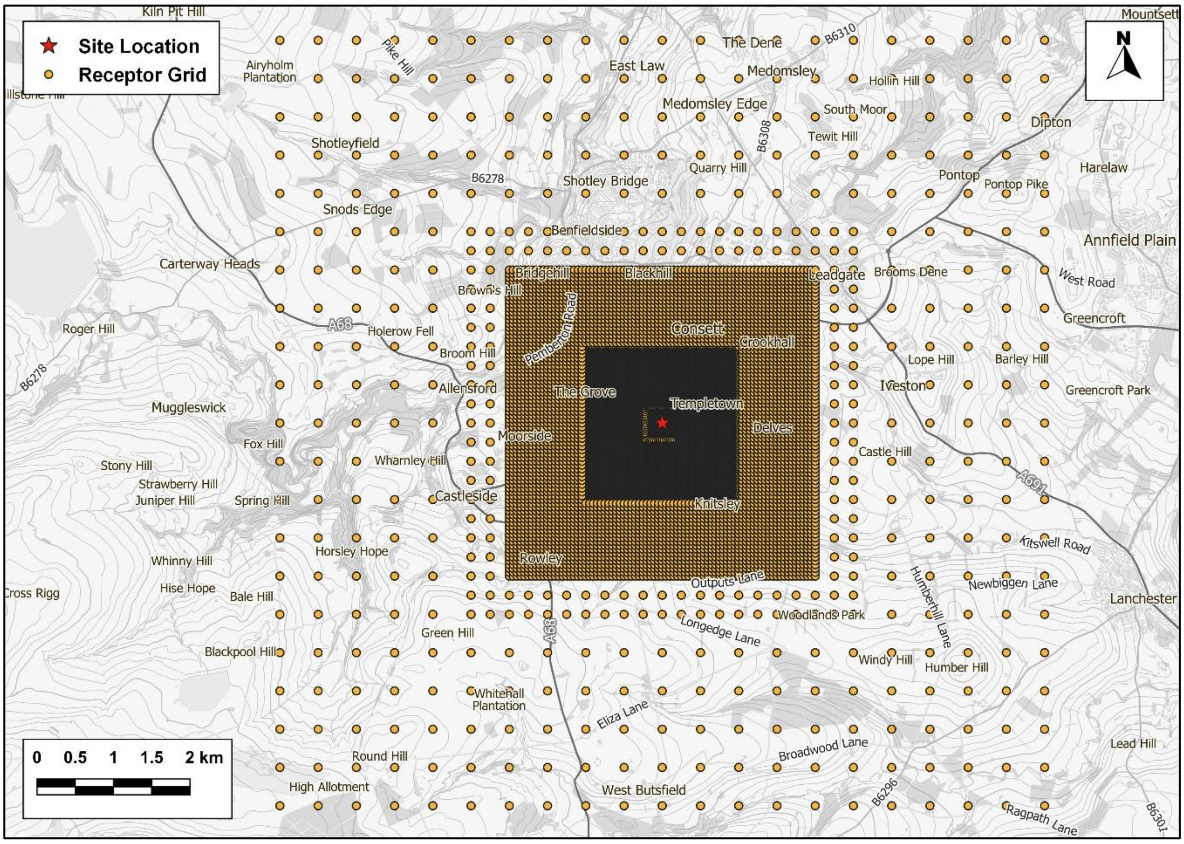

Figure 2: Nested Cartesian Grids of Receptors

4.5 Pollutant concentrations have also been modelled for a number of discrete receptor locations. These represent both human health exposure, including the nearest (worst-case) residential properties, and designated ecosystems which are sensitive to changes in pollutant concentrations.

4.6 Nineteen (19) human health locations have been identified as receptors for this assessment, which include existing residential properties, residential dwellings planned or under construction, and planned healthcare facilities. An additional 38 receptor locations have been identified to represent worst-case locations within the designated sensitive ecosystems; these have been located at the habitat boundaries closest to the facility. The receptors are described in Table 4, with the human health receptors shown in Figure 3, and the designated habitat receptors shown in Figure 4.

Table 4: Description of Receptor Locations

Receptor	Description	X coordinate	Y coordinate	Heights Modelled (m) [a]
Human Health Receptors				
1	Spiro Court	410672.6	550091.0	1.5, 5.0, 8.0
2	The Chequers	410701.3	550044.7	1.5, 5.0, 8.0
3	The Chequers	410764.2	549998.8	1.5, 5.0, 8.0
4	The Chequers	410824.5	549975.3	1.5, 5.0, 8.0
5	Ovington Court	410943.8	549928.1	1.5, 5.0, 8.0
6	Millfield	410963.6	549796.9	1.5, 5.0, 8.0
7	Langdon Close	410981.3	549697.6	1.5, 5.0, 8.0
8	Langdon Close	411016.7	549550.0	1.5, 5.0, 8.0
9	Berry Edge South [b]	409883.1	550159.4	1.5, 5.0
10	Berry Edge South [b]	409965.9	550218.5	1.5, 5.0
11	Berry Edge South [b]	410113.6	550337.9	1.5, 5.0
12	Deneburn Terrace	409594.4	549941.5	1.5, 5.0
13	Deneburn Terrace	409575.1	549928.2	1.5, 5.0
14	Howns Farm	409896.0	549158.6	1.5, 5.0
15	Knitsley Lane	410955.3	549449.4	1.5, 5.0
16	Social Care Unit, Genesis Way [b]	410344.2	550106.8	1.5, 5.0
17	Extra Care Unit, Genesis Way [b]	410379.3	550049.2	1.5, 5.0
18	Extra Care Unit, Genesis Way [b]	410419.2	550038.1	1.5, 5.0
19	Community Hospital, Genesis Way [b]	410462.3	550071.7	1.5, 5.0
Designated Ecosystem Receptors				
NPM1	North Pennine Moors SAC/SPA	404181.0	549859.3	1.5
NPM2	North Pennine Moors SAC/SPA	404658.6	549446.9	1.5
NPM3	North Pennine Moors SAC/SPA	404699.7	549340.5	1.5
NPM4	North Pennine Moors SAC/SPA	404539.2	548633.4	1.5
NPM5	North Pennine Moors SAC/SPA	405287.4	547543.7	1.5
NPM6	North Pennine Moors SAC/SPA	405518.8	547271.3	1.5
NPM7	North Pennine Moors SAC/SPA	405712.9	547095.9	1.5
NPM8	North Pennine Moors SAC/SPA	405675.5	546886.9	1.5
NPM9	North Pennine Moors SAC/SPA	405294.9	546442.8	1.5
NPM10	North Pennine Moors SAC/SPA	405492.7	544834.5	1.5
NPM11	North Pennine Moors SAC/SPA	405485.2	544640.4	1.5
AFW1	Allensford Woods	408551.9	550240.5	1.5
AFW2	Allensford Woods	408494.2	550014.2	1.5
AFW3	Allensford Woods	408447.1	549944.1	1.5
AFW4	Allensford Woods	408457.8	549747.0	1.5

Receptor	Description	X coordinate	Y coordinate	Heights Modelled (m) [a]
AFW5	Allensford Woods	408481.8	549569.5	1.5
RBCB1	Rowley Bank/Crag Bank	409292.1	549163.0	1.5
RBCB2	Rowley Bank/Crag Bank	409304.5	549125.7	1.5
RBCB3	Rowley Bank/Crag Bank	409441.2	549028.1	1.5
RBCB4	Rowley Bank/Crag Bank	409496.2	549008.6	1.5
KW1	Knitsley Wood	409664.9	549097.3	1.5
KW2	Knitsley Wood	409886.7	549005.0	1.5
KW3	Knitsley Wood	410007.5	548931.4	1.5
KW4	Knitsley Wood	410149.5	549042.3	1.5
KW5	Knitsley Wood	410461.0	549081.4	1.5
KW6	Knitsley Wood	410677.6	549015.7	1.5
KW7	Knitsley Wood	410795.6	548915.4	1.5
KW8	Knitsley Wood	411235.8	548337.6	1.5
HB1	Howden Burn	409068.4	550908.8	1.5
HB2	Howden Burn	409112.8	551084.6	1.5
CLW1	Consett Low Wood	409091.5	549641.4	1.5
CLW2	Consett Low Wood	409125.2	549691.1	1.5
CLW3	Consett Low Wood	409159.0	549728.4	1.5
CLW4	Consett Low Wood	409157.2	549795.8	1.5
DW1	Dam Wood	411377.8	548263.0	1.5
DW2	Dam Wood	411505.6	548229.3	1.5
DW3	Dam Wood	411704.5	548486.7	1.5
DW4	Dam Wood	411716.9	548531.1	1.5

[a] A height of 1.5 m is used to represent ground level exposure. Additional heights of 5.0 m and 8.0 m have been modelled for certain receptors to represent first and second-floor level exposure.

[b] Receptors planned or under construction.

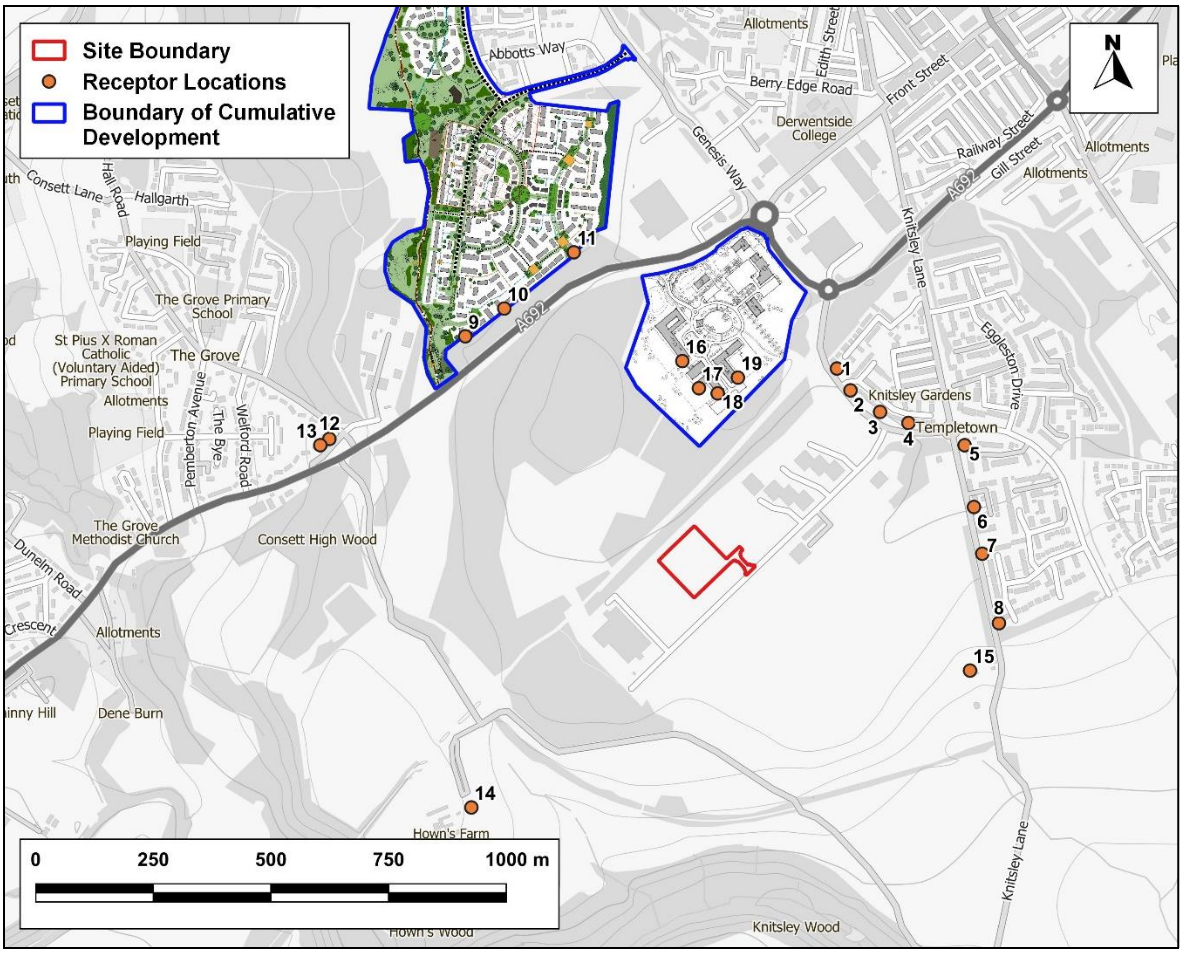

Figure 3: Human Health Receptor Locations

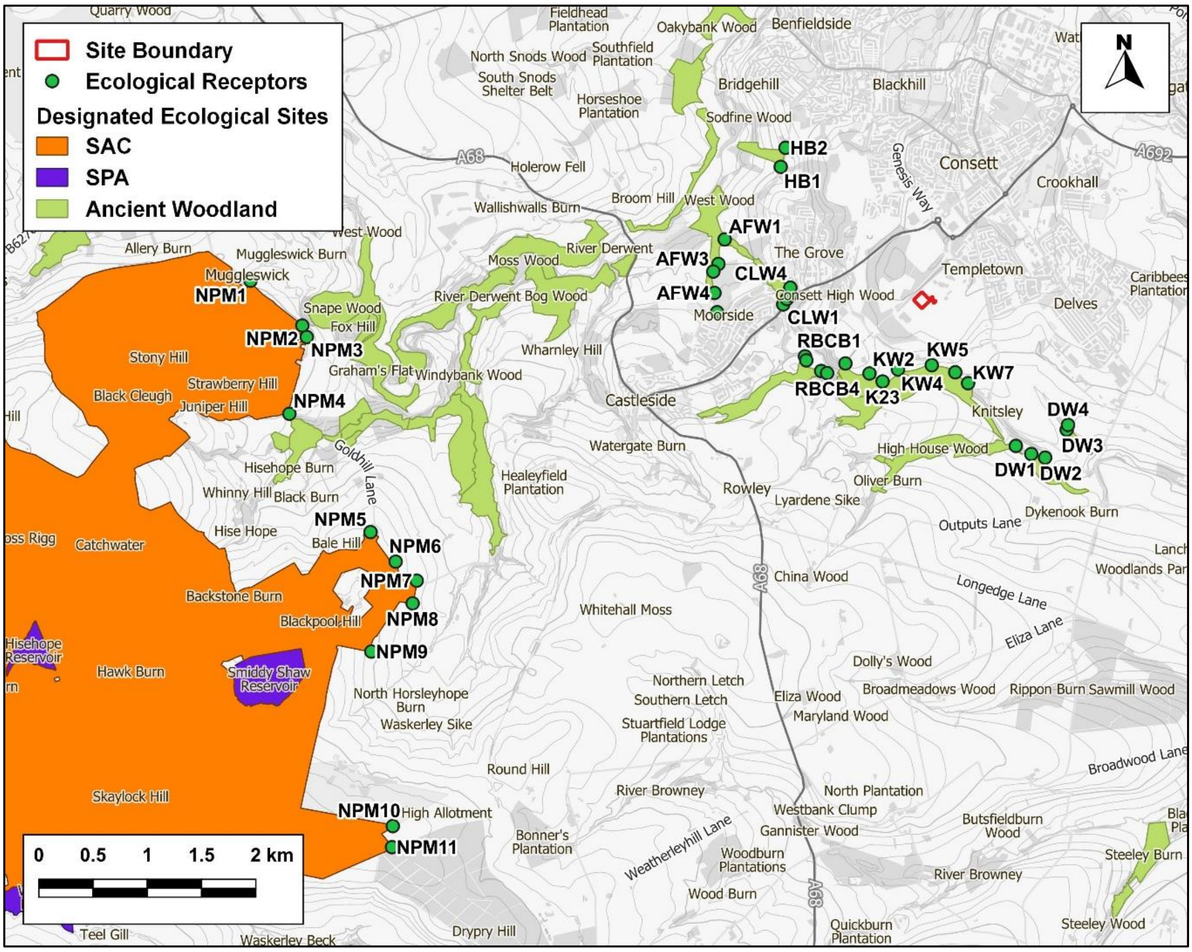

Figure 4: Designated Habitat Receptor Locations

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Modelling Methodology

4.7 The impacts of emissions from the proposed development have 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.

4.8 The facility will include an emergency diesel generator to provide power in case of emergencies, which will be tested briefly once per week as part of routine maintenance checks. This is expected to amount to a total operation of approximately 13 hours per year. Given this very limited usage, it is expected that the contribution of the generator to concentrations of nitrogen dioxide and particulate matter will be so small as to be insignificant when compared to that of the emissions from the main stack, and it is therefore not considered further.

Stack Emissions

4.9 The applicant has provided data on the stack diameter, volumetric flow rate, temperature and gas composition in terms of the volume of water and oxygen. This information has been provided for actual operating conditions and has been used to calculate the exit velocity and 'normalised' conditions. The data provided, and the calculated parameters, are set out in Table 5.

Table 5: Release Parameters for the Proposed Facility

Stack Parameter	Annual Average Conditions
Efflux Actual Volume Rate (Am^3/s)	13.8
Exhaust Temperature (°C)	165
Water Volume (%)	19.0
Oxygen by Dry Volume (%)	7.4
Stack Internal Diameter (m)	1.2
Stack Height above Ground Level (m)	50
Stack Location (O.S. x,y)	410342.8, 549710.3
Calculated Parameters	
Actual Exit Velocity	12.2
Efflux Normalised Volume Rate (Nm^3/s) [a]	9.5

[a] Normalised to 273 K, 1 atm, dry gas, 11% O_2.

4.10 The pollutant emission rates used in the assessment have been derived from a combination of sources, and are set out in Table 6; where new emission rates are presented for a given averaging period in the BREF, these have been used. Where no new emission rates are presented in the BREF, those from the IED have been used. An emission rate for PAH (as B[a]P) has been taken from Figure 8.121 of the BREF, which presents measured emission rates at municipal solid waste incineration sites. The maximum "average" emission rate from any site included in the graph has been estimated from the graph, and used as the annual mean emission rate, which is considered worst-case. The relevant calculated emission rates (g/s) are presented in Table 6, based on combining the relevant limit with the release conditions.

Table 6: Pollutant Emission Parameters for the Proposed Facility

Pollutant	Averaging Period	Maximum Emission Concentration (mg/Nm^3)	Emission Rate (g/s) [a, b]
NOx	Annual mean	120	1.14
	1-hour mean	400	3.80
PM_{10}	Annual mean	5	0.047
	24-hour mean	5	0.047
SO_2	Annual mean	30	0.29
	1-hour / 15-minute mean	200	1.90
	24-hour mean	200	1.90
CO	Annual mean	50	0.48
	8-hour rolling mean	100	0.95
TOC	Annual mean	10	0.095
	1-hour mean	20	0.19
HCl	Annual mean	6	0.057
	1-hour mean	60	0.57
HF	Annual mean	1	0.009
	1-hour mean	1	0.009
	24-hour / 168-hour mean	1	0.009
Cd and Tl	Annual mean	0.02	0.0002
Hg	Annual mean	0.01	9.49×10^{-5}
	1-hour mean	0.01	9.49×10^{-5}
Group III Metals [c]	Annual mean	0.3	0.0028
	1-hour mean	0.3	0.0028
NH_3	Annual mean	10	0.095
	1-hour mean	10	0.095
Dioxins and Furans	Annual mean	0.00000006	5.70×10^{-10}
Cr(VI) [d]	Annual mean	0.00013 (max)	1.23×10^{-6}
		0.000035 (mean)	3.32×10^{-7}
		0.0000023 (min)	2.18×10^{-8}
PAH	Annual mean	0.00015	1.42×10^{-6}
PCB	Annual mean	0.00000008	7.59×10^{-10}
	1-hour mean	0.00000008	7.59×10^{-10}

a The emission rate is calculated by multiplying the normalised emission rate by the efflux normalised volume flow rate, and dividing by 1000.

b Rounded values are presented, but unrounded values were used in the model.

c Group III metals include Sb, As, Pb, Cr(III), Co, Cu, Mn, Ni and V.

[d] Minimum, mean and maximum measured emission rates of Cr(VI) specified in the EA's Guidance Note for Metals (Environment Agency, 2016b).

Boiler Emissions

4.11 The proposed development will also include 3 no. natural gas-fired boilers to provide hot water during periods of routine maintenance of the main EfW. It is anticipated that the EfW will operate for approximately 8,000 hours per year, thus the boilers will operate for up to 760 hours per year. The principal pollutant of concern from the boilers is nitrogen dioxide.

4.12 The emission parameters for the boilers have been derived from technical datasheets for the units. The parameters input into the model are presented in Table 7.

Table 7: Release Parameters for the Proposed Boilers (per Boiler)

Stack Parameter	Annual Average Conditions		
Specified Net Fuel Input (kW)	3,000		
Calculated Gross Fuel Input (kW)	3,323		
Efflux Actual Volume Rate (Am^3/s)	1.25		
Normalised Efflux Volume Rate (Nm^3/s) [a]	0.84		
Water Volume (%)	17.1%		
Oxygen by Dry Volume (%)	2.5%		
Exit Velocity (m/s)	6.278		
Normalised NOx Emission Rate (mg/Nm^3) [a]	70		
Calculated NOx Emission Rate (g/s)	0.059		
Exhaust Temperature (°C)	65		
Stack Internal Diameter (m)	0.504		
Stack Height above Ground Level (m)	25		
Stack Location (O.S. x,y)	410372.5, 549725.4	410374.6, 549723.3	410376.7, 549721.2

[a] Normalised to 273 K, 1 atm, dry gas, 3% O_2.

Post-Processing

4.13 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 percentile of the 1-hour mean nitrogen oxides concentrations, 90.4th 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.

4.14 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.

4.15 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 taken from AQTAG06 (2011), as outlined in Table 8.

Table 8: Dry Deposition Velocities

Pollutant	Habitat Type	Velocity (m/s)
NO_2	Grassland	0.0015
	Forest	0.003
NH_3	Grassland	0.02
	Forest	0.03
SO_2	Grassland	0.012
	Forest	0.024
HCl	Grassland	0.025
	Forest	0.06

4.16 In this assessment, the grassland deposition velocity has been applied to the North Pennine Moors designated site, whereas the forest deposition velocity has been applied to all designated ancient woodlands. The velocities are applied by multiplying the predicted pollutant concentration (µg/m^3) by the velocity (m/s) to predict a deposition flux (µg/m^2/s). Subsequent calculations required to present the data as kg/ha/yr (nutrient nitrogen) or keq/ha/yr (acidification) follow chemical and mathematic rules.

Assessment Scenarios

4.17 Predictions of pollutants from the stack have been modelled assuming that the facility operates continuously throughout the year, at full load, which is conservative given that it will actually be shut down for routine maintenance for 4-5 weeks each year. Predictions have been made assuming that the facility operates at the IED (or BREF) emission limits.

4.18 Annual mean PCs from the boilers have been scaled assuming they will operate for up to 760 hours per year, i.e. outputs have been multiplied by 0.087 (760 / 8760). Short term PCs have not been scaled.

Meteorology

4.19 Five years of hourly sequential data (2015 to 2019 inclusive) from the Albemarle meteorological monitoring station have been used in the assessment as a sensitivity test to account for the variable effects of meteorology on pollution dispersion. The wind roses for each year of meteorological data, along with the meteorological parameters required for the modelling, are provided in Appendix A3. The maximum predicted PCs during any of the five years have then been used in the assessment.

Building Wake Effects

4.20 ADMS-5 has the ability to simulate the entrainment of exhaust plumes into the wake of nearby buildings. Figure 5 shows the location and extent of the buildings included in the modelling.

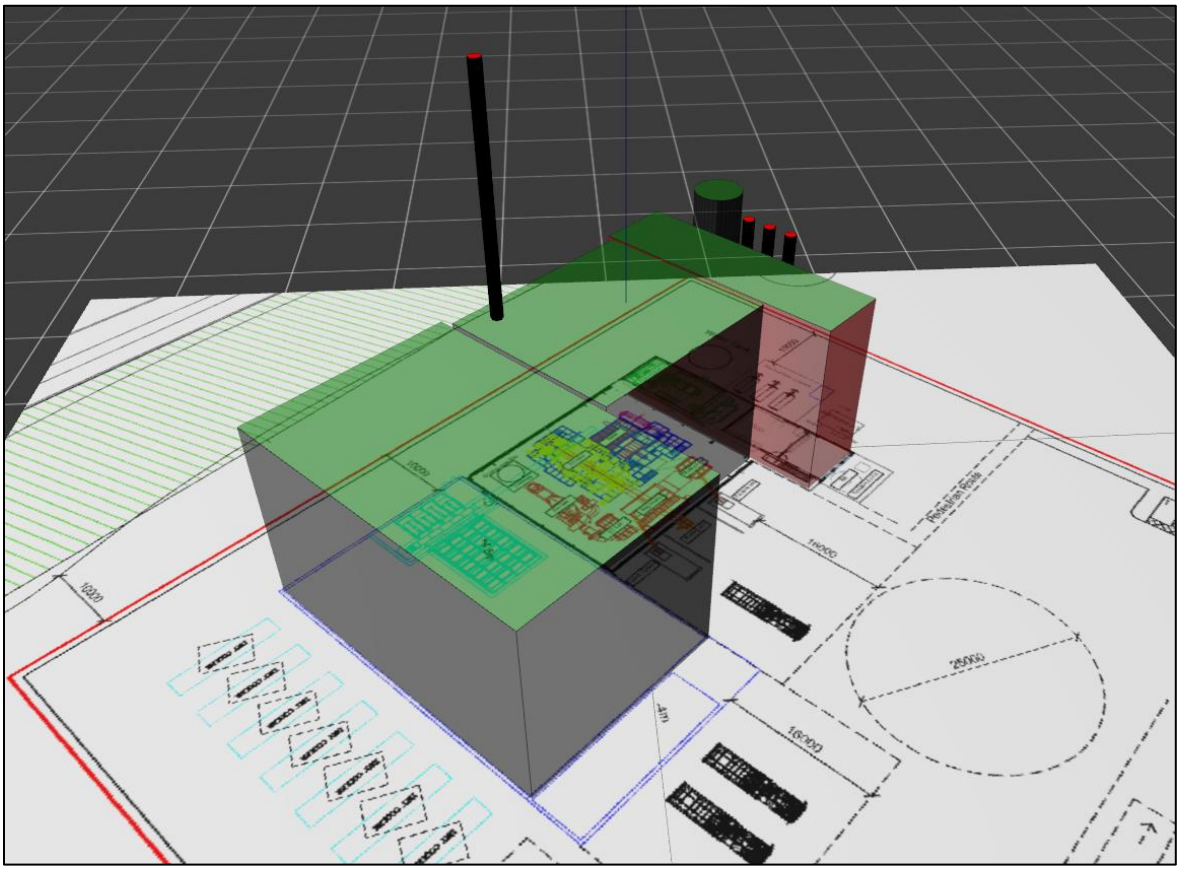

Figure 5: 3D Modelled Buildings (green tops) and Stack and Flue Locations (red top)

Contains data from SBA AKA Architects Group, drawing no. SBAKA-00-GF-DR-A AL(0) 001 Proposed Site Plan.

Terrain Effects

4.21 The effects of local terrain have been included within the model based on OS Terrain 50 data. The variation of terrain across the study area is shown in Figure 6.

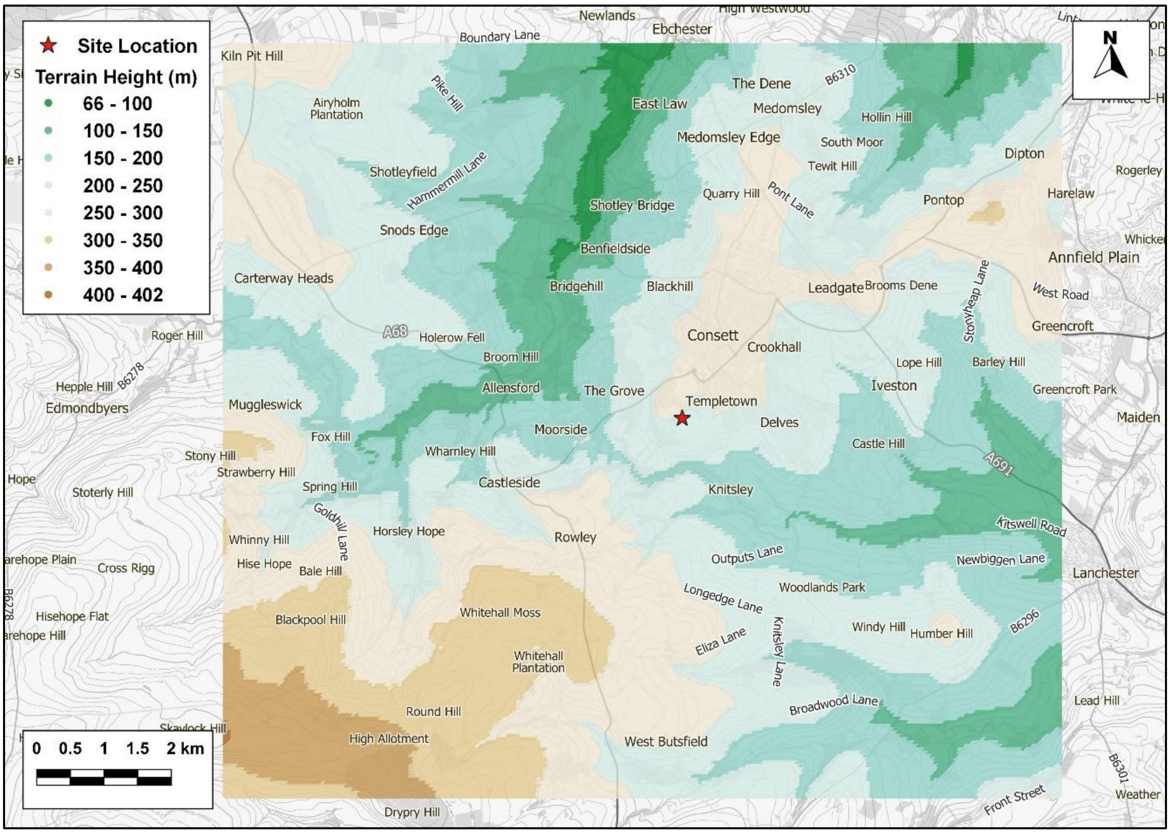

Figure 6: Modelled Terrain

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Surface Roughness

4.22 The study area encompasses a range of land types. A variable surface roughness file has been used to represent the spatial variation of the surface roughness over each land type, as presented in Figure 7. The following parameters have been used in creating this file:

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

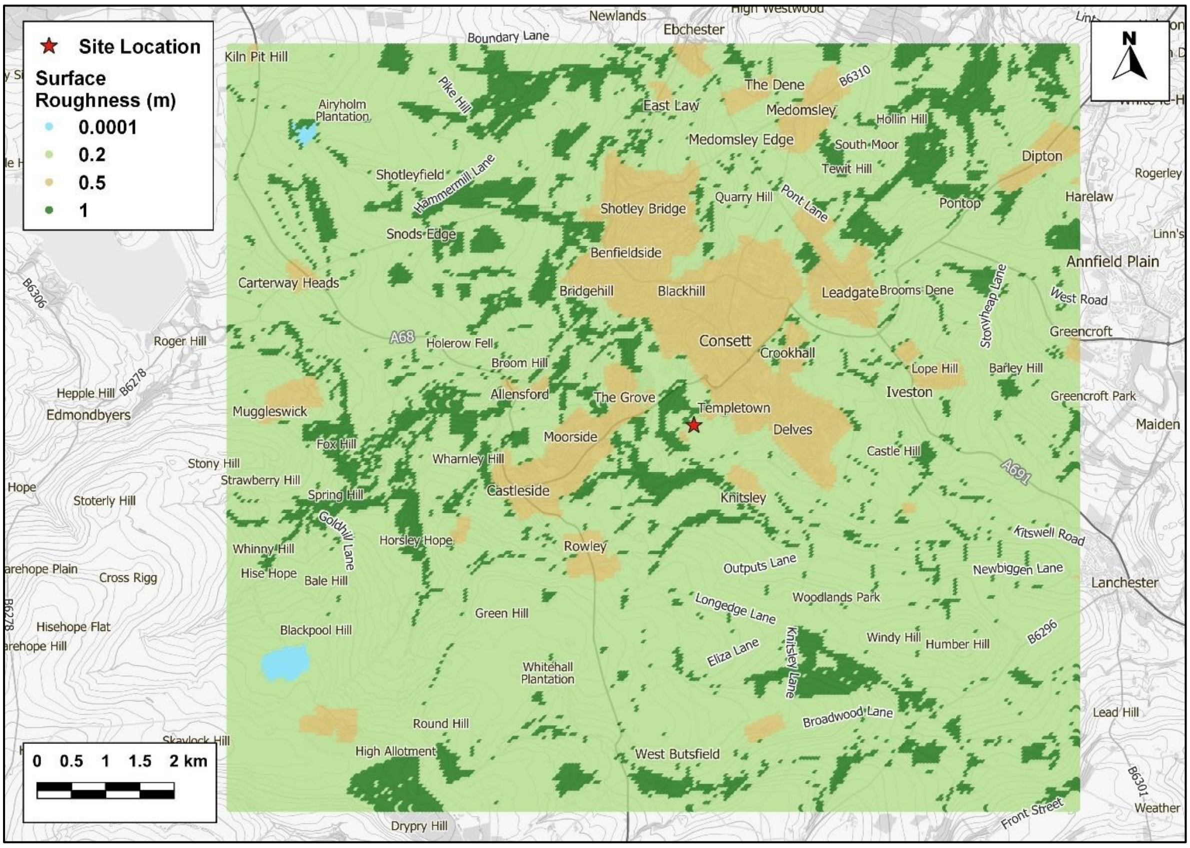

Figure 7: Variable Surface Roughness

Stack Height Testing

4.23 The approach set out above has initially been used alongside a series of potential stack heights ranging from 25 m to 60 m, in 5 m increments, to determine an appropriate stack height (in air quality terms) and inform the design of the facility. The models used for the stack height testing, the results of which are described in Section 7, were identical to those used for the main impact assessment (Section 8), with just the stack height entered into the model being varied.

5 Baseline Conditions

5.1 The proposed development is located within Hownsgill Technology Park, approximately 1 km to the southwest of Consett town centre. The application site is bounded to the southeast by the industrial estate access road. There are other industrial/commercial premises to the southwest and northeast, and a footpath/cycle route runs parallel to the north-western boundary, beyond which is an area of open countryside. The nearest residential receptors are located approximately 400 m to the east, in Templetown.

Industrial Sources

5.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2020a) has not identified any significant industrial or waste management sources that are likely to affect the study area, in terms of air quality.

Exceedances of the EU Limit Value

5.3 There are no AURN (Defra, 2020e) monitoring sites within the study area with which to identify exceedances of the annual mean nitrogen dioxide limit value. Defra's roadside mapped annual mean nitrogen dioxide concentrations (Defra, 2020d), which are used to report exceedances of the limit value to the EU, do not identify any exceedances within the study area in 2018; the maximum roadside concentration anywhere in Consett is 20.0 µg/m^3, along the A691. As such, there is considered to be no risk of a limit value exceedances in the vicinity of the proposed development by the time it is operational.

Local Air Quality Monitoring

5.4 Durham County Council operates one automatic monitoring site within its area, as well as a network of nitrogen dioxide diffusion tube monitoring sites. However, none of these sites are located close to the proposed development (the nearest monitoring site is located approximately 17 km away, in Chester-le-Street).

5.5 Baseline conditions for nitrogen dioxide are likely to be close to background concentrations (see Table 9) at receptors which are located away from main roads. However, baseline concentrations at receptors located at the roadside, for example on Delves Lane or The Chequers, may be affected by the emissions from traffic along these roads. There is no nitrogen dioxide monitoring carried out anywhere in Consett, and thus no measured roadside concentrations from which to establish a baseline. However, Defra's roadside annual mean nitrogen dioxide maps (Defra, 2020d) predict a concentration of 20.0 µg/m^3 along the A691, approximately 2 km north of the proposed facility. This road is much more heavily trafficked than Delves Lane or The Chequers, but as a conservative approach, the Defra mapped concentration has been used as the baseline roadside concentration in this assessment.

Background Concentrations and Fluxes

National Background Pollution Maps

5.6 Estimated background concentrations in the study area have been determined from background pollutant maps published by Defra. The values presented are the range of concentrations across the town of Consett, which covers multiple 1x1 km grid squares. All of the background concentrations are well below the objectives.

Table 9: Estimated Annual Mean Mapped Background Concentrations in 2020 (µg/m^3)

Pollutant	Background (µg/m^3)	Objective
NOx	6.0 – 12.3	30
NO_2	4.4 – 9.0	40
PM_{10}	7.6 – 9.3	40
$PM_{2.5}$	5.0 – 5.8	25
SO_2 [a]	1.4 – 3.6	20
CO [a]	149 – 257	10,000
Benzene [b]	0.07 – 0.32	5
1,3-butadiene [b]	0.03 – 0.13	2.25

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

[b] Background concentrations are based on the 2003 base year. No later year is available.

Trace Metals

5.7 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 Network. The current Heavy Metals Network consists of 24 sites across the UK. Measured concentrations at the nearest four sites to the proposed facility are summarised in Table 10, with the maximum concentration of these four sites used as the background concentration in the assessment. All concentrations are well below the relevant EALs.

Table 10: Heavy Metal Background Concentrations 2019 (µg/m³) [a]

Pollutant		Scunthorpe Town	Scunthorpe Low Santon	Eskaldemuir	Sheffield Devonshire Green	Annual Mean EAL
Antimony (Sb)		Not measured				5
Arsenic (As)		**0.0009**	0.0008	0.0002	0.0008	0.003
Cadmium (Cd)		0.0004	**0.0007**	0.00003	0.0002	0.005
Chromium (Cr) [b]	Total	0.0028	0.0039	0.0001	**0.0042**	5 [c]
	Cr(VI)	0.00022	0.00031	0.00001	**0.00033**	0.0002
Cobalt (Co)		0.00013	**0.00018**	0.00002	0.00015	1
Copper (Cu)		Not measured				10
Lead (Pb)		0.0139	**0.0157**	0.0010	0.0076	0.25
Manganese (Mn)		0.0240	**0.0760**	0.0010	0.0078	0.15
Mercury (Hg)		Not measured				0.25
Nickel (Ni)		0.0011	0.0013	0.0002	**0.0018**	0.02
Thallium (Tl)		Not measured				1
Vanadium (V)		0.0017	**0.0079**	0.0004	0.0008	5

[a] The maximum of the four sites is shown in bold, and is used as the background concentration in the assessment.

[b] The Heavy Metals Network measures total chromium. The Expert Panel on Air Quality Standards (EPAQS) report that ambient Cr(VI) concentrations may typically constitute between 3 and 8% of total ambient chromium. The higher value (8%) has been used to derive a background concentration of Cr(VI) from total monitored chromium.

[c] EAL for Cr(III).

Acid Gases and Ammonia

5.8 Defra monitors concentrations of HCl at around 30 monitoring sites across the UK as part of the UKEAP Acid Gas and Aerosol Network. The closest monitoring site to the proposed development is located at Moorhouse (38 km). The measured concentration in 2015 (the latest year for which data are available) at Moorhouse was 0.18 µg/m³, which has therefore been used in this assessment.

5.9 Defra monitors background concentrations of ammonia as part of the National Ammonia Monitoring Network (NAMN). The closest monitoring site to the proposed development is located at Moorhouse (38 km). The measured concentration in 2019 was 0.56 µg/m³, which has therefore been used in this assessment.

5.10 The backgrounds used in the assessment are summarised in Table 11. There is currently no UK monitoring of HF, and no background data are available.

Table 11: HCl and Ammonia Background Concentrations (µg/m³)

Pollutant	Background Concentration (µg/m³)	Annual Mean EAL
HCl	0.18	20
NH_3	0.56	3

Dioxins and Furans

5.11 Monitoring of PCDD/Fs (dioxins and furans) is currently carried out by Defra at six locations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) Network. To provide an indication of the range of PCDD/Fs concentrations in the UK, a summary of the annual mean concentrations between 2014 and 2016 is presented in Table 12; no data for later years is available as data capture is extremely low (<1%). The maximum of these sites is Manchester, with an average concentration of 11.7 fg/m³, and is assumed to be representative of the baseline dioxin and furan concentration in the study area.

Table 12: UK PCDD/Fs Concentrations (fg/m³) [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.

Polyaromatic Hydrocarbons

5.12 Defra monitors polyaromatic hydrocarbons (PAHs) as part of the PAH Network. The latest annual mean concentrations of B[a]P at the four closest monitoring sites to the proposed development are presented in Table 13. The maximum of these sites (0.18 ng/m³) has been used in this assessment.

Table 13: PAH Concentrations (as B[a]P) 2019 (ng/m^3)

Site	Annual Mean Concentration (ng/m^3)
High Muffles	0.04
Lynemouth 2	0.12
Middlesbrough	0.18
Newcastle Centre	0.15

Background Deposition and Acidity

5.13 Background nitrogen deposition fluxes to the designated habitats are presented in Table 14. Background nutrient and acid nitrogen deposition rates both exceeded the critical loads.

Table 14: Estimated Annual Mean Background Nitrogen Deposition [a]

Site	Nutrient Nitrogen Deposition (kgN/ha/yr)	Acid Nitrogen Deposition (keq/ha/yr)	Acid Sulphur Deposition (keq/ha/yr)
North Pennine Moors	13.5 – 37.2 (5)	1.0 – 2.7 (0.491)	0.1 – 0.5 (0.491)
Ancient Woodland	23.7 – 24.6 (10)	1.7 – 1.8 [b]	0.2 [b]

[a] Critical load relevant to each habitat are in parentheses after the background value.

[b] There is no acid deposition critical load defined for broadleaved, mixed and yew woodland.

6 Construction Phase Impact Assessment

Construction Traffic

6.1 It is anticipated that the additional heavy vehicle movements on local roads will be well below the 100 AADT screening criterion recommended by EPUK/IAQM guidance for screening potentially significant impacts on air quality at existing locations (Moorcroft and Barrowcliffe et al, 2017). It is, therefore, not considered necessary to assess the impacts of traffic emissions during the construction phase.

On-Site Exhaust Emissions

6.2 The IAQM guidance (IAQM, 2016) states:

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur".

6.3 The areas of the site within which NRMM and site traffic will typically operate are located more than 400 m away from any sensitive receptors, such a residential properties. It is judged that there no risk of significant effects at existing receptors as a result of on-site machinery emissions during construction.

Construction Dust and Particulate Matter Emissions

6.4 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. Step 1 of the assessment procedure is to screen the need for a detailed assessment. 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

6.5 There is no requirement for demolition on site.

Earthworks

6.6 The characteristics of the soil at the site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2020), as set out in Table 15. The characteristics of the soil across the site are mixed, but overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 15: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Mixed (Intermediate (Shallow) to Deep)
Soil Parent Material Grain Size	Mixed (Argillic [a] – Arenaceous [b] – Rudaceous [c])
European Soil Bureau Description	Mudstone and Sandstone / Glacial Till
Soil Group	Medium to Heavy
Soil Texture	Clayey Loam to Sandy/Silty Loam [d]

[a] grain size < 0.06 mm.

[b] grain size 0.06 – 2.0 mm.

[c] grain size > 2.0 mm.

[d] a loam is composed mostly of sand and silt.

6.7 The site covers approximately 12,000 m^2, but the main area of earthworks will be focused on the northern half of the site where the main buildings will be erected. Dust will arise mainly from vehicles travelling over unpaved ground and from the handling of dusty materials (such as dry soil). Based on the example definitions set out in Table A1.1 in Appendix A1, the dust emission class for earthworks is considered to be *medium*.

Construction

6.8 Construction will involve the erection of the main, metal-clad, industrial building, the exhaust stack to 50 m height, and a number of smaller ancillary structures, to a total volume of around 50,000 m^3. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials, and from the cutting of concrete (which is likely to be limited). Based on the example definitions set out in Table A1.1 in Appendix A1, the dust emission class for construction is considered to be *medium*.

Trackout

6.9 It is anticipated that there could be more than 10 outward heavy vehicle movements on some days during the construction works, although the average will be less than 10 per day. Based on the example definitions set out in Table A1.1 in Appendix A1, the dust emission class for trackout is considered to be *medium*.

6.10 Table 16 summarises the dust emission magnitude for the proposed development.

Table 16: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	N/A
Earthworks	Medium
Construction	Medium
Trackout	Medium

Sensitivity of the Area

6.11 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.

6.12 The IAQM guidance explains that residential properties are 'high' sensitivity receptors to dust soiling, while the most industrial premises are of 'low' sensitivity (Table A1.2 in Appendix A1). Residential properties are also classified as being of 'high' sensitivity to human health effects, while places of work, and therefore industrial facilities, are classified as being of 'medium' sensitivity.

6.13 There are no receptors within 50 m of the site, and one commercial/industrial building within 100 m of the site (see Figure 8). Most of the buildings located within Hownsgill Industrial Park are within 350 m of the site boundary.

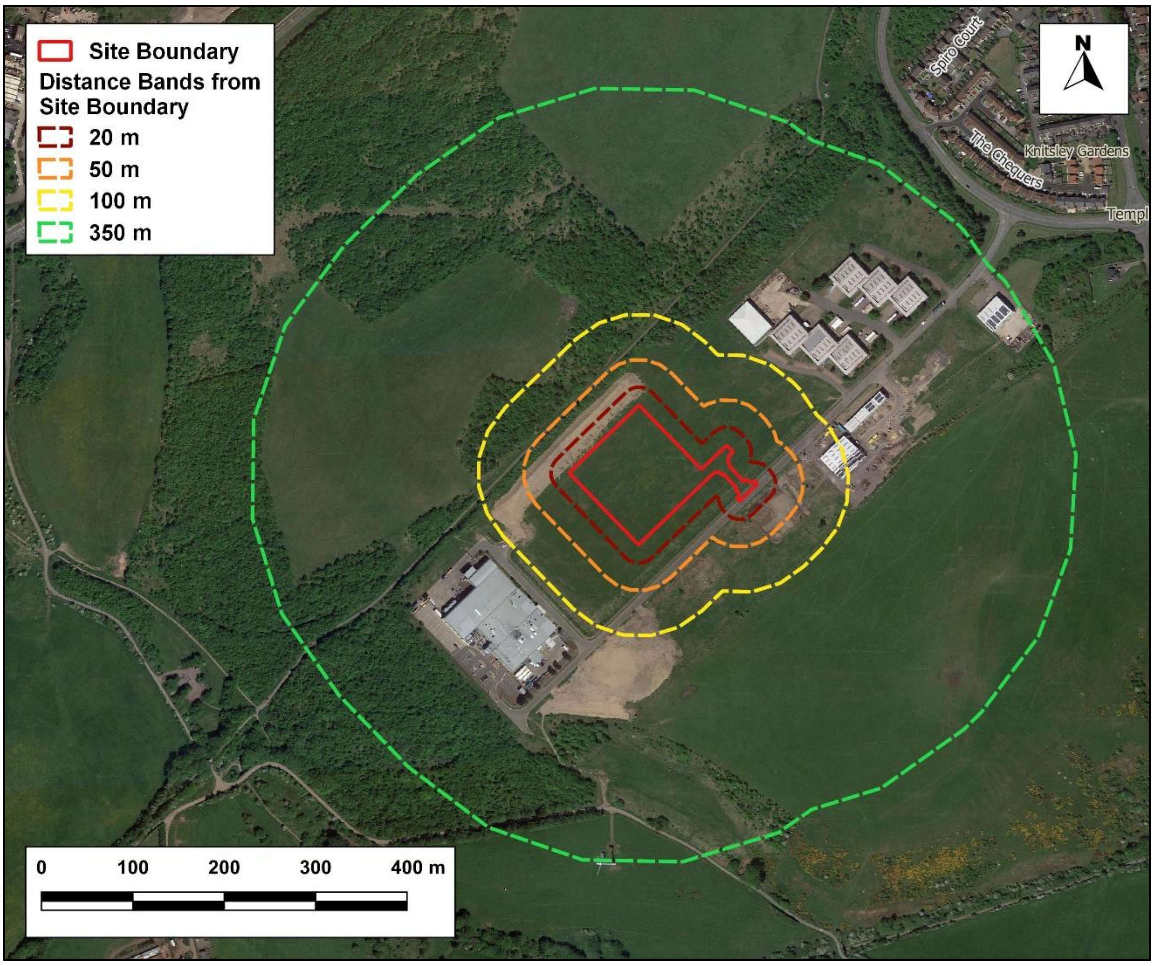

Figure 8: 20 m, 50 m, 100 m and 350 m Distance Bands around Site Boundary

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

6.14 Table 16 shows that the dust emission magnitude for trackout is *medium* and Table A1.3 in Appendix A1 thus explains that there is a risk of material being tracked 200 m from the site exit. It is assumed that all construction vehicles will exit the site and head northeast. There are two commercial/industrial units within 20 m, and a further three units within 50 m, of the roads along which material could be tracked (see Figure 9).

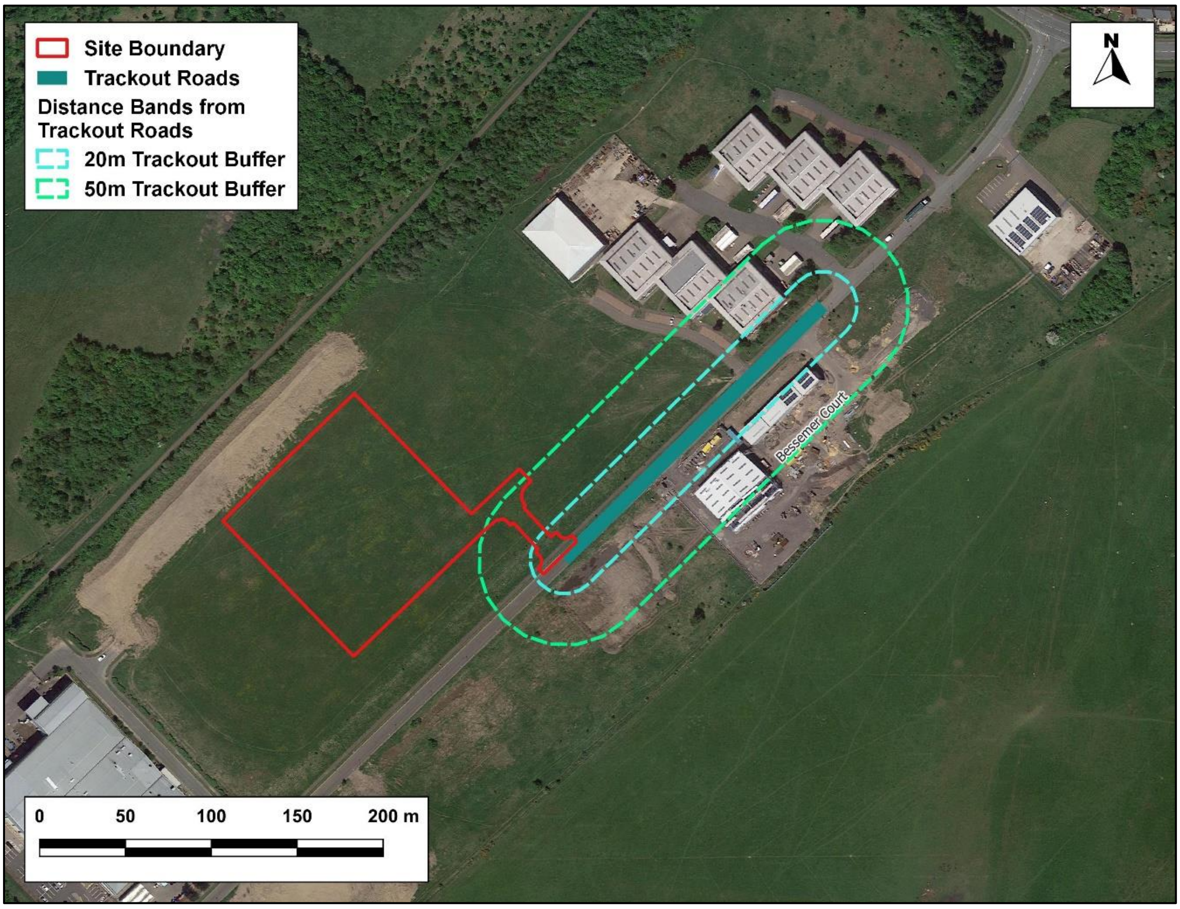

Figure 9: 20 m and 50 m Distance Bands around Roads Used by Construction Traffic Within 200 m of the Site Exit

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies

Sensitivity of the Area to Effects from Dust Soiling

6.15 Using the information set out in Paragraph 6.12 and Figure 8 alongside the matrix set out in Table A1.3 in Appendix A1, the area surrounding the onsite works is of 'low' sensitivity to dust soiling. Using the information set out in Paragraph 6.14 and Figure 9 alongside the same matrix, the area is also of 'low' sensitivity to dust soiling due to trackout.

Sensitivity of the Area to any Human Health Effects

6.16 The matrix in Table A1.4 in Appendix A1 requires information on the baseline annual mean PM_{10} concentration in the area. As the site is located away from major roads and there are no other nearby industrial sources, it is assumed that the background concentration is representative of annual mean PM_{10} concentrations. As detailed in Table 9, baseline concentrations are well below 24 µg/m^3. Using the information set out in Paragraphs 6.12 and Figure 8 alongside the matrix in Table A1.4 in Appendix A1, the area surrounding the onsite works is of 'low' sensitivity to human health effects. Using the information set out in Paragraph 6.14 and Figure 9 alongside the same matrix, the area surrounding roads along which material may be tracked from the site is also of 'low' sensitivity.

Sensitivity of the Area to any Ecological Effects

6.17 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 site boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

Summary of the Area Sensitivity

6.18 Table 17 summarises the sensitivity of the area around the proposed construction works.

Table 17: Summary of the Area Sensitivity

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

Risk and Significance

6.19 The dust emission magnitudes in Table 16 have been combined with the sensitivities of the area in Table 17 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 18. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 9 (step 3 of the assessment procedure).

Table 18: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk

6.20 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' (IAQM, 2016).

7 Stack Height Testing

7.1 In order to determine the most appropriate stack height for the proposed facility, initial dispersion models were run using the same release parameters as detailed in Section 4 of this report, but with the height of the stack varied from 25 m to 60 m, at 5 m intervals.

7.2 The stack height analysis presented in this section focuses on the key pollutants of concern for the proposed facility (i.e. those that are not immediately screened out in the first part of Section 8), which are also the key drivers in the stack height selection, although the judgement made on the most appropriate stack height took account of the impacts for all the pollutants modelled. Stack height analysis is thus presented for the following pollutants:

- annual mean NO_2;
- 1-hour mean NO_2 (99.79th percentile);
- annual mean TOC; and
- annual mean Group III metals.

7.3 It is not deemed necessary to present analysis of the impact of the stack height for designated ecological sites, as PCs for the chosen stack height at designated ecological sites were below the screening thresholds for all pollutants and all averaging periods.

Nitrogen Dioxide

Annual Mean

7.4 Table 19 and Figure 10 present two sets of maximum predicted annual mean nitrogen dioxide PCs with varying stack height, one being the maximum anywhere on the modelled receptor grid, and the other the maximum at any specific sensitive receptor (as described in Table 4). These are the maxima from any of the meteorological years modelled.

Table 19: Maximum Predicted Annual Mean NO_2 PC with Varying Stack Height (µg/m^3)

Stack Height (m)	25	30	35	40	45	50	55	60
Max on Grid	1.39	1.23	1.14	1.10	0.98	0.88	0.67	0.48
Max at Sensitive Receptor	6.11	3.82	2.55	2.29	1.50	1.10	0.71	0.47
Environment Agency Screening Threshold	0.4 (1% of EAL) [a]							

[a] Although the assessment screening threshold for nitrogen dioxide is 0.5% of the EAL, the EA screening threshold of 1% of the EAL has been used for consistency with other pollutants in the stack height testing.

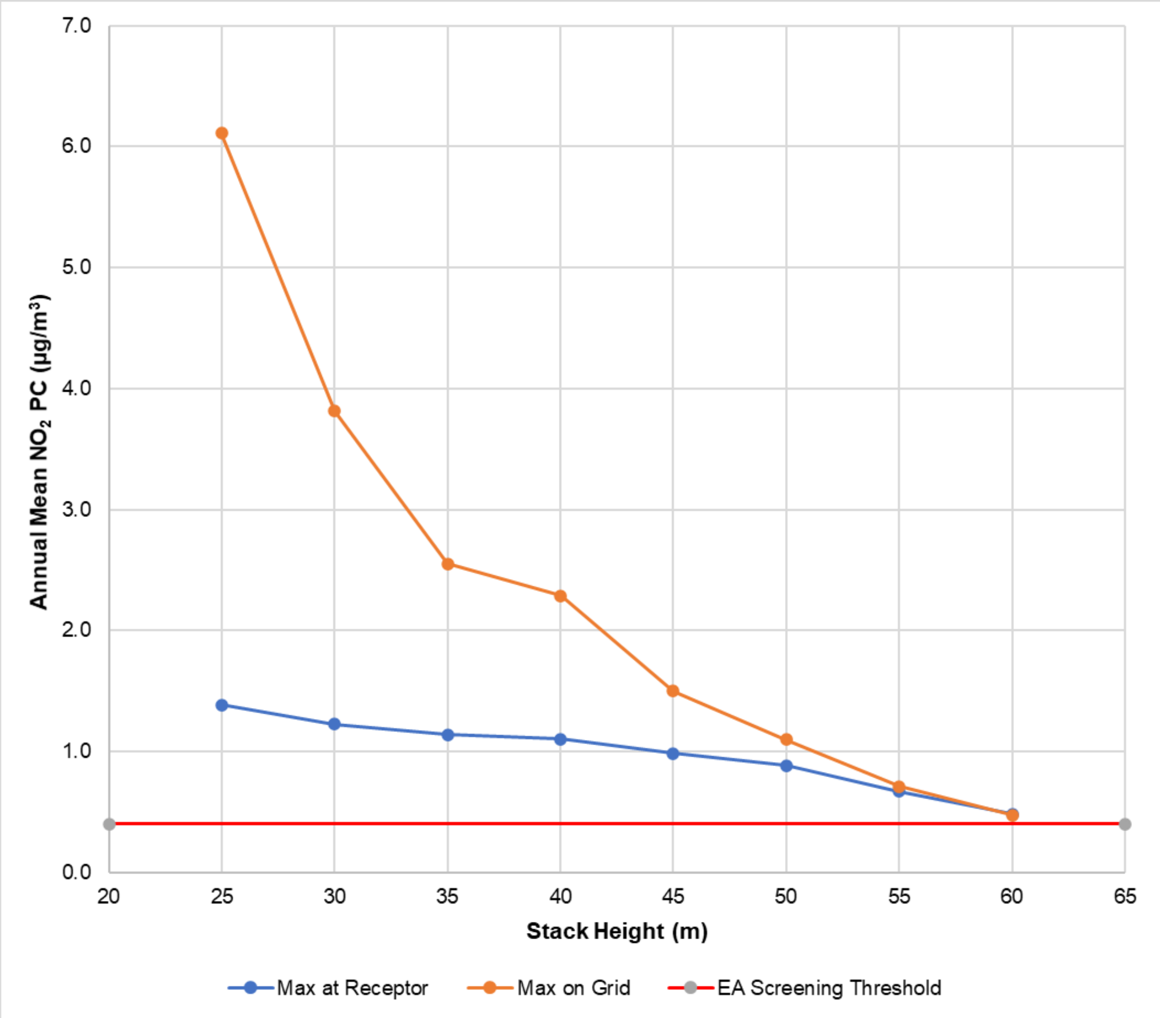

Figure 10: Maximum Predicted Annual Mean NO_2 PC with Varying Stack Height

7.5 Figure 10 demonstrates that maximum PCs reduce rapidly as the stack height is increased from 25 m to 45 m (with some less pronounced reduction between 35 m and 40 m), but that reductions begin to flatten after 45 m.

7.6 At no stack height up to 60 m would the annual mean PC fall below 1% of the EAL for the contribution to be considered *insignificant* without further consideration of the PEC. However, considering the low baseline NO_2 concentrations in the study area (see Section 5), it is considered that there is no necessity for a stack height greater than 50 m on the basis of annual mean nitrogen dioxide concentrations.

1-hour Mean

7.7 Table 21 and Figure 11 present the maximum predicted 99.79th percentile of 1-hour mean nitrogen dioxide PCs with varying stack height. The maximum PCs reduce rapidly with stack height, with PCs below the 10% screening threshold at any location on the receptor grid at heights above 40 m, and at any sensitive receptor at 35 m or higher. There is little change with increasing stack height above 50 m. It is noted that there is a slight increase in concentrations predicted at sensitive receptors at 30 m compared to 25 m; it is likely that this slight increase is due to the building wake effects when the tested stack height is comparable to the height of nearby buildings.

Table 20: Maximum Predicted 99.79th Percentile of 1-Hour Mean NO_2 PCs with Varying Stack Height (µg/m³)

Stack Height (m)	25	30	35	40	45	50	55	60
Max on Grid	19.93	20.67	18.26	14.18	10.64	8.47	8.04	7.44
Max at Sensitive Receptor	87.88	57.82	33.06	20.17	13.11	11.99	10.33	9.24
Screening Threshold	20 (10% of EAL)							

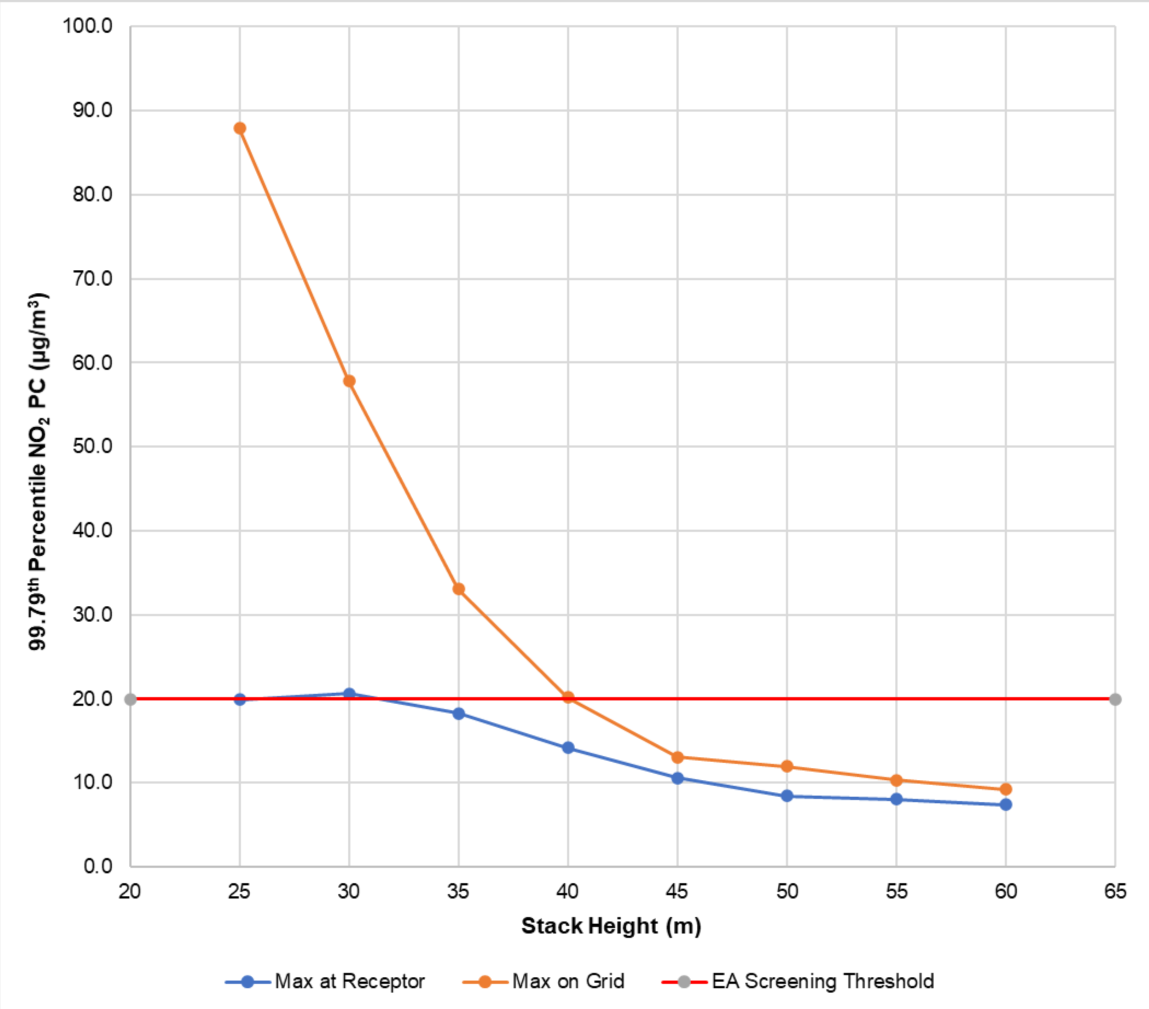

Figure 11: Maximum Predicted 99.79th Percentile of 1-Hour Mean NO_2 PCs with Varying Stack Height

Annual Mean TOC

7.8 Table 21 and Figure 12 present the maximum predicted TOC PCs with varying stack height. Maximum PCs reduce rapidly with height between 25 m and 45 m, with reductions flattening from 50 m to 60 m.

7.9 The annual mean PC would not be below the 1% screening threshold for benzene (the TOC with the most stringent AQO) at any height up to 60 m. However, considering TOC is a mixture of compounds and that background concentrations of benzene and 1,3-butadiene are very low (see Table 9), it is again considered that there is no need for a stack height greater than 50 m on the basis of annual mean TOC.

Table 21: Maximum Predicted Annual Mean TOC PC with Varying Stack Height (µg/m^3)

Stack Height (m)	25	30	35	40	45	50	55	60
Max on Grid	0.17	0.15	0.14	0.13	0.12	0.10	0.08	0.06
Max at Sensitive Receptor	0.73	0.45	0.30	0.27	0.18	0.12	0.08	0.06
Screening Threshold	0.05 (Benzene); 0.0225 (1,3-butadiene) (1% of EAL)							

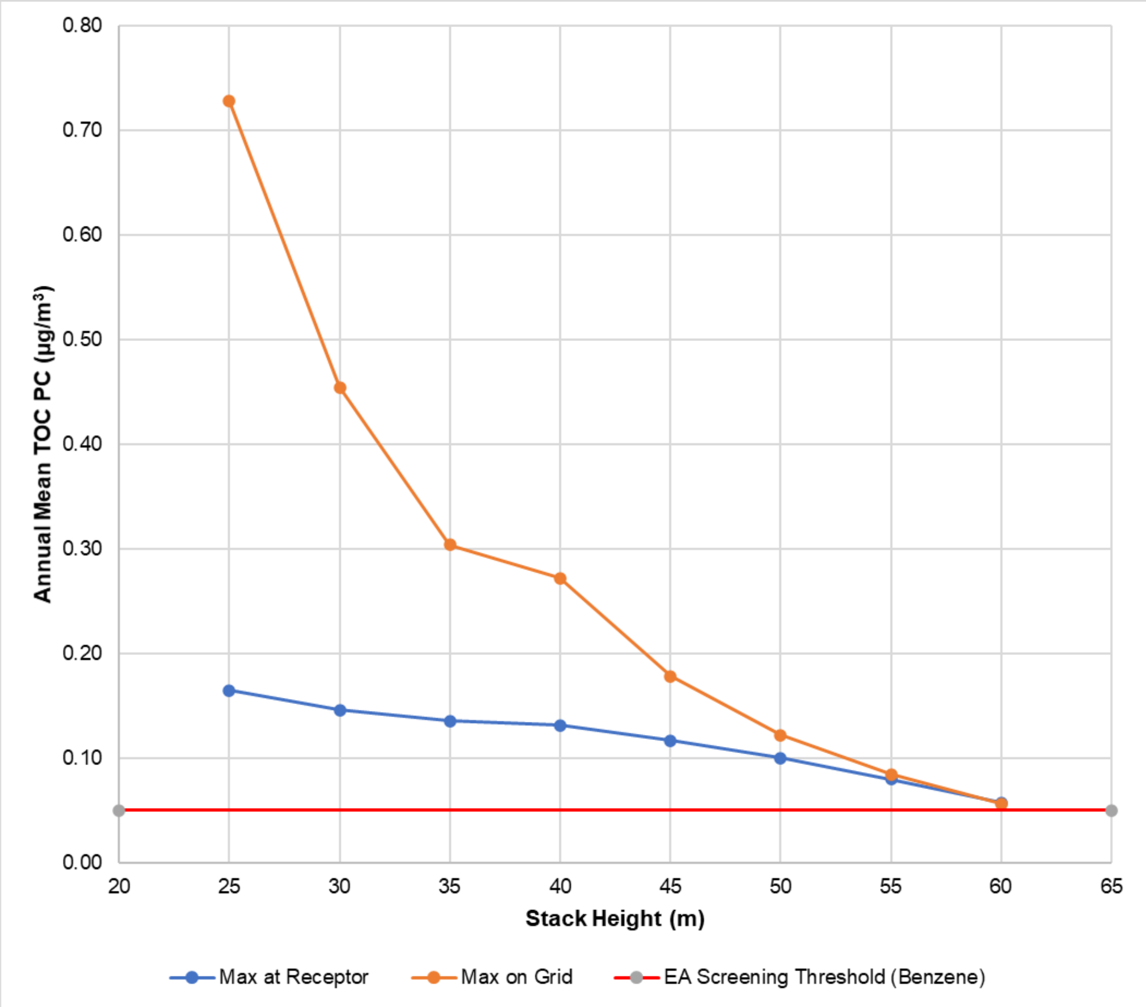

Figure 12: Maximum Predicted Annual Mean TOC PC with Varying Stack Height

Annual Mean Group III Metals

7.10 Table 22 and Figure 13 present the maximum predicted Group III metals PCs with varying stack height. It must be emphasised that the individual metals will only form part of the Group III metals PC, and no scaling has been applied to the likely actual proportions of each metal.

7.11 Again, the reduction in PCs diminishes greatly once the stack height exceeds 45 m, and a stack height of 50 m should be considered acceptable provided there are no significant impacts at this stack height (see Section 8).

Table 22: Maximum Predicted Annual Mean Group III Metal PC with Varying Stack Height (µg/m^3)

Stack Height (m)	25	30	35	40	45	50	55	60
Max on Grid	0.0050	0.0044	0.0041	0.0039	0.0035	0.0030	0.0024	0.0017
Max at Sensitive Receptor	0.0218	0.0136	0.0091	0.0082	0.0053	0.0037	0.0025	0.0017

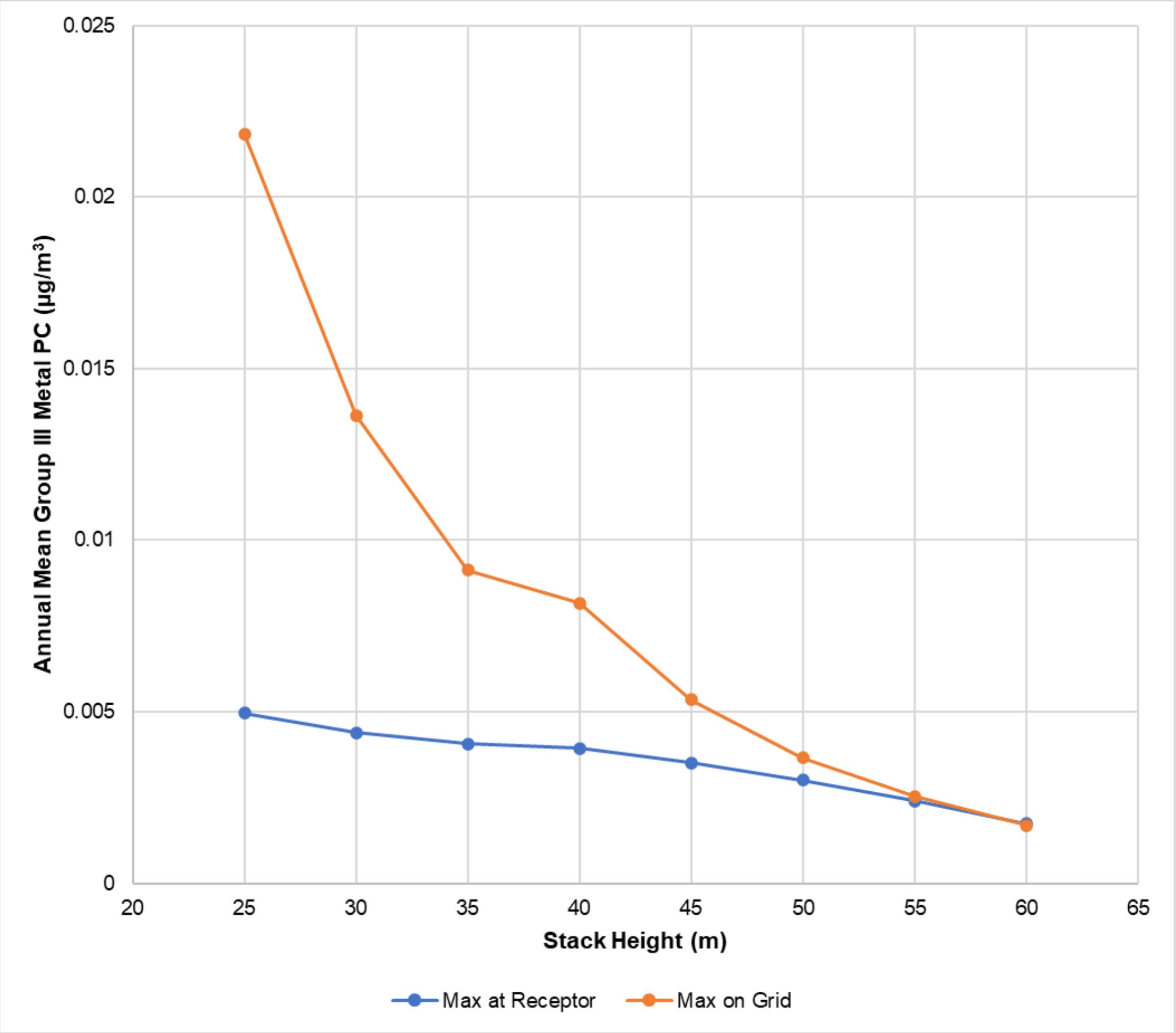

Figure 13: Maximum Predicted Annual Mean Group III Metal PC with Varying Stack Height

Summary

7.12 All of the graphs demonstrate steep reductions in maximum pollutant concentrations with increased stack height, with the gradient of the reductions reducing greatly beyond 50 m. No significant impacts were predicted with a stack height of 50 m (see Section 8), thus it was deemed the most appropriate stack height for the proposed facility.

8 Operational Phase Impact Assessment

Stack Emissions

Initial Screening Assessment

Health

8.1 The predicted maximum PCs at any location on the modelled receptor grid have been compared with the relevant screening criteria described in paragraphs 3.25 and 3.26. For nitrogen dioxide, the PCs also include the contributions from the proposed boilers. The results are set out in Table 23, with the conclusions based on the screening criteria for the PCs set out in the final column.

8.2 The PCs can be screened as insignificant for most pollutants and averaging periods; more detailed assessment for those that cannot be screened at this stage is provided later.

Table 23: Maximum Predicted PCs in the Study Area (µg/m^3)

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Nitrogen Dioxide	Annual mean	1.10	40	2.7	**Yes**
	1-hour mean	11.99	200	6.0	No
PM_{10}	Annual mean	0.06	40	0.1	No
	24-hour mean	0.16	50	0.3	No
$PM_{2.5}$ [a]	Annual mean	0.06	25	0.2	No
SO_2	24-hour mean	1.47	125	1.2	No
	1-hour mean	15.82	350	4.5	No
	15-minute mean	19.81	266	7.4	No
CO	8-hour rolling mean	10.14	10,000	0.1	No
HF	Annual mean	0.01	16	0.1	No
	1-hour mean	0.26	160	0.2	No
HCl [c]	Annual mean	0.07	20	0.4	No
	1-hour mean	15.37	750	2.0	No
TOC as Benzene [b]	Annual mean	0.12	5	2.4	**Yes**
1,3-butadiene	Annual mean	0.12	2.25	5.4	**Yes**
Cadmium	Annual mean	0.0002	0.005	4.9	**Yes**
Thallium [c]	Annual mean	0.0002	1	<0.1	No
	1-hour mean	0.0051	30	<0.1	No
Mercury	Annual mean	0.0001	0.25	<0.1	No
	1-hour mean	0.003	7.5	<0.1	No

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Antimony	Annual mean	0.004	5	0.1	No
	1-hour mean	0.077	150	0.1	No
Arsenic	Annual mean	0.004	0.003	122.0	**Yes**
Lead	Annual mean	0.004	0.25	1.5	**Yes**
Chromium (III)	Annual mean	0.004	5	0.1	No
	1-hour mean	0.077	150	0.1	No
Chromium (VI) [c]	Annual mean	0.004	0.0002	1,829.4	**Yes**
	1-hour mean	0.077	15	0.5	No
Cobalt [c]	Annual mean	0.004	1	0.4	No
	1-hour mean	0.077	30	0.3	No
Copper	Annual mean	0.004	10	<0.1	No
	1-hour mean	0.077	200	<0.1	No
Manganese	Annual mean	0.004	0.15	2.4	**Yes**
	1-hour mean	0.077	1,500	<0.1	No
Nickel	Annual mean	0.004	0.02	18.3	**Yes**
Vanadium	Annual mean	0.004	5	0.1	No
	1-hour mean	0.077	1	7.7	No
NH_3	Annual mean	0.12	180	0.1	No
	1-hour mean	2.56	2500	0.1	No
PCDD/F	Annual mean	7.3×10^{-10}	0.0000003	0.2	No
PAH (as B[a]P)	Annual mean	1.8×10^{-6}	0.00025	0.7	No
PCBs	Annual mean	9.8×10^{-10}	0.2	<0.1	No
	1-hour mean	2.1×10^{-8}	6	<0.1	No

a The $PM_{2.5}$ objective, which was 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 was 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 Cr(VI) have been calculated from the exposure limits in EH4024, and converted to the respective EAL using guidance in H1 (Environment Agency, 2010).

Ecosystems

8.3 The predicted nitrogen oxides, sulphur dioxide, hydrogen fluoride and ammonia concentrations, and the rate of nutrient nitrogen deposition and acid deposition associated with the facility, have been compared to the Environment Agency screening criteria. The results are set out in Table 24 for the North Pennine Moors SAC/SPA, and in Table 25 for all locally designated ancient woodland sites.

As a reminder, a screening criterion of 1% is used for annual mean averaging periods, with 10% used for all other (shorter) averaging periods.

Table 24: Maximum Predicted PCs to North Pennine Moors SAC/SPA

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Nitrogen Oxides	Annual mean	0.02 µg/m^3	30 µg/m^3	0.1	No
	24-hour mean	0.39 µg/m^3	75 µg/m^3	0.5	No
Sulphur Dioxide	Annual mean	0.004 µg/m^3	20 µg/m^3	<0.1	No
Hydrogen Fluoride	24-hour mean	0.002 µg/m^3	5 µg/m^3	<0.1	No
	Weekly mean	0.001 µg/m^3	0.5 µg/m^3	0.2	No
Ammonia	Annual mean	0.001 µg/m^3	3 µg/m^3	<0.1	No
Nutrient Nitrogen Deposition	Annual mean	0.008 kgN/ha/yr	5 kgN/ha/yr	0.2	No
Acid Deposition	Annual mean	0.001 keq/ha/yr	0.491 keq/ha/yr	0.2	No

Table 25: Maximum Predicted PCs to Designated Ancient Woodland Sites

Pollutant	Averaging Period	Maximum PC	EAL	% of EAL	Detailed Assessment Required
Nitrogen Oxides	Annual mean	0.12 µg/m^3	30 µg/m^3	0.4	No
	24-hour mean	4.11 µg/m^3	75 µg/m^3	5.5	No
Sulphur Dioxide	Annual mean	0.029 µg/m^3	20 µg/m^3	0.1	No
Hydrogen Fluoride	24-hour mean	0.018 µg/m^3	5 µg/m^3	0.4	No
	Weekly mean	0.011 µg/m^3	0.5 µg/m^3	2.1	No
Ammonia	Annual mean	0.010 µg/m^3	3 µg/m^3	0.3	No
Nutrient Nitrogen Deposition	Annual mean	0.10 kgN/ha/yr	10 kgN/ha/yr	1.0	No

8.4 The PCs are below the screening criteria for all pollutants and averaging periods at all ecological sites, therefore no further detailed assessment is required. The potential impacts are thus considered to be *insignificant*. It is worth noting that the tables assess against the EALs for annual mean ammonia and sulphur dioxide that apply where sensitive lichens and bryophytes are not present (which are likely to be those most appropriate for these habitats), but even were it to use the lower values for lichens and bryophytes, the process contributions would still screen out as insignificant.

Detailed Assessment

8.5 A more detailed assessment of the impacts for those pollutants and averaging periods that could not be screened out in Table 23 is provided below.

Nitrogen Dioxide

Annual Mean

8.6 Table 26 sets out the maximum predicted PC to annual mean nitrogen dioxide concentrations, and the maximum PEC for annual mean nitrogen dioxide at any sensitive receptor. The maximum PEC is well below the relevant EAL, and so following EA guidance, the impact on annual mean nitrogen dioxide can be described as *insignificant*.

Table 26: Maximum PC and PEC for Annual Mean Nitrogen Dioxide (µg/m^3)

Objective	EAL	PC	Baseline	PEC	PEC as % of EAL
Annual mean	40	0.9	20.0	20.9	52.3

8.7 The maximum PC is 0.9 µg/m^3, which equates to a maximum increase in concentration of 2% compared with the EAL (AQO). As the baseline concentration is less than 75% of the EAL, it can be concluded that the impact of the proposed facility on annual mean nitrogen dioxide is *negligible*, in line with the EPUK/IAQM impact descriptor matrix in Table 3 for pollutants with an AQO.

8.8 Following both EA and EPUK/IAQM guidance, the impacts of the facility on annual mean concentrations of nitrogen dioxide are demonstrated to be not significant.

8.9 A contour plot of the annual mean nitrogen dioxide PCs at ground level (1.5 m) is shown in Figure 14.

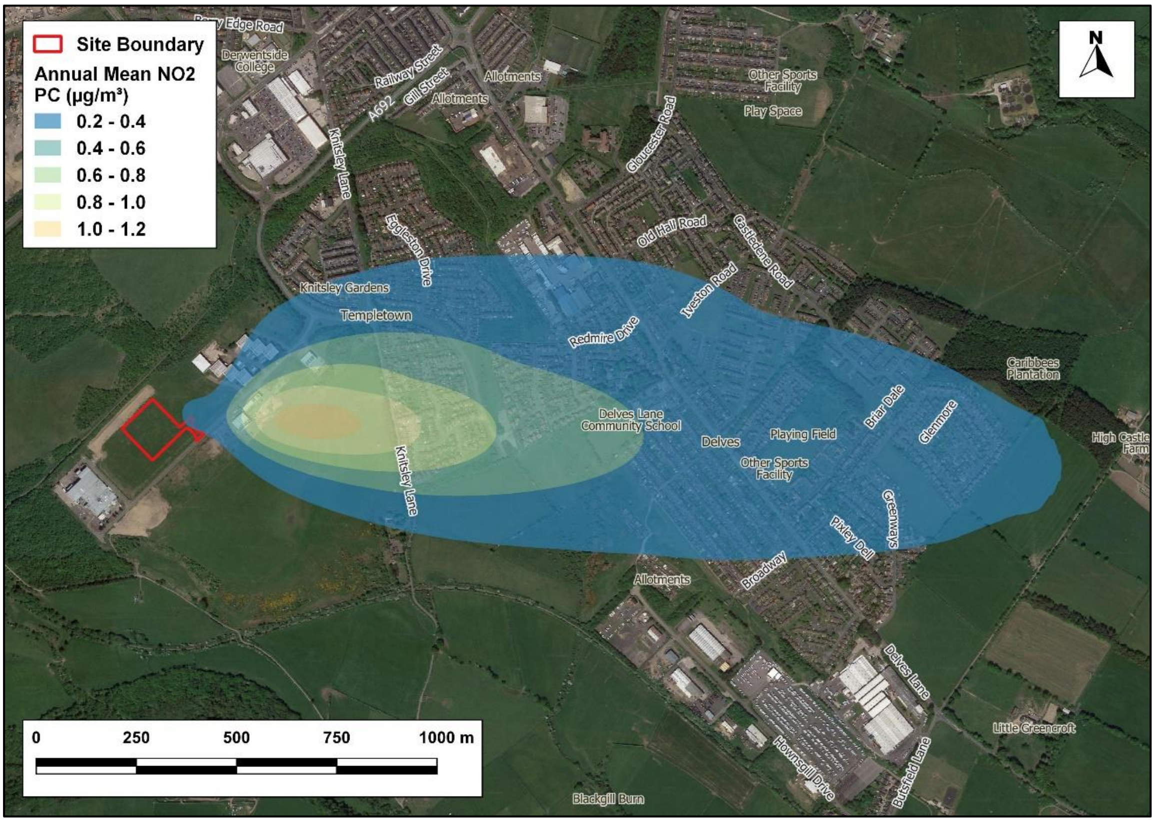

Figure 14: Annual Mean Nitrogen Dioxide Process Contributions (Ground Floor Level)

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

1-hour Mean

8.10 The maximum predicted 99.79th percentile nitrogen dioxide PC at any sensitive receptor is 8.5 µg/m³, or 4.3% of the short-term EAL. Therefore, impacts on 1-hour mean nitrogen dioxide concentrations are considered *insignificant*, as the maximum PC is less than 10% of the short-term EAL.

8.11 A contour plot of 99.79th percentile nitrogen dioxide PCs at ground level is provided in Figure 15 for information. The maximum PC anywhere on the modelled grid is 12.0 µg/m³ (6.0% of the EAL); therefore, the screening criterion of 10% of the short-term EAL is not exceeded anywhere in the study area.

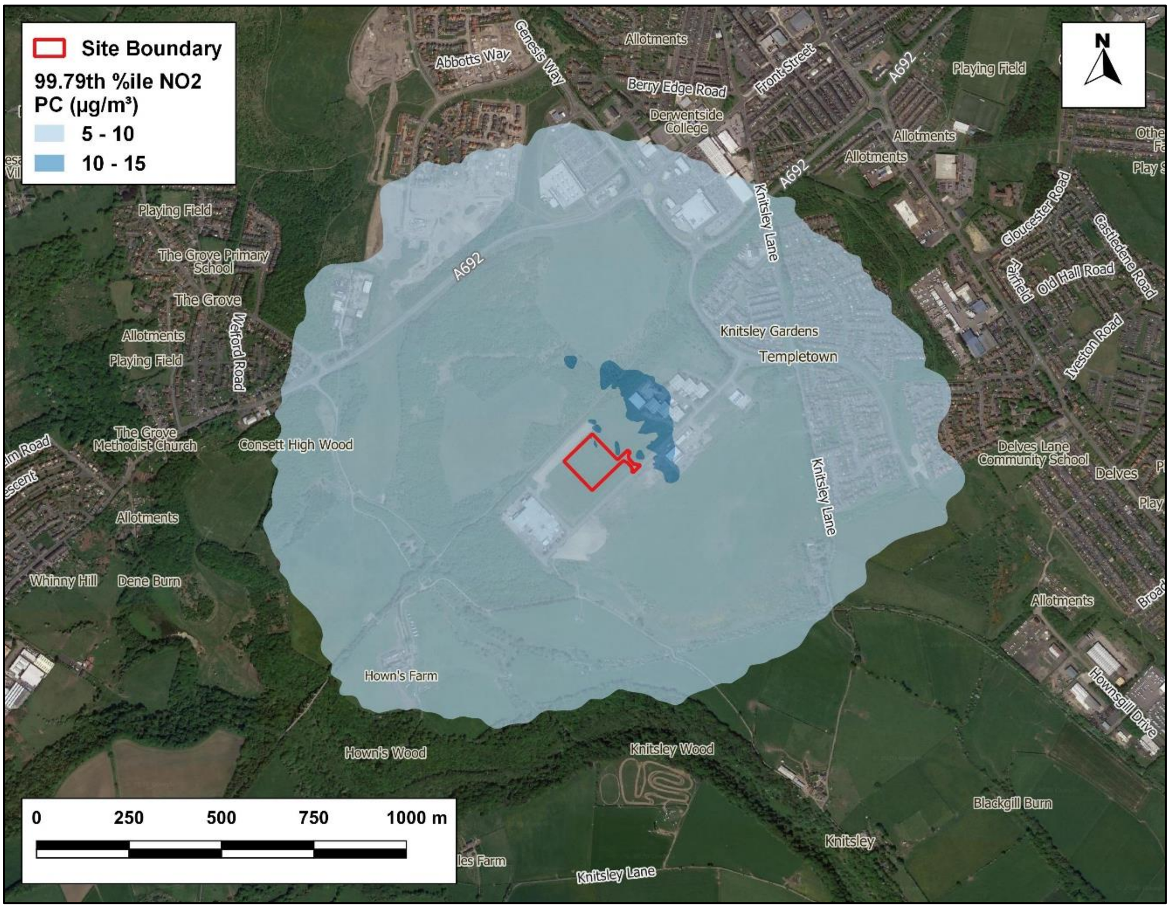

Figure 15: 99.79th Percentile Nitrogen Dioxide Process Contributions (Ground Level)

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies.

TOC as Benzene

8.12 Table 27 sets out the maximum predicted PC to annual mean TOC concentrations, and the maximum PEC for annual mean TOC concentrations at any sensitive receptor. The maximum PEC is well below the relevant EAL, and so the impact is considered to be *insignificant*.

Table 27: Maximum PC and PEC for TOC (as Benzene) (µg/m^3)

Objective	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	5	0.10	0.32	0.42	8.3

[a] See Table 9.

TOC as 1,3-butadiene

8.13 Table 28 sets out the maximum predicted PC to annual mean 1,3-butadiene concentrations, and the maximum PEC for annual mean 1,3-butadiene concentrations at any sensitive receptor. The maximum PEC is well below the relevant EAL, and the impact is considered to be *insignificant*.

Table 28: Maximum PC and PEC for TOC (as 1,3-butadiene) (µg/m³)

Averaging Period	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	2.25	0.10	0.13	0.23	10.0

[a] See Table 9.

Cadmium

8.14 Table 29 sets out the maximum predicted PC to annual mean cadmium concentrations, and the maximum PEC for annual mean cadmium concentrations at any sensitive receptor. The maximum PEC is well below the relevant EAL, and the impact is considered to be *insignificant*.

Table 29: Maximum PC and PEC for Cadmium (µg/m³)

Averaging Period	EAL	PC	Background [a]	PEC	PEC as % of EAL
Annual mean	0.005	0.0002	0.0007	0.0009	17.0

[a] See Table 10.

Group III Metals

8.15 The assessment of Group III metals follows the recommended methodology described by the Environment Agency in its 'Guidance to Applicants on Impacts for Group 3 Metals' (Environment Agency, 2016b). The methodology set out in the EA guidance describes a three-step approach to the assessment of trace metals in stack emissions, as outlined in Paragraph 3.19.

Step 1: Screening Scenario

8.16 On the basis of initial screening of the PCs (Table 23), further assessment is required for long-term concentrations of arsenic, lead, chromium (VI), manganese and nickel. The impacts from all other Group III metals for long-term concentrations, and for all Group III metals for short-term concentrations, are considered to be *insignificant*.

8.17 The annual mean PECs for Group III metals that could not be initially screened out are shown in Table 30. Using the screening criteria for the PEC, the impacts of lead, manganese and nickel can be considered *insignificant*, as the PECs are less than 70% of the EAL. Assessment of arsenic and chromium (VI) must proceed to Step 2, as the PEC is greater than 70% of the EAL.

Table 30: Group III Metals Assessment Step 1: Emissions at 100% BREF Emission Limit (µg/m³)

Metal	EAL	PC	Background [a]	PEC	PEC as % of EAL [b]
Arsenic	0.003	0.003	0.001	0.004	**128.6**
Lead	0.25	0.003	0.016	0.019	7.5
Chromium (VI)	0.0002	0.003	0.00033	0.003	**1,666.7**

Metal	EAL	PC	Background [a]	PEC	PEC as % of EAL [b]
Manganese	0.15	0.003	0.076	0.079	52.7
Nickel	0.02	0.003	0.002	0.005	24.2

[a] See Table 10.

[b] Based on unrounded values.

Step 2: Worst Case Scenario Based on Currently Operating Plant

8.18 Step 2 of the EA's approach then advises that the Group III metal emissions are factored in accordance with the *maximum* measured emission concentration (derived from 34 measured values) listed in Appendix A of the Guidance. The revised PCs (and if necessary, PECs) are then compared to the screening criteria. The results of the Step 2 screening stage are presented in Table 31.

Table 31: Group III Metals Assessment Step 2: Process Contributions at Maximum Measured Emission Concentration (µg/m^3)

Metal	Averaging Period	EAL	PC	PC as % EAL	Further Assessment Required
Arsenic	Annual mean	0.003	0.00031	10.2	**Yes**
Chromium (VI)	Annual mean	0.0002	1.59 x 10^{-6}	0.8	No

8.19 On the basis of the maximum measured emission concentrations, the impact on annual mean chromium (VI) can be screened as *insignificant*, as the revised PC is less than 1% of the long-term EAL. Further assessment, involving the calculation of the PEC, is required for arsenic, as the revised PC exceeds 1% of the long-term EAL. The results of the PEC assessment stage are presented in Table 32.

Table 32: Group III Metals Assessment Step 2: PECs at Maximum Measured Emission Concentration (µg/m^3)

Metal	EAL	PC	Background [a]	PEC	PEC as % of EAL [b]
Arsenic	0.003	0.0003	0.0009	0.0012	38.7

8.20 The PEC based on the maximum measured emission concentration for arsenic is less than 70% of the long-term EAL, and as such the impacts for long-term arsenic concentrations are also *insignificant*.

Road Traffic

8.21 The proposed development is expected to generate a total of 18 daily light vehicle trips and 20 daily heavy vehicle trips, with trips expected to distribute 50% southwest and 50% northeast on the A692. These daily trips are well below the screening thresholds recommended for use outside of an AQMA (see Paragraph 3.11). However, it is necessary to consider the possibility of cumulative air quality impacts as a result of both emissions from the operational facility and road traffic arising from the proposed development.

8.22 The maximum annual mean NO_2 PC from the main stack and boilers at any sensitive roadside receptor is 0.9 µg/m^3, with a maximum predicted PEC of 20.9 µg/m^3 (see Table 26). As the increases in road traffic are well below the screening thresholds for potentially significant impacts on air quality, it can reasonably be assumed that the increase in roadside concentrations that the additional traffic will generate will be no greater than that which will trigger a *negligible* impact regardless of baseline concentrations when using the EPUK/IAQM impact descriptors (see Table 3). This threshold is 0.5% of the EAL, or 0.2 µg/m^3. Taking a worst-case approach, adding 0.2 µg/m^3 to the maximum predicted PEC would result in an absolute maximum PEC of 21.1 µg/m^3, which represents an increase in concentration from the baseline of 1.1 µg/m^3 (2.8% of the EAL), a *negligible* impact according to the EPUK/IAQM impact descriptor matrix in Table 3. The cumulative impacts would, therefore, remain 'not significant'.

Uncertainty in Modelling Predictions

8.23 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 appropriate and required. In particular, by assuming continuous operation throughout the year (when the EfW process will be shut down for 4-5 weeks per year), and by using emission concentrations set at the regulatory maxima (when the plant will operate well below these limits most of the time), the assessment is likely to have over-predicted the process contributions by a relatively large margin.

8.24 Additional steps have also been taken to account for model uncertainty, such as the use of five years of meteorological data, and the worst-case (highest) modelled concentrations form any of these five years have been presented for robustness.

Significance of Operational Air Quality Effects

8.25 The operational air quality effects are judged to be 'not significant'. This professional judgement takes account of the assessment that:

- the impacts of the emissions from the proposed facility, and from additional traffic on the local road network, on human health receptors has been demonstrated to be 'not significant'; and
- the impacts of emissions from the proposed facility on sensitive ecological habitat receptors has been demonstrated to be 'not significant'.

9 Mitigation

Construction Impacts

9.1 Measures to mitigate dust emissions will be required during the construction phase of the development in order to minimise effect upon nearby sensitive receptors.

9.2 The site has been identified as *low risk*, as set out in Table 18. Comprehensive guidance has been published by the IAQM (2016) that describes measures that should be employed, as appropriate, to reduce the impacts. This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A4.

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

Operational Impacts

9.4 The proposed facility 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 6. This will be a requirement of the environmental permit, regulated by the Environment Agency, that must be issued in order for the facility to operate. No additional mitigation measures are proposed for the development, given that its impact when adhering to these levels is ‘not significant’.

10 Conclusions

10.1 The air quality assessment has considered the impacts of the proposed development on local air quality during both the construction and operational phases.

10.2 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 emissions. Mitigation measures have been recommended appropriate to a *low risk* site and, with these measures in place, it is expected that any residual effects will be ‘not significant’.

10.3 The operational impacts of the emissions to air from the proposed facility 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 or EAL, it has been shown that the total PEC will be below the objective or EAL. Annual mean nitrogen dioxide concentrations have been assessed in detail using the EPUK/IAQM impact descriptors, which are all *negligible*. Overall, the impacts on human health are considered to be *insignificant*.

10.4 The operational impacts of the emissions have been shown to be *insignificant* at the sensitive ecological habitats. All pollutants and averaging periods were screened out based on their PC being less than 1% of the long-term EALs, and 10% of the short-term EALs at all designated sites.

10.5 The assessment has demonstrated that the proposed 50 m stack height for the facility is appropriate in terms of air quality.

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12 Glossary

AADT	Annual Average Daily Traffic
ADMS-5	Atmospheric Dispersion Modelling System model for point sources
APIS	Air Pollution Information System
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AURN	Automatic Urban and Rural Network
AW	Ancient Woodland
B[a]P	Benzo[a]pyrene
BAT	Best Available Techniques
BREF	BAT Reference Document
CAZ	Clean Air Zone
CO	Carbon Monoxide
CROW	Countryside and Rights of Way Act
Defra	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
EAL	Environmental Assessment Limit
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
EU	European Union
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
IED	Industrial Emissions Directive
kW	Kilowatt

LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
LNR	Local Nature Reserve
$\mu g/m^3$	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
NRMM	Non-road Mobile Machinery
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
PAH	Polycyclic Aromatic Hydrocarbons
PC	Process Contribution
PCB	Polychlorinated biphenyls
PCDD/F	Dioxins and furans
PEC	Predicted Environmental Concentration
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
PPG	Planning Practice Guidance
SAC	Special Area of Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
VOC	Volatile Organic Compound
WHO	World Health Organisation

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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 m^3 – 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 A4.

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 PM_{10}
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 [4]

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

4 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 for trackout, 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 [4]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	>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 [4]

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 Professional Experience

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is an Associate Director with AQC, with 15 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.

Ricky Gellatly, BSc (Hons) CSci MIEnvSc MIAQM

Mr Gellatly is a Principal Consultant with AQC with over nine years' relevant experience. He has undertaken air quality assessments for a wide range of projects, assessing many different pollution sources using both qualitative and quantitative methodologies, with most assessments having included dispersion modelling (using a variety of models). He has assessed road schemes, airports, energy from waste facilities, anaerobic digesters, poultry farms, urban extensions, rail freight interchanges, energy centres, waste handling sites, sewage works and shopping and sports centres, amongst others. He also has experience in ambient air quality monitoring, the analysis and interpretation of air quality monitoring data, the monitoring and assessment of nuisance odours and the monitoring and assessment of construction dust. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Tom Richardson, MSci (Hons)

Mr Richardson is a Consultant with AQC, having joined in April 2018. His experience includes a variety of assessment techniques, including qualitative assessment, dispersion modelling (using ADMS-Roads and ADMS-5), construction dust risk assessments, Air Quality Neutral assessments and the assessment of impacts on designated ecological sites. He also has experience in reporting for environmental permitting at industrial and waste facilities, including energy from waste sites. He also manages ongoing dust monitoring at sites across Greater London.

Mr Richardson completed an MSci Chemistry at the University of Bristol in 2017, specialising in optical greenhouse gas (N_2O) monitoring methods and data processing using OpenAir and the R package.

A3 Meteorological Parameters

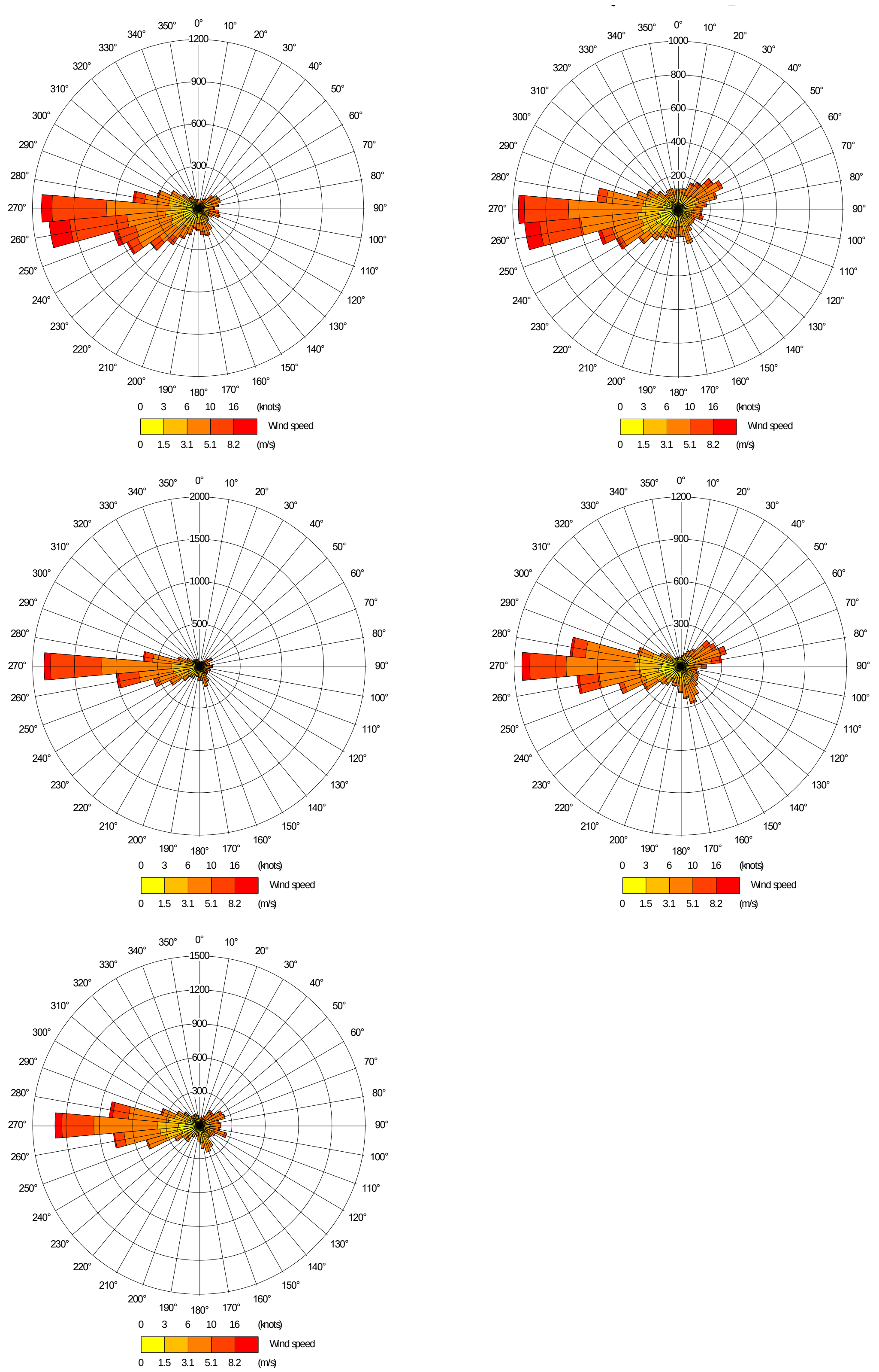

Figure A5.1: Wind Roses for Albemarle 2015-2019

Table A3.1: Meteorological Data Used in the Model

Parameter	Development Site	Meteorological Site
Surface Roughness (m)	Variable surface roughness file	0.2
Surface Albedo	Model default (0.23)	Model default (0.23)
Minimum M-O Length (m)	10	1
Priestly Taylor Parameter	Model default (1)	Dispersion site value

A4 Construction Mitigation

A4.1 Table A4.1 sets out a list of best-practice measures from the IAQM guidance (IAQM, 2016) that should be incorporated into the specification for the works. These measures should ideally be written into a Dust Management Plan. Some of the measures may only be necessary during specific phases of work, or during activities with a high potential to produce dust, and the list should be refined and expanded upon in liaison with the construction contractor when producing the Dust Management Plan.

Table A4.1: Best Practice Mitigation Measures Recommended for the Works

Measure	Desirable	Highly Recommended
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		✓
Display the head or regional office contact information		✓
Dust Management Plan		
Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management		✓
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		✓
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		✓
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		✓
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	✓	
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		✓
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		✓
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	✓	
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	✓	
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport	✓	
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)	✓	