5 AIR QUALITY

5.1 INTRODUCTION

5.1.1 This chapter sets out the air quality assessment for the Proposed Development and primarily focusses on the potential air quality impacts associated with emissions from the flue stack. The assessment also considers the potential for air quality impacts as a result of dust emissions during construction, as well as additional road traffic emissions and odour and bioaerosol emissions during operation. It also takes into consideration emissions from the emergency diesel generator.

5.1.2 The gasification and combustion of waste can give rise to emissions of a number of pollutants with the potential to lead to air quality impacts. The pollutants covered in this assessment in terms of human health impacts, which form the focus of the assessment, are listed below:

- nitrogen dioxide (NO_2);
- sulphur dioxide (SO_2);
- total dust, which includes fine airborne particulate matter (PM_{10} and $PM_{2.5}$);
- carbon monoxide (CO);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- Volatile Organic Compounds (VOCs);
- ammonia (NH_3);
- dioxins and furans; and
- the following trace metals:
    - cadmium (Cd);
    - thallium (Tl);
    - mercury (Hg);
    - antimony (Sb);
    - arsenic (As);
    - lead (Pb);
    - chromium (Cr);
    - copper (Cu);
    - manganese (Mn);
    - nickel (Ni); and

- vanadium (V).

5.1.3 In addition, there are nature conservation sites sufficiently close to the site that warrant assessment. These are the Northumbria Coast Special Protection Area (SPA) and Ramsar sites, the Durham Coast Special Area of Conservation (SAC), the High Wood Ancient Woodland site and Barmston Pond Local Nature Reserve (LNR). There are also a number of non-statutory Sites of Nature Conservation Importance (SNCIs) within 2 km of the site, which also require assessment. The SNCIs are Usworth Pond, Severn Houses, Peepy Plantation, Hylton Plantation, Wear River Bank Woods, Washington Wildfowl and Wetlands Centre, and Willows Pond. The relevant pollutants with the potential to affect sensitive ecosystems are:

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

5.1.4 In terms of road traffic emissions, the primary pollutants of concern are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$). During construction, the focus is on dust and particulate matter (PM_{10}) emissions. Waste handling during operation could also potentially lead to emissions of bioaerosols and odorous compounds.

5.1.5 The facility will have a diesel-powered emergency generator installed, which will only be used in the unlikely event of a major failure of the electrical distribution system within the facility. It is unlikely that it will ever be required to operate for this purpose. It will, though, be tested weekly. Nitrogen oxides emissions from diesel generators have been identified as potentially having significant air quality impacts, thus the emissions from the proposed generator have also been considered.

5.1.6 **Appendix 5.1** provides references and **Appendix 5.2** a glossary.

5.2 ASSESSMENT APPROACH

Methodology

Assessment Criteria

Criteria to Protect Human Health

5.2.1 **Table A5.3.1** in **Appendix 5.3** defines the assessment criteria for human health used in this study. The UK Government's Air Quality Objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. The UK objectives for nitrogen dioxide, PM_{10} and $PM_{2.5}$ are the same as the EU limit values.

5.2.2 The objectives apply at locations where members of the public are likely to be regularly present and exposed over the averaging period of the objective. Where there is no air quality objective, the Environment Agency's Environmental Assessment Levels (EALs) have been applied. Defra explains where the objectives apply in its Local Air Quality Management Technical Guidance (Defra, 2016). Annual mean objectives and EALs are considered to apply anywhere with residential exposure. The 24-hour mean objective for PM_{10} is taken to apply at residential properties as well as the gardens of residential properties. The 1-hour mean objective for nitrogen dioxide, and those EALs for shorter time periods than the annual mean, are taken to apply anywhere where people may spend one hour or more (or fifteen minutes in the case of the 15-minute sulphur dioxide objective).

5.2.3 Where there is no EAL quoted in Environment Agency guidance, one has been derived from the Health and Safety Executive's workplace exposure limits (HSE, 2005). This applies to the short term EAL for chromium VI, and the short- and long-term EALs for thallium and cobalt.

5.2.4 The Industrial Emissions Directive (IED) (Directive 2010/75/EU of the European Parliament and the Council on industrial emissions) 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, assuming that all TOCs are Volatile Organic Compounds (VOCs); that all VOCs are both benzene and 1,3 butadiene with respect to annual mean concentrations; and that all VOCs are dimethyl sulphate with respect to short-term EALs. This situation would not happen in practice and provides an extremely conservative assessment.

5.2.5 There are no assessment criteria for dioxins and furans. The World Health Organisation (WHO, 2000) provides an indicator of 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). In the absence of suitable criteria, the process contributions ('PC's) have been compared against this value.

5.2.6 **Table A5.3.1** in **Appendix 5.3** 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 identifies whether the 1-hour mean nitrogen dioxide objective is exceeded. A similar approach is applied to assessing other short-term objectives with a permitted number of exceedances, as outlined in **Table 5.1**.

Table 5.1: Equivalent Percentiles to the Air Quality Objectives

Pollutant	Averaging Period	Permitted Exceedances	Equivalent Percentile
NO_2	1 hour	18 per year	99.79th
PM_{10}	24 hour	35 per year	90.4th
SO_2	24 hour	3 per year	99.18th
	1 hour	24 per year	99.7th
	15 minute	35 per year	99.9th

Criteria to Protect Ecological Sites

5.2.7 Objectives for the protection of vegetation and ecosystems have been set by the UK Government. These are based on the European Union 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. These objectives and limit values do not, therefore, strictly apply within the study area, although it is common practice for them to be considered.

5.2.8 Critical levels and critical loads are the ambient concentrations and deposition fluxes below which significant harmful effects to sensitive ecosystems are unlikely to occur. The critical levels are set at the same concentrations as the objectives. 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 a Special Area of Conservation) is significantly greater than that afforded to a Local Nature Reserve (LNR), reflecting the relative sensitivity of the sites as well as their perceived ecological value.

5.2.9 The Air Pollution Information System (APIS) database (APIS, 2017) has been searched to obtain relevant critical levels and critical loads. Where APIS does not provide critical levels for a given pollutant, they have been taken from the Environment Agency's "Air Emissions Risk Assessment" guidance (Environment Agency, 2016a). Different critical loads are available for different habitats; and in the case of acidity, different locations. The Durham Coast ecological sites overlap the Northumbria Coast sites. As the nutrient nitrogen and acid deposition critical loads for the Northumbria Coast SPA are the lowest and therefore the most worst-case, these have been used for all the Northumbria Coast and Durham Coast sites. The nutrient nitrogen and acid deposition critical loads for acid grassland have been used to represent the habitat at Barmston Pond LNR, as it provides the lowest, and thus worst-case, threshold. The relevant critical levels and critical loads are set out in **Table 5.2**. The approach recommended by APIS for assessing acid deposition only refers to nitrogen and sulphur. In order to account for the acidifying input from hydrogen chloride, the sum of nitrogen, sulphur and chlorine acidity has been assessed directly against the 'N_{max}' values from APIS. This provides a conservative assessment.

Table 5.2: Relevant Assessment Criteria for the Protection of Sensitive Ecosystems [a]

Pollutant	Averaging Period	Species/Habitat	EAL
NH_3	Annual	All higher plants	3 μg/m^3
NOx	Annual	All sensitive communities (but does not apply as an objective or limit value within the study area)	30 μg/m^3
	24 hour	All sensitive communities	75 μg/m^3
SO_2	24 hour	All higher plants	20 μg/m^3
HF	1 hour	All sensitive communities	5 μg/m^3
	15 minute	All sensitive communities	0.5 μg/m^3
Nutrient Nitrogen Deposition Critical Loads	Annual	Northumbria Coast SPA and Ramsar Site	8 kg-N/ha/yr
		Durham Coast SAC	N/A [b]
		High Wood Ancient Woodland	10 kg-N/ha/yr
		Barmston Pond LNR	10 kg-N/ha/yr
		All SNCIs	10 kg-N/ha/yr
Acid Deposition Critical Load (Nmax) [b]	Annual	Northumbria Coast SPA	0.786 keq/ha/yr
		Durham Coast SAC	N/A [c]
		High Wood Ancient Woodland	2.734 keq/ha/yr
		Barmston Pond LNR	2.008 keq/ha/yr
		Peepy Plantation and Hylton Plantation SNCIs	2.734 keq/ha/yr
		All other SNCIs	2.008 keq/ha/yr

[a] Taken from the Air Pollution Information System (APIS) database (APIS, 2017) and from the Environment Agency's "Air Emissions Risk Assessment" guidance (Environment Agency, 2016a).

[b] No comparable habitat with an established critical load estimate is available.

[c] Not sensitive to acid deposition.

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

Screening and Descriptive Criteria

Criteria Issued by the Environment Agency

5.2.10 The Environment Agency has adopted criteria (Environment Agency, 2016a) that allow health-related PCs to be screened out as insignificant regardless of the baseline environmental conditions. The emissions from a process can be considered to be insignificant if:

- the long-term (annual mean) PC is <1% of the long-term environmental standard; and
- the short-term (24-hour mean or shorter) PC is <10% of the short-term environmental standard.

5.2.11 It should be recognised that these criteria determine when an effect can be screened out as insignificant. They do not imply that effects will necessarily be significant above these levels, only that there is a potential for significant effects that should be assessed using a detailed assessment methodology, such as detailed dispersion modelling (as has been carried out for this project in any event), and taking into account background concentrations. The next step in the Environment Agency's screening process for long-term contributions is to add the PC to the local background concentration to calculate the Predicted Environmental Concentration (PEC). For short-term contributions it is to compare the PC against the short-term environmental standard minus twice the long-term background concentration. The emissions are insignificant if:

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

5.2.12 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.

5.2.13 In terms of the potential for ecological impacts on local (as opposed to national or European) wildlife sites, the Environment Agency discounts as insignificant any impacts where the PC is less than 100% of the long-term or short-term environmental standard (Environment Agency, 2013). The criteria for national and European wildlife sites is the same as that set out in paragraph 5.2.10.

Environmental Protection UK and Institute of Air Quality Management Criteria

5.2.14 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 Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance document aimed specifically at planning applications.

5.2.15 The approach developed jointly by EPUK & IAQM (Moorcroft and Barrowcliffe et al, 2017), as described in **Appendix 5.4**, 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 is only really intended to be used in considering impacts on the primary pollutants associated with road traffic emissions, nitrogen dioxide and particulate matter, thus it is more appropriate to use the Environment Agency criterion for other pollutants. With respect to changes in short-term concentrations, the guidance explains that:

5.2.16 "Where peak short term concentrations (those averaged over periods of an hour or less) from an elevated source are in the range 10-20% of the relevant Air Quality Assessment Level (AQAL), then their magnitude can be described as small, those in the range 20-50% medium and those above 50% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. In most cases, the assessment of impact severity for a proposed development will be governed by the long-term exposure experienced by receptors and it will not be a necessity to define the significance of effects by reference to short-term impacts. The severity of the impact will be substantial when there is a risk that the relevant AQAL for short-term concentrations is approached through the presence of the new source, taking into account the contribution of other local sources".

Approach Used in This Assessment

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

- is the long-term (annual mean) PC less than 1% (0.5% for nitrogen dioxide and particulate matter) of the long-term environmental standard? and

- is the short-term (24-hour mean or shorter) PC less than 10% of the short-term environmental standard?

5.2.18 Where both of these criteria are met, the impacts are negligible and thus insignificant. Where these criteria are breached, a more detailed assessment, considering total concentrations, has been undertaken.

Construction Dust Criteria

5.2.19 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (2016) has been used. Full details of this approach are provided in **Appendix 5.5**.

Odour Criteria

5.2.20 There are currently no statutory standards in the UK covering the release and subsequent impacts of odours. This is due to complexities involved with measuring and assessing odours against compliance criteria, and the inherently subjective nature of odours.

5.2.21 It is recognised that odours have the potential to pose a nuisance for residents living near to an offensive source of odour. Determination of whether or not an odour constitutes a statutory nuisance in these cases is usually the responsibility of the local planning authority or the Environment Agency. The Environmental Protection Act 1990 (HMSO, 1990) outlines that a local authority can require measures to be taken where any:

"dust, steam, smell or other effluvia arising on an industrial, trade and business premises and being prejudicial to health or a nuisance…" or

"fumes or gases are emitted from premises so as to be prejudicial to health or cause a nuisance".

5.2.22 Odour can also be controlled under the Statutory Nuisance provisions of Part III of the Environmental Protection Act.

5.2.23 The Environment Agency's H4 guidance document (Environment Agency, 2011a) provides guideline odour benchmarks for predicted 98th percentiles of 1-hour mean odour concentrations. The guideline odour benchmarks are:

- 1.5 OU_E/m^3 for most offensive odours;
- 3 OU_E/m^3 for moderately offensive odours; and
- 6 OU_E/m^3 for less offensive odours.

5.2.24 These concentrations are used later in the assessment to determine where odour impacts may occur.

Bioaerosol Criteria

5.2.25 There is currently no guidance relevant to bioaerosol releases from the storage, disposal or thermal treatment of refuse derived fuel (RDF). All current guidance in the UK relates to composting activities, which have a much greater propensity for bioaerosol production than would be expected from RDF.

5.2.26 In 2001, the Environment Agency commissioned a study into the health effects of composting which included close examination of bioaerosols (Environment Agency, 2001). The study examined three major UK composting sites at which bioaerosol monitoring was undertaken for a number of sources at each site during visits at different times of year. The monitoring provided information on the concentration of bioaerosols, measured in colony forming units per cubic metre of air (cfu/m^3), and the reduction in concentrations with distance from the source brought about by the dilution and dispersion of microorganisms during transport in air.

5.2.27 The study set out the following threshold limit values for short-term non-occupational exposure to bioaerosols:

- Bacteria = 1000 cfu/m^3;
- Fungi = 1000 cfu/m^3; and
- Gram-negative Bacteria = 300 cfu/m^3.

5.2.28 Although these limit values were not supported by significant scientific evidence, they were accepted as being a conservative estimate of "safe" levels of exposure.

5.2.29 In addition, an Environment Agency position statement on the health effects of bioaerosols from composting (Environment Agency, 2010) states that bioaerosol concentrations *"generally decline to background levels within 250 m"* of composting activities. This statement was based on general consensus at the time of publication.

5.2.30 Until new, industry-specific guidance is released, the information available on bioaerosols from composting remains the only available guidance that is applicable to the waste industry. However, as stated above, composting activities will have a much greater propensity for bioaerosol production than would be expected from the handling of RDF.

Approach- Existing Conditions

5.2.31 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority and by Defra. Background concentrations have been defined using the national pollution maps published by Defra (2017a). These cover the whole country on a 1x1 km grid. These cover the whole country on a 1x1 km grid. Further information about background concentrations can be found in **Appendix 5.6**.

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

Approach- Stack Emissions

Study Area

5.2.33 The study area for consideration of the health impacts of emissions from the stack covers a 3km x 3km area centred on the Proposed Development, plus an extension of this area covering a further 6km to the north and east, in the direction of prevailing winds and thus the area where impacts are greatest.

5.2.34 The Environment Agency requires an assessment of the impacts on European designated ecological sites (e.g. SPAs, SACs etc) within 10 km of the facility, and on national and local designated ecological sites (e.g. SSSIs, LNRs etc) within 2 km of the facility (Environment Agency, 2016a). The relevant sites for this assessment are the Northumbria Coast SPA and Ramsar sites, 8.6 km to the east, the Durham Coast SAC, 9.1 km to the north east and 9.4 km to the south east, the High Wood Ancient Woodland site, 1.6 km to the south east, and Barmston Pond LNR, approximately 200 m to the south-east of the proposed development site. Refer to **Chapter 11 Ecology & Nature Conservation** for further information on the ecological credentials of these sites.

Modelling Impacts from the Proposed REC

5.2.35 The impacts of emissions from the proposed facility have been modelled using the ADMS-5.2 dispersion model. ADMS-5.2 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer.

Receptors

5.2.36 Impacts have been predicted at a number of locations close to the proposed development. Individual receptors have been identified to represent worst-case exposure within these locations, being located on the facades of residential properties closest to the sources pf pollution. Impacts have also been predicted across three nested cartesian grids:

- a 1km x 1km inner grid, centred on the Proposed Development, with receptors spaced 20 m apart;
- a middle grid, extending 3km from the Proposed Development, with receptors spaced 40 m apart; and
- an outer grid, extending 6km to the north and east of the Proposed Development, with receptors spaced 100 m apart.

5.2.37 The individual receptors and the gridded receptors have been modelled at a height of 1.5 m, to represent ground-level human exposure. The gridded receptors are shown in **Figure 5.1**, while the individual human receptors (R1 to R16) are shown in **Figure 5.2**. Receptors E1 to E15 in **Figure 5.3** represent the relevant nearby nature conservation sites, and have also been modelled at a height of 1.5 m.

Meteorology

5.2.38 Five years of hourly-sequential meteorological data (2012 to 2016 inclusive) from Newcastle Airport have been used. This meteorological station is located approximately 18.5 km to the north east of the Proposed Development site. It is the nearest station that measures all of the required parameters. Both the Proposed Development site and the Newcastle Airport meteorological station are located in the north east of England where they will be influenced by the effects of inland meteorology. The specific setting of the meteorological station is more open than that of the Proposed Development site, which is more urban. The different meteorological parameters used in the model for the Proposed Development site and the meteorological site (such as surface roughness) are intended to account for these differences.

5.2.39 **Appendix 5.7** provides a wind-rose for each meteorological dataset, and outlines the other meteorological parameters used in the model (such as surface roughness etc.). The maximum predicted PC during any year has been reported throughout this chapter.

Building Wake Effects

5.2.40 ADMS-5 has the ability to simulate the entrainment of exhaust plumes into the wake of nearby buildings. In order to ensure that the worst-case building configuration was covered, modelling has been carried out for two scenarios: 1) no buildings included in the model; 2) the main on-site building included in the model. **Figure 5.4** shows the building modelled. The building has been split into three sections and modelled at heights of 20 m, 36 m and 30 m, with the 20 m section closest to the stack. The maximum predicted concentrations from the two scenarios have been used throughout this assessment.

Terrain Effects

5.2.41 The terrain within the study area is largely flat and is not expected to have any impact on dispersion. A topographical grid has not, therefore, been included in the model runs.

Emissions

5.2.42 The plant manufacturer has provided data on efflux volumes in Nm^3/s[1], as well as flue/stack dimensions (the stack will house two flues of 1.4 m diameter, which have been combined within the model, as recommended by the model developer, into a combined flue of 1.98 m diameter) and the actual release conditions. The release parameters are set out in **Table A5.6.1** in **Appendix 5.6**. The pollutant emission rates used in the assessment are derived from IED limits, which are also set out in **Appendix 5.6** along with the emission rates entered into the dispersion model.

Post-Processing

5.2.43 ADMS-5 has been run to predict the contribution of the stack emissions to annual mean concentrations of the pollutants for which there are annual mean objectives and EALs in **Table A5.3.1** in **Appendix 5.3**, as well as to the 99.79th percentile of 1-hour mean nitrogen oxides concentrations, 90th percentile of 24-hour mean PM_{10} concentrations, 99.7th percentile of 1-hour mean sulphur dioxide concentrations, 99.9th percentile of 15-minute sulphur dioxide concentrations and 99.18th percentile of 24-hour mean sulphur dioxide concentrations.

5.2.44 The approach recommended by Defra (Defra, 2016) 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 concentrations = Annual mean nitrogen oxides x 0.7; and

- 99.79th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.79th percentiles of 1-hour mean nitrogen oxides x 0.35.

5.2.45 Deposition of pollutants to ecosystems has not been calculated within the dispersion model. Instead, deposition has been calculated from the predicted ambient concentrations using the deposition velocities for forest (High Wood Ancient Woodland only) or grassland (all remaining sites) taken from AQTAG06 (Environment Agency, 2011a):

- NO_2 – 0.003 m/s (forest); 0.0015 m/s (grassland)

- NH_3 – 0.03 m/s (forest); 0.02 m/s (grassland)

- SO_2 – 0.024 m/s (forest); 0.012 m/s (grassland)

- HCl – 0.06 m/s (forest); 0.025 m/s (grassland)

5.2.46 The velocities are applied simply by multiplying a concentration ($\mu g/m^3$) by the velocity (m/s) to predict a deposition flux ($\mu g/m^2/s$). Subsequent calculations required

[1] Throughout this report, 'normal' ('N') is used to refer to conditions recorded in the absence of moisture, at 11% oxygen, and at 0 degrees Celsius. These are the reference conditions at which the relevant IED emissions limits are expressed.

to present the data as kg/ha/yr of nitrogen and as keq/ha/yr for acidity follow basic chemical and mathematical rules[2].

Assumptions and Uncertainty

5.2.47 It is important to highlight that some of the assumptions made with regard to the stack emissions modelling will ensure a worst-case assessment. It has been assumed that the facility will operate continuously, although it will be shut down for maintenance for at least five weeks each year. Predicted annual mean concentrations should, therefore, be some 9.5% lower than presented in this chapter.

5.2.48 IED emission rates have also been assumed. The gasification technology is expected to result in emission rates lower than these maxima permitted under IED, and the Environment Agency often imposes even lower limits, especially for nitrogen oxides. The assessment has been founded on the maximum predicted concentration from any of the five years modelled. These assumptions ensure that the assessment is worst-case, and that the actual impacts of the facility will be considerably lower than those described.

Approach- Emergency Diesel Generator

5.2.49 The principal pollutant of potential concern from diesel generators is nitrogen dioxide, thus the assessment has focussed on predicting the concentrations of this pollutant. The emissions from the diesel generator have been modelled using the ADMS-5 dispersion model.

5.2.50 The exact diesel generator to be installed within the facility is not known at this stage, thus a number of assumptions have been made in calculating the emission parameters. The assumed parameters are set out in Table 5.7. Where parameters have been estimated the approach has been to use the reasonable worst-case assumptions set out in Table 5.7, i.e. the combination of parameters that would lead to the highest ground-level concentrations has been assumed.

Table 5.7: Emission Parameters for the Diesel Generator

Parameter	Value
Anticipated Electrical Output (kVA)	750
Typical Generator Efficiency (%)	35
Estimated Net Fuel Input (MW)	1.606
Low-End Typical Generator Exhaust Temperature (^{o}C)	475
Typical Generator Excess Air In (%)	90
Assumed NOx Emission Standard	EU Stage II [a]
Assumed NOx Emission Rate (mg/Nm^3) [b]	2,780
Assumed Flue Internal Diameter (m)	0.35
Calculated Exit Velocity (m/s)	23.7
Calculated Actual Volume Flow Rate (m^3/s)	2.28
Calculated Normalised Volume Flow Rate (Nm^3/s) [b]	0.516

2 For example, 1 kg N/ha/yr = 0.071 keq/ha/yr

Calculated NOx Emission Rate (g/s)	1.43
Stack Height Above Ground-Level (m)	17.0
Stack Location (O.S. x,y)	432246,557325
Assumed Annual Usage (Hours)	52 [c]

[a] This is a fairly conservative assumption, as it is likely that by the time the diesel generator is installed in the facility, it will be required to comply with the emission requirements of the Medium Combustion Plant Directive (Directive 2015/2193/EU of the European Parliament and of the Council, 2015), which sets a much lower NOx emission limit of 200 mg/Nm^3 to be applied to new plant from December 2018.

[b] In this instance, 'normal' conditions are dry, at 5% oxygen, and at 0°C.

[c] The emergency generator is unlikely to ever be required to operate, but will be tested weekly. It has been conservatively assumed that these tests will last for an hour each, and will take place at full load.

5.2.46 It has been assumed that the generator will operate for 52 hours each year (1 hour of testing per week) and the model-output concentrations have been adjusted accordingly.

Approach- Road Traffic Emissions

5.2.51 The approach taken in this assessment has been to model the road traffic emissions along local roads using the ADMS-Roads model. Baseline and 'with development' road traffic emissions dispersion modelling has been undertaken in order to calculate total annual mean nitrogen dioxide concentrations at sensitive receptors close to busy roads where the impacts of the stack emissions, and the increases in road traffic as a result of the Proposed Development, are greatest.

Receptors

5.2.52 Nitrogen dioxide concentrations have been predicted at a number of locations in local areas, where the stack emissions impacts are expected to be greatest, or where the road traffic impacts of the Proposed Development are expected to be greatest. Receptors have been identified to represent worst-case exposure at these locations, being located at the façades of the properties closest to the sources. When selecting these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links and the Proposed Development.

5.2.53 Sixteen existing residential properties have been identified as receptors for the assessment, where the PCs from the stack emissions and the traffic impacts of the Proposed Development are expected to be greatest. All roadside receptors have been modelled at 1.5 m height. In addition, concentrations have been modelled at the Parkside South nitrogen dioxide monitoring site in Sunderland, in order to verify the modelled road traffic emissions results (see **Appendix 5.6** for the road traffic model verification method).

Assessment Scenarios

5.2.54 Predictions of nitrogen dioxide concentrations have been carried out for a base year (2016), and the proposed year of opening (2021). For 2021, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). In addition to the set of 'official' predictions, a sensitivity test has been carried out for nitrogen dioxide that involves assuming much higher nitrogen oxides emissions from certain vehicles than have been forecast by Defra. This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016a).

Modelling Methodology

5.2.55 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs, assumptions and the verification are provided in **Appendix 5.6**, together with the method used to derive current and future year background nitrogen dioxide concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Uncertainty in Road Traffic Modelling Predictions

5.2.56 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

5.2.57 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see **Appendix 5.6**). This can only be done for the road traffic model. Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2016) concentrations.

5.2.58 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

5.2.59 Historically, large reductions in nitrogen oxides emissions have been projected, which has led to significant reductions in nitrogen dioxide concentrations from one year to the next being predicted. Over time, it was found that trends in measured concentrations did not reflect the rapid reductions that Defra and DfT had predicted (Carslaw et al., 2011). This was evident across the UK, although the effect appeared to be greatest in inner London; there was also considerable inter-site variation. Emission projections over the 6 to 8 years prior to 2009 suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25%, whereas monitoring data showed that concentrations remained relatively stable, or even showed a slight increase. Analysis of more recent data for 23 roadside sites in London covering the period 2003 to 2012 showed a weak downward trend of around 5% over the ten years (Carslaw and Rhys-Tyler, 2013), but this still falls short of the improvements that had been predicted at the start of this period. This pattern of no clear, or limited, downward trend is mirrored in the monitoring data assembled for this study, as set out later in paragraph 5.3.8.

5.2.60 The reason for the disparity between the expected concentrations and those measured relates to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have had to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles has often been no better than that of earlier models. This has been compounded by an increasing proportion of nitrogen dioxide in the nitrogen oxides emissions, i.e. primary nitrogen dioxide, which has a significant effect on roadside concentrations (Carslaw et al., 2011) (Carslaw and Rhys-Tyler, 2013).

5.2.61 A detailed analysis of emissions from modern diesel vehicles has been carried out (AQC, 2016a). This shows that, where previous standards had limited on-road success, the 'Euro VI' and 'Euro 6' standards that new vehicles have had to comply with from 2013/16 are delivering real on-road improvements. A detailed comparison of the predictions in Defra's latest Emission Factor Toolkit (EFT v7.0) against the results from on-road emissions tests has shown that Defra's latest predictions still have the potential to under-predict emissions from some vehicles, albeit by less than has historically been the case (AQC, 2016a). In order to account for this potential under-prediction, a sensitivity test has been carried out in which the emissions from Euro IV, Euro V, Euro VI, and Euro 6 vehicles have been uplifted as described in paragraph A5.6.9 in **Appendix 5.6**, using AQC's CURED (V2A) tool (AQC, 2016b). The results from this sensitivity test are likely to over-predict emissions from vehicles in the future (AQC, 2016b) and thus provide a reasonable worst-case upper-bound to the assessment.

<u>Approach- Construction Dust</u>

5.2.62 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 the IAQM (Institute of Air Quality Management, 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 5.5** explains the approach in more detail.

<u>Approach- Odour</u>

5.2.63 There are a number of odour assessment methods and tools that have been developed, and which are widely used in the UK, including desk-based methods, such as complaints analysis and qualitative risk assessment, through to field odour testing (sniff testing) and dispersion modelling. Each has its advantages and disadvantages and not all assessment methods are appropriate in every case; for example, where a potentially odorous process is proposed rather than existing, then assessment methods such as sniff testing and odour sampling are less relevant than predictive methods such as odour risk assessment.

5.2.64 The approach to assessing the odour impacts from the Proposed Development has been to utilise the qualitative risk-assessment approach described in the IAQM guidance on the assessment of odours for planning (IAQM, 2014).

5.2.65 The odour risk assessment set out in the IAQM guidance follows a Source-Pathway-Receptor approach. This approach describes the concept that, in order for an odour impact (such as annoyance or nuisance) to occur, there must be a source of odour, a pathway to transport the odour to an off-site location, and a receptor (e.g. people) to be affected by the odour.

5.2.66 The risk of odour effects at a given receptor location may be estimated using the following fundamental relationship:

$$\text{Effect} \approx \text{Dose} \times \text{Response}$$

5.2.67 In this relationship, the **dose** is a measure of the likely exposure to odours, in other words the ***impact***. The **response** is determined by the sensitivity of the receiving environment and thus the overall ***effect*** is the result of changes in odour exposure at specific receptors, taking into account their sensitivity to odours.

5.2.68 In order to determine the risk of potential odour effects from the facility, the 'FIDOR' factors for odour exposure have been used. These factors are commonly used in the assessment of odours and are outlined in the IAQM guidance, but are also described in the Environment Agency's H4 guidance document on odour management (Environment Agency, 2011a), as well as Defra's odour guidance for local authorities (Defra, 2010). The FIDOR factors are:

- **F**requency – the frequency with which odours are detected;
- **I**ntensity – the intensity of odours detected;
- **D**uration – the duration of exposure to detectable odours;
- **O**ffensiveness – the level of pleasantness or unpleasantness of odours; and
- **R**eceptor – the sensitivity of the location where odours are detected, and/or the proximity of odour releases to an odour-sensitive location.

5.2.69 Odour emissions from the proposed REC have been assigned a risk-ranking based on the "effect ≈ dose x response" relationship, whereby the dose (impact) is determined by the "FIDO" part of FIDOR, and the response is determined by the "R" (receptor sensitivity). The risk of odour effects can therefore be described as:

Effect ≈ Impact (FIDO) x Receptor Sensitivity (R)

5.2.70 The key factors that will influence the effects of odours are the magnitude of the odour source(s), the effectiveness of the pathway for transporting odours, and the sensitivity of the receptor. The methodology set out in the IAQM guidance document describes in detail a Source-Pathway-Receptor approach to odour risk assessment, and includes tables and matrices to assist in determining the likely risk of odour effects. The IAQM methodology is outlined below. It includes an element of professional judgement.

5.2.71 The assessment examines the source odour potential (source magnitude) of the renewable energy centre, and then identifies the effectiveness of the pathway and receptor sensitivity at sensitive locations.

5.2.72 **Table 5.3** describes the risk-rating criteria (high, medium and low) for source odour potential, pathway effectiveness and receptor sensitivity applied in this assessment. This table has been adapted from Table 8 in the IAQM odour guidance.

Table 5.3: Source-Pathway-Receptor Risk Ratings

Source Odour Potential	Pathway Effectiveness	Receptor Sensitivity
Large Source Odour Potential: Large-scale odour source and/or a source with highly unpleasant odours (hedonic tone -2 to -4); no odour control.	**Highly Effective Pathway:** Very short distance between source and receptor; receptor downwind of source relative to prevailing wind; ground level releases; no obstacle between source and receptor.	**High Sensitivity:** Highly sensitive receptors e.g. residential properties and schools.
Medium Source Odour Potential: Medium-scale odour source and/or a source with moderately unpleasant odours (hedonic tone 0 to -2); basic odour controls.	**Moderately Effective Pathway:** Receptor is local to the source; releases are elevated, but compromised by building effects.	**Medium Sensitivity:** Moderately sensitive receptors e.g. commercial and retail premises, and recreation areas.
Small Source Odour Potential: Small-scale odour source and/or a source with pleasant odours (hedonic tone +4 – 0); best practise odour controls.	**Ineffective Pathway:** Long distance between source and receptor (>500 m); receptors upwind of source relative to prevailing wind; odour release from stack/high level.	**Low Sensitivity:** Receptors not sensitive e.g. industrial activities or farms.

5.2.73 The risk ratings for source magnitude and pathway effectiveness (for each receptor) identified using the criteria in **Table 5.3** are then combined using the matrix shown in **Table 5.4** to estimate an overall risk of odour impact at each specific receptor location.

Table 5.4: Assessment of Risk of Odour Impact at a Specific Receptor Location

Pathway Effectiveness	**Source Odour Potential (Source Magnitude)**		
	Large	**Medium**	**Small**
Highly Effective	High Risk	Medium Risk	Low Risk
Moderately Effective	Medium Risk	Low Risk	Negligible Risk
Ineffective	Low Risk	Negligible Risk	Negligible Risk

5.2.74 The next stage of the risk assessment is to identify the potential odour effect at each receptor location. This is done using the matrix presented in **Table 5.5**, which combines the overall odour impact risk descriptor for each receptor with the receptor sensitivity determined using the criteria in **Table 5.3**.

Table 5.5: Assessment of Potential Odour Effect at a Specific Receptor Location

Risk of Odour Impact	Receptor Sensitivity		
	High	**Medium**	**Low**
High Risk	Substantial Adverse Effect	Moderate Adverse Effect	Slight Adverse Effect
Medium Risk	Moderate Adverse Effect	Slight Adverse Effect	Negligible Effect
Low Risk	Slight Adverse Effect	Negligible Effect	Negligible Effect
Negligible Risk	Negligible Effect	Negligible Effect	Negligible Effect

5.2.75 As a final stage of assessment, an overall significance of odour effects is determined, based on professional judgment and taking into account the significance of effect at each specific receptor location.

Approach- Bioaerosols

5.2.76 A qualitative approach has been taken to the bioaerosol assessment, based upon the likelihood of the generation of bioaerosols, the quantity likely to be generated, the potential for them to be released to the air outside of the facility, and the potential for such releases to lead to significant impacts at the nearest sensitive receptors.

Assessment of Significance

Construction Dust Significance

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

Operational Air Quality Impact Significance

5.2.78 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. While the Environment Agency's "Air Emissions Risk Assessment" (Environment Agency, 2016a) guidance does not set out a method of describing air quality impacts or determining how significant they are, it does set out screening criteria below which impacts can be considered insignificant (see paragraphs 5.2.10 and 5.2.11). These screening criteria have, therefore, been used in this assessment, along with the approach developed jointly by EPUK & IAQM (Moorcroft and Barrowcliffe et al, 2017). The EPUK & IAQM approach includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in **Appendix 5.4**. The approach includes elements of professional judgement, and the experience of the consultants preparing the assessment is set out in **Appendix 5.8**.

5.2.79 It is important to differentiate between the terms impact and effect with respect to the assessment of air quality. The term impact is used to describe a change in pollutant concentration at a specific location. The term effect is used to describe an environmental response resulting from an impact, or series of impacts. Within this chapter, the air quality assessment has used published guidance and criteria described in the following sections to determine the likely air quality impacts at a number of sensitive locations. The potential significance of effects has then been determined by professional judgement, based on the frequency, duration and magnitude of predicted impacts and their relationship to appropriate assessment criteria.

Operational Odour & Bioaerosol Significance

5.2.80 The IAQM guidance document (IAQM, 2014) contains a method for estimating the significance of potential odour impacts, and has been used in determining the significance of potential odour impacts. There is no guidance that sets out how to determine the significance of bioaerosol impacts, thus professional judgement has been applied.

Policy Framework

European Legislation

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

5.2.81 The European Union has set limit values (concentrations which must not be exceeded) for a range of air pollutants. These limit values are set out in the EU Framework Directive (2008/50/EC, 2008). Achievement of these values is a national obligation and was required by 2010 for nitrogen dioxide and benzene, by 2005 for all other pollutants apart from $PM_{2.5}$, which was required by 2015.

Waste Framework Directive, 2008

5.2.82 The Waste Framework Directive (2008/98/EC, 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:

5.2.83 "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:

- *without risk to water, air, soil, plants or animals;*
- *without causing nuisance through noise or odours; and*
- *without adversely affecting the countryside or places of special interest*."

European Industrial Emissions Directive, 2010

5.2.84 The Industrial Emissions Directive (IED) (2010/75/EU, 2010) brings together seven existing directives, including the Waste Incineration Directive, into one piece of legislation. The IED sets total emission limit values (ELVs) for a number of pollutants typically emitted during waste incineration. These are nitrogen oxides, carbon monoxide, total dust, hydrogen chloride, hydrogen fluoride, sulphur dioxide, organic substances, trace metals, and dioxins and furans. The design and operation of all new waste incineration facilities must ensure compliance with the ELVs.

National Legislation

The Environmental Permitting Regulations in England and Wales, 2016

5.2.85 The Environmental Permitting Regulations (2016) sets the legislative background for environmental permitting in England and Wales. The Regulations include a commitment to minimise emissions to air from permitted processes, and include obligations for compliance with all legislated emissions limits for permitted processes, including the IED emission limits for waste incineration processes.

The Waste (England and Wales) Regulations 2011

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

The UK Air Quality Strategy, 2007

5.2.87 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment (Defra, 2007). The 'standards' are set as pollutant concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale.

5.2.88 The Strategy also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives (AQO). 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

5.2.89 These Regulations define the air quality objectives for the Local Air Quality Management (LAQM) Regime.

Air Quality Standards Regulations, 2010

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

<u>National Planning Policy</u>

National Planning Policy Framework, 2012

5.2.91 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should *"contribute to…reducing pollution"*. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the *"effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account"*.

5.2.92 More specifically the NPPF makes clear that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan".

Planning Practice Guidance

5.2.93 The NPPF is now supported by National Planning Practice Guidance (NPPG) (DCLG) which was launched in 2014 and is updated electronically periodically. The NPPG includes guiding principles on how planning can take account of the impacts of new development on air quality. The NPPG states that *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*". The PPG makes clear that *"Air quality can also affect biodiversity and may therefore impact on our international obligation under the Habitats Directive".* In addition, the PPG makes clear that *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

5.2.94 The NPPG states that:

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

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

National Policies to Protect Ecosystems

5.2.96 The Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity. National planning policy on biodiversity and conservation is set out in the NPPF (National Planning Policy Framework, 2012). This emphasises that the planning system should seek to minimise impacts on biodiversity and provide net gains in biodiversity wherever possible as part of the Government's commitment to halting declines in biodiversity and establishing coherent and resilient ecological networks.

5.2.97 Local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife sites will be judged, making distinctions between different levels of site designation. If significant harm from a development cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

Local Planning Policy

Sunderland Unitary Development Plan

5.2.98 Sunderland's Unitary Development Plan (UDP) was adopted in 1998 and an updated policy framework (UDP Alteration No. 2) was adopted in 2007 (Sunderland City Council, 2007). The UDP acknowledges that road traffic is the main cause of poor air quality. UDP Policy EN9 confirms air pollution, dust or smell will be a material consideration in determining applications.

5.2.99 Sunderland City Council is currently preparing a new Local Plan. The draft Core Strategy and Development Plan 2015-2033 was published for consultation in 2017 to form part of the Local Plan and is expected to be ready for adoption in 2019. Draft Policy E17 states that planning permission for new development proposals will be granted provided that it does not generate unacceptable adverse impacts, including in terms of dust, odour and emissions.

Air Quality Action Plans

National Air Quality Plan

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

Guidance Notes

Environment Agency Air Emissions Risk Assessment, 2016

5.2.101 The Environment Agency's "Air Emissions Risk Assessment" (Environment Agency, 2016a) provides methods for quantifying the air quality effects of industrial emissions. It contains long- and short-term Environment Assessment Levels (EALs) for releases to air derived from a number of published UK and international sources.

5.2.102 In addition, the Environment Agency's Interim Guidance Note for Metals provides guidance for applicants for environmental permits, on how to consider the air quality effects from Group III metals in stack emissions from incineration and co-incineration plant (Environment Agency, 2016b).

Health and Safety Executive, Workplace Exposure Limits, 2005

5.2.103 The Health and Safety Executive's EH40/2005 Workplace exposure limits (HSE, 2005) document 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.

Odour Guidance

Defra Guidance

5.2.104 Defra released Odour Guidance for Local Authorities in March 2010 (Defra, 2010). This is a reference document aimed at environmental health practitioners and other professionals engaged in preventing, investigating and managing odours. The purpose of the guide is:

5.2.105 "…to support local authorities in their regulatory roles in preventing, regulating and controlling odours..."

5.2.106 The guidance outlines tools and methods which may be employed by environmental health practitioners in determining whether there is a statutory nuisance from odours; it covers the fundamentals of odours, the legal framework, assessment methods, mitigation measures and intervention strategies which may be adopted.

Environment Agency Guidance

5.2.107 The Environment Agency has produced a horizontal guidance note (H4) on odour assessment and management (Environment Agency, 2011b), which is designed for operators of Environment Agency-regulated processes (i.e., those which classify as Part A(1) processes under the Pollution Prevention and Control (PPC) regime). The H4 guidance document is primarily aimed at methods to control and manage the release of odours, but also contains a series of recommended assessment methods which can be used to assess potential odour impacts.

Institute of Air Quality Management Guidance

5.2.108 The latest UK guidance on odour was published by the Institute of Air Quality Management (IAQM) in 2014 (IAQM, 2014). The IAQM guidance sets out assessment methods which may be utilised in the assessment of odours for planning applications. It is the only UK odour guidance document which contains a method for estimating the significance of potential odour impacts.

5.2.109 The IAQM guidance endorses the use of multiple assessment tools for odours, stating that, "best practice is to use a multi-tool approach where practicable". This is in order to improve the robustness of the assessment conclusions. Only one of the methods outlined in the IAQM guidance could realistically be adopted in this odour assessment.

Bioaerosol Guidance

5.2.110 The limited guidance addressing bioaerosols has been summarised in paragraphs 5.2.25 to 5.2.30.

5.3 BASELINE CONDITIONS

Site Description and Context

5.3.1 The Proposed Development lies some 7.5 km to the west of Sunderland city centre, in an area dominated by business parks and industry, but with surrounding residential areas. The nearest residential properties to the site lie some 250 m to the northwest. Further residential properties are located approximately 350 m to the south, on the other side of the A1231, Sunderland Highway.

Baseline Information

Industrial Sources

5.3.2 Emissions from local industrial sites are included in the background concentrations discussed below. There are no significant point sources sufficiently close to the Proposed Development to warrant direct inclusion in the assessment.

Air Quality Review and Assessment

5.3.3 Sunderland City Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. The Council has not declared any AQMAs within its area.

Local Air Quality Monitoring

2014 Baseline Measurements

5.3.4 Sunderland City Council currently operates two automatic monitoring stations within its area. The nearest of these to the Proposed Development is approximately 6.7 km to the east, close to Sunderland city centre. There is also an automatic monitor in an urban background location to the south of Sunderland, approximately 5.5 km to the south east of the development site. In addition, there is an AURN site located in Southwick, 5.8 km to the east; this site became operational in 2015. All of these sites are located closer to the centre of Sunderland than the Proposed Development, in what are generally more built-up areas, and thus they are not representative of conditions near to the Proposed Development.

5.3.5 The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes, the closest of which (Site 136) is approximately 4.7 km southwest of the Proposed Development. Further diffusion tube monitoring sites to the north of the Proposed Development are operated by South Tyneside Council. Again, none of these are especially representative of conditions near to the Proposed Development, although they are mostly more representative than the automatic monitors.

5.3.6 Annual mean data for the years 2012 to 2016 for the automatic monitors and diffusion tubes within 6 km of the Proposed Development are summarised in **Table 5.6**, having been provided by the two Councils or extracted from their LAQM reports

(Sunderland, 2017) (South Tyneside, 2016). Data from the AURN monitoring site has been taken from Defra's website (Defra, 2017e). The monitoring locations are shown in **Figure 5.5**.

Table 5.6: Summary of Annual Mean Nitrogen Dioxide Monitoring in 2012-2016 ($\mu g/m^3$) [a]

Site ID	Site Type	2012	2013	2014	2015	2016
Sunderland						
Automatic Monitors - Annual Mean (µg/m^3)						
CM1	Kerbside	35	34	39	34	37
CM2	Urban Background	18	16	16	14	16
AURN	Roadside	-	-	-	**47**	39
Objective		**40**				
Automatic Monitors - No. of Hours > 200 µg/m^3						
CM1	Kerbside	0	0	0	0 (92)	7
CM2	Urban Background	0 (80)	0 (80)	0 (76)	0 (67)	0
AURN	Roadside	-	-	-	133	158
Objective		**18 (200)** [b]				
Diffusion Tube - Annual Mean (µg/m^3)						
38	Roadside	32	31	29	29	36
58	Kerbside	36	33	33	32	34
113	Urban Centre	33	30	27	26	22
123	Roadside	39	35	36	34	38
133	Roadside	32	32	31	29	31
135	Roadside	25	26	24	21	24
136	Roadside	25	25	22	21	24
Objective		**40**				
South Tyneside						
Diffusion Tube - Annual Mean (µg/m^3)						
4	Roadside	22	- [c]	23	22	- [c]
5	Kerbside	21	26	30	26	- [c]
6	Roadside	26	25	26	30	- [c]
9	Urban Background	15	29	25	27	- [c]
10	Roadside	12	30	28	23	- [c]
11	Urban Background	25	39	32	36	- [c]
15	Roadside	14	19	24	21	- [c]
Objective		**40**				

[a] Exceedances of the objective are shown in bold.

[b] Values in brackets are 99.79th percentiles, which are presented where data capture is <75%.

[c] Data either not provided or not published in South Tyneside's LAQM reports.

5.3.7 The results show that the annual mean and short term objectives have been achieved at all monitoring sites within 6 km of the proposed development, with the exception of the AURN site, at which the annual mean objective was exceeded in 2015. This site is located adjacent to a busy dual carriageway in a built-up area, and is not representative of any locations with relevant exposure near to the Proposed Development.

5.3.8 There are no clear trends in monitoring results for the past six years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards. The implications of this are discussed in paragraphs 5.2.59 to 5.2.61.

5.3.9 Both of Sunderland City Council's automatic monitors measure PM_{10} concentrations, and the urban background site also measures $PM_{2.5}$ concentrations. Data for the years 2011 to 2016 are presented in **Table 5.7**.

Table 5.7: Summary of PM_{10} and $PM_{2.5}$ Automatic Monitoring in 2012-2016 (µg/m^3)

Site ID	Site Type	2012	2013	2014	2015	2016
PM_{10} Annual Mean (µg/m^3)						
CM1	Kerbside	22	22	21	21	18
CM2	Urban Background	16	15	14	15	13
Objective		**40**				
PM_{10} No. Days >50 µg/m^3						
CM1	Kerbside	10	3	6	1	2
CM2	Urban Background	0	3	2	1	0
Objective		**35**				
$PM_{2.5}$ Annual Mean (µg/m^3)						
CM2	Urban Background	10	9	10	7	6
Objective		**25** [a]				

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

5.3.10 The PM_{10} and $PM_{2.5}$ objectives have been achieved at both monitoring locations in all years for which data are presented. There is also a downward trend in both PM_{10} and $PM_{2.5}$ concentrations over the past five years.

Exceedances of EU Limit Values

5.3.11 The Sunderland AURN monitoring site shows no exceedance of the annual mean nitrogen dioxide limit value in 2016. However, this site is more than 6 km from the Proposed Development. Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2017b), used to report exceedances of the limit value to the EU and which have been updated to support the 2017 Air Quality Plan, identifies exceedances of the limit value along Sunderland Highway, 270 m to the south of the Proposed Development. Defra's predicted concentrations for 2021, presented for three scenarios ('baseline', 'with Clean Air Zones' and 'with Clean Air Zones and additional actions' – the latter two taking account of the measures contained in its 2017 Air Quality Plan (Defra, 2017d)), do not identify any exceedances within 1 km of the Proposed Development in any scenario. As such, there is considered to be no risk of a limit value exceedance in the vicinity of the Proposed Development by the time that it is operational.

Background Concentrations

5.3.12 Where necessary (i.e. where total concentrations have been calculated in the impact assessment), estimated background concentrations in the study area have been determined.

5.3.13 Annual mean background concentrations of nitrogen oxides, nitrogen dioxide, PM_{10} and $PM_{2.5}$ across the study area have been determined for both 2016 and the opening year 2021 (**Table 5.8**) using Defra's background maps (Defra, 2017a). The range of concentrations shown represents the range in background concentrations across the study area. The background concentrations have been derived as described in **Appendix 5.6**. The background concentrations are all well below the objectives.

Table 5.8: Estimated Annual Mean Background Concentrations Across the Study Area in 2016 and 2021 (μg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2016	19.1 – 31.2	12.8 – 19.6	11.7 – 16.1	8.3 – 10.7
2021 [a]	15.1 – 24.9	10.3 – 16.1	11.3 – 15.7	7.9 – 10.4
2021 Worst-Case Sensitivity test [b]	*16.3 – 26.9*	*11.0 – 17.3*	*N/A*	*N/A*
Objective	**-**	**40**	**40**	**25** [c]

N/A = not applicable. The range of values is for the different 1 x 1 km grid squares covering the study area.

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described in **Appendix 5.6**.

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

5.3.14 Estimated background concentrations of sulphur dioxide, carbon monoxide, benzene and 1,3-butadiene in the study area have been determined from Defra's published maps of background concentrations. The sulphur dioxide data have been taken for 2001; this is the base year for the most recent set of published maps, and is the approach recommended by Defra. Concentrations of carbon monoxide, benzene and 1,3-butadiene have been factored forwards from the 2001 mapped values using the projection factors published by Defra. 2016 values for carbon monoxide, benzene and 1,3-butadiene have been used in the impact assessment (rather than 2021 values), which is worst-case. **Table 5.9** shows the maximum background concentrations in the study area, which are the only values to have been used in the assessment when calculating total concentrations, to ensure that it is worst-case.

Table 5.9: Annual Mean Background Pollutant Concentrations Taken from Defra's Background Maps (Defra, 2017a) (μg/m^3)

Pollutant	Maximum Background Concentration	EAL (µg/m³)
Sulphur Dioxide (SO_2)	21.8 µg/m³	N/A [a]
Carbon Monoxide (CO)	0.169 mg/m³	N/A [a]
Benzene	0.541 µg/m³	5
1,3-butatiene	0.133 µg/m³	2.25

[a] No EAL is defined for the annual mean.

5.3.15 Defra has undertaken monitoring of trace elements at a number of locations in the UK since 1976 as part of the UK Urban and Rural Heavy Metals Monitoring Networks. As none of these locations are close to the Proposed Development, the maximum concentrations measured at the four nearest monitoring sites have been used. Measured annual mean concentrations of selected heavy metals are summarised in **Table 5.10**. These data have been downloaded from the Defra website (Defra, 2016a). All concentrations are well below the EALs.

Table 5.10: Trace Metal Annual Mean Background Concentrations in 2016 (ng/m³) [a]

Pollutant	Monitoring Location				Maximum	EAL (ng/m³)	% of EAL
	Sheffield Devonshire Green	Scunthorpe Town	Eskdalemuir	Auchencorth Moss			
Arsenic	0.676	0.704	0.083	0.142	0.704	**3**	23.5
Cadmium	0.135	0.175	0.019	0.022	0.175	**5**	3.5
Chromium	4.62	1.58	1.35	1.26	4.62	**5,000**	0.1
Cobalt	0.229	0.015	0.015	0.024	0.229	**1,000**	0.02
Lead	7.8	11.2	0.8	1.1	11.2	**250**	12.1
Manganese	8.6	18.2	0.8	1.0	18.2	**150**	13.3
Nickel	2.66	0.94	0.41	0.25	2.66	**20**	4.5
Vanadium	0.76	1.30	0.31	0.31	1.30	**5,000**	0.03

[a] 1,000 ng = 1 µg

Baseline Dispersion Model Results

Human Health Receptors

5.3.16 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing roadside receptor locations (see **Figure 5.2**). The results, which cover both the existing (2016) and future year (2021) baseline (Without Scheme), are set out in **Table 5.11** and **Table 5.12**. The predictions for nitrogen dioxide include a sensitivity test which accounts for the potential under-performance of emissions control technology on modern diesel vehicles (see **Appendix 5.6**). The modelled road components of nitrogen oxides, PM_{10} and $PM_{2.5}$ have also been increased based on a comparison with local measurements (see **Appendix 5.6**).

Table 5.11: Modelled Annual Mean Baseline NO_2 Concentrations at Existing Receptors in 2016 and 2021 (µg/m^3)

Receptor	Annual Mean Baseline NO_2 Concentration			
	2016 [a]	2021 [a]	*Worst-Case Sensitivity test* [b,c]	
			2016	*2021*
R1	21.3	17.3	*21.3*	*18.7*
R2	23.7	15.1	*23.6*	*16.1*
R3	22.0	17.6	*22.0*	*19.1*
R4	24.4	19.1	*24.2*	*20.8*
R5	23.3	18.3	*23.1*	*19.9*
R6	22.0	17.6	*21.9*	*19.0*
R7	23.1	18.3	*22.9*	*19.8*
R8	23.4	18.5	*23.3*	*20.1*
R9	24.6	19.1	*24.4*	*20.9*
R10	23.4	18.4	*23.3*	*20.1*
R11	22.0	16.7	*21.9*	*18.6*
R12	23.1	17.4	*23.0*	*19.6*
R13	23.5	17.7	*23.4*	*19.9*
R14	22.5	17.3	*22.4*	*19.2*
R15	21.5	16.6	*21.4*	*18.4*
R16	21.7	16.7	*21.6*	*18.5*
Objective	**40**			

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described in **Appendix 5.6**.

[c] The methodology for the sensitivity test uses different traffic emissions and required a separate verification (see **Appendix 5.6**), which leads to slightly different 2016 values.

Table 5.12: Modelled Annual Mean Baseline Concentrations of PM_{10} and $PM_{2.5}$ at Existing Receptors in 2016 and 2021 (µg/m^3)

Receptor	PM_{10}		$PM_{2.5}$	
	2016	2021	2016	2021
R1	16.7	16.3	11.1	10.7

Receptor	PM_{10}		$PM_{2.5}$	
	2016	2021	2016	2021
R2	17.2	15.8	11.4	10.5
R3	15.2	14.7	10.5	10.0
R4	15.7	15.2	10.7	10.2
R5	15.3	14.8	10.5	10.0
R6	15.2	14.7	10.4	10.0
R7	15.5	15.0	10.6	10.1
R8	15.5	15.1	10.6	10.2
R9	15.5	15.0	10.6	10.2
R10	15.4	14.9	10.6	10.1
R11	14.6	14.1	10.1	9.7
R12	14.8	14.3	10.2	9.8
R13	14.8	14.4	10.3	9.8
R14	16.0	15.5	10.8	10.4
R15	15.8	15.3	10.7	10.3
R16	15.6	15.2	10.6	10.2
Objective / Criterion	32 [a]		25 [b]	

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2016). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

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

5.3.17 The predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are below the objective at all receptors in both 2016 and 2021. The annual mean PM_{10} concentrations are below 32 µg/m^3 and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded. The results from the upper-bound sensitivity test for nitrogen dioxide are not materially different from those derived using the 'official' predictions.

5.4 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

Construction Phase

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

Potential Dust Emission Magnitude

Demolition

5.4.2 There is no requirement for demolition on site.

Earthworks

5.4.3 The characteristics of the soil at the Proposed Development site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2017), as set out in **Table 5.13**. Overall, it is considered that, when dry, this soil has the potential to be highly dusty.

Table 5.13: Summary of Soil Characteristics

Category	Record
Soil layer thickness	Deep
Soil Parent Material Grain Size	Argillaceous [a]
European Soil Bureau Description	Quaternary Marine / Estuarine Clay / Silt
Soil Group	Heavy to Medium to Light (Silty)
Soil Texture	Clay to Silt

[a] grain size < 0.06 mm.

5.4.4 The site covers approximately 3.7 ha and most of this will be subject to earthworks, involving excavation, haulage, tipping, stockpiling and landscaping of the topsoil and subsoil. There will also be the requirement to excavate a trench for the electrical connection to Nissan Sunderland. During the earthworks 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 A5.5.1** in **Appendix 5.5**, the dust emission class for earthworks is considered to be *large*.

Construction

5.4.5 Construction will involve the laying of hard pavings and the building of the main REC buildings along with all of the ancillary structures. The buildings will primarily be constructed of steelwork, reinforced concrete, cladding and sheet roofing. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials, and from the cutting of concrete. Based on the example definitions set out in **Table A5.5.1** in **Appendix 5.5**, the dust emission class for construction is considered to be *medium*.

Trackout

5.4.6 It is anticipated that there will be an average of approximately 30 outward heavy vehicle movements per day during construction, with a maximum of 60 per day during major concrete pours. Based on the example definitions set out in **Table A5.5.1** in **Appendix 5.5**, the dust emission class for trackout is considered to be *large,* although, in reality, it will be lower once the hardstanding and paving have been installed across the site.

5.4.7 **Table 5.14** summarises the dust emission magnitude for the Proposed Development.

Table 5.14: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Earthworks	Large
Construction	Medium
Trackout	Large

Sensitivity of the Area

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

Sensitivity of the Area to Effects from Dust Soiling

5.4.9 The IAQM guidance explains that residential properties and long-term car parks are 'high' sensitivity receptors to dust soiling, while industrial and commercial premises are 'medium' sensitivity receptors and short-term car parks are 'low' sensitivity receptors (see **Table A5.5.2** in **Appendix 5.5**). The nearest residential properties to the site lie some 250 m to the northwest, and there are between 10 and 100 within 350 m of the site boundary (see **Figure 5.6**). There are a number of commercial premises, with associated car parking, within 100 m of the site to the west, and there is also a car-parking area approximately 120 m east of the site for new vehicles produced at the Nissan Sunderland Plant. The trench to house the electrical connection to Nissan Sunderland runs adjacent to the parking area for the new vehicles; this parking area is a 'high' sensitivity receptor to dust soiling. While the trench will represent a source of dust, it will be excavated in sections and each section is likely to only be a source of dust for a few days. Nissan Sunderland will be informed in advance of any works adjacent to the parking area and appropriate mitigation put in place. Using the matrix set out in **Table A5.5.3** in **Appendix 5.5**, the area surrounding the onsite works is of 'low' sensitivity to dust soiling.

5.4.10 **Table 5.14** shows that dust emission magnitude for trackout is 'large' and **Table A5.5.3** in **Appendix 5.5** thus explains that there is a risk of material being tracked 500 m from the site exit. As the route between the site boundary and the A1290 is not paved, it has been assumed that material could be tracked up to 500 m after vehicles reach the A1290. There are 19 residential properties within 50 m of the roads along which material is likely to be tracked (see **Figure 5.7**). **Table A5.5.3** in **Appendix 5.5** indicates that the area is of 'medium' sensitivity to dust soiling due to trackout.

Sensitivity of the Area to any Human Health Effects

5.4.11 Residential properties are also classified as being of 'high' sensitivity to human health effects, while places of work are of 'medium' sensitivity. The matrix in **Table A5.5.4** in **Appendix 5.5** requires information on the baseline annual mean PM_{10} concentration in the area. No PM_{10} monitoring is undertaken nearby, thus the maximum predicted baseline concentration at any receptor in **Table 5.12** has been used (16.7 $\mu g/m^3$). Using the matrix, the area surrounding the onsite works is of 'low' sensitivity to human health effects, as is the area surrounding roads along which material may be tracked from the site.

Sensitivity of the Area to any Ecological Effects

5.4.12 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.

5.4.13 **Table 5.15** summarises the sensitivity of the area surrounding the site.

Table 5.15: Summary of the Area Sensitivity

Source	**Sensitivity of the Surrounding Area**	
	On-site Works	**Trackout**
Dust Soiling	Low Sensitivity	Medium Sensitivity
Human Health	Low Sensitivity	Low Sensitivity

<u>Risk and Significance</u>

5.4.14 The dust emission magnitudes in **Table 5.14** have been combined with the sensitivities of the area in **Table 5.15** using the matrix in **Table A5.5.6** in **Appendix 5.5**, 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 5.16**. These risk categories have been used to determine the appropriate level of mitigation as set out in the next Section on mitigation.

Table 5.16: Summary of Risk of Impacts Without Mitigation

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

5.4.15 The IAQM 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' (Institute of Air Quality Management, 2016)

Operational Phase

Air Quality Impacts – Stack Emissions

Predicted Concentrations Relevant to Human Health

Screening of Maximum PCs

5.4.16 **Table 5.17** sets out the maximum predicted PC anywhere within the Cartesian grid of receptors, in any of the meteorological years modelled; these maximum PCs are, therefore, extremely worst-case, and are likely to be higher than the actual PCs at locations of relevant exposure. For most of the pollutants and averaging periods, the PC is less than 1% of the long-term EAL (0.5% for NO_2 and PM), or less than 10% of the short-term EAL, and the impacts can thus be discounted as insignificant (see paragraphs 5.2.10 to 5.2.18 on screening criteria). It should be noted that the PCs presented in this table for heavy metals have been generated assuming that the emission rate of each individual metal is at the emission rate for all heavy metals combined, which is a highly unrealistic and worst-case assumption. The VOC concentrations presented assume that all TOCs are VOCs, and that all VOCs are benzene and 1,3 butadiene respectively, which is again an extremely conservative assumption. The implications of these conservative assumptions are addressed further below.

Table 5.17: Maximum Predicted PCs in the Study Area (µg/m^3) Based on Maximum Emission Rates [a]

Pollutant	Averaging Period	Maximum PC		EAL
		PC	% of EAL	
NO_2	Annual Mean	**2.13**	**5.3%**	**40**
	99.79th%ile of 1-hour Means	**39.1**	**19.6%**	**200**
SO_2	99.7th%ile of 1-hour Means	**55.1**	**15.8%**	**350**
	99.18th%ile of 24-hour Means	8.72	7.0%	**125**
	99.9th%ile of 15-minute Means	**62.6**	**23.5%**	**266**
PM_{10}	Annual Mean	0.145	0.4%	**40**
	90.4th%ile of 24-hour Means	0.479	1.0%	**50**
$PM_{2.5}$	Annual Mean	**0.145**	**0.6%**	**25**
CO	Rolling 8-hour Mean	44.2	0.4%	**10,000**
HCl	Annual Mean	0.152	0.8%	**20**
	Max Hourly Mean	37.0	4.9%	**750**
HF	Annual mean	0.0152	0.1%	**16**
	Max Hourly Mean	2.46	1.5%	**160**
VOCs (as benzene)	Annual Mean	**0.152**	**3.0%**	**5**

VOCs (as 1,3-butadiene)	Annual Mean	**0.152**	**6.8%**	**2.25**
Cd	Annual Mean	**0.000761**	**15.2%**	**0.005**
Tl	Annual Mean	0.000761	0.1%	**1**
	Max Hourly Mean	0.0298	0.1%	**30**
Hg	Annual Mean	0.000761	0.3%	**0.25**
	Max Hourly Mean	0.0298	0.4%	**7.5**
Sb	Annual Mean	0.00761	0.2%	**5**
	Max Hourly Mean	0.298	0.2%	**150**
As	Annual Mean	**0.0076**	**253.5%**	**0.003**
Pb	Annual Mean	**0.0076**	**3.0%**	**0.25**
Cr III	Annual Mean	0.0076	0.2%	**5**
	Max Hourly Mean	0.298	0.2%	**150**
Cr VI	Annual Mean	**0.0076**	**3802.5%**	**0.0002**
	Max Hourly Mean	0.298	2.0%	**15**
Co	Annual Mean	0.0076	0.8%	**1**
	Max Hourly Mean	0.298	1.0%	**30**
Cu	Annual Mean	0.0076	0.1%	**10**
	Max Hourly Mean	0.298	0.1%	**200**
Mn	Annual Mean	**0.0076**	**5.1%**	**0.15**
	Max Hourly Mean	0.298	0.0%	**1,500**
Ni	Annual Mean	**0.0076**	**38.0%**	**0.02**
V	Annual Mean	0.0076	0.2%	**5**
	Max Hourly Mean	**0.298**	**29.7%**	**1**
NH_3	Annual Mean	0.152	0.1%	**180**
	Max Hourly Mean	5.950	0.2%	**2500**
Dioxins and furans	Annual Mean	0.0000000015	0.5%	**0.0000003** [b]

[a] Where the PC as a % of the EAL is more than 1% of an annual mean EAL (0.5% for NO_2 and PM) or more than 10% of a short-term EAL, it is shown in bold.

[b] This is the WHO indicator concentration (300 fg/m^3) above which it would be considered necessary to identify and control emissions.

Screening of Maximum PECs

5.4.17 For 1-hour and 15-minute mean sulphur dioxide, VOCs, annual mean cadmium, arsenic, lead, Chromium VI, manganese and nickel, and 1-hour mean vanadium, the PC in **Table 5.17** exceeds the screening criterion. As such, it is necessary to proceed to the next stage of screening. The long-term PEC has been calculated by adding the long-term local background concentrations (see **Table 5.9** and **Table 5.10**) to the PC, as shown in **Table 5.18**. Short-term emissions have been considered by comparing the PC to the short-term environmental standards minus twice the long-term background concentration. The PCs for annual mean and short-term nitrogen dioxide concentrations and annual mean $PM_{2.5}$ concentrations also cannot be screened out at this stage, but these are considered separately in paragraph 5.4.23 onwards.

Table 5.18: Maximum Long-Term and Short-Term PECs in the Study Area for Pollutants where the PC Exceeds the Screening Criteria (µg/m^3) Based on Maximum Emission Rates [a]

Long-Term				
Pollutant	**Averaging Period**	**Maximum PEC**		**EAL**
		PEC	**% of EAL**	
VOCs (as benzene)	Annual Mean	0.693	13.9%	**5**
VOCs (as 1,3-butadiene)	Annual Mean	0.285	12.7%	**2.25**
Cd	Annual Mean	0.000935	18.7%	**0.005**
As [b]	Annual Mean	**0.00831**	**277.0%**	**0.003**
Pb [b]	Annual Mean	0.0188	7.5%	**0.25**
Cr VI [b]	Annual Mean	**0.012**	**5947.3%**	**0.0002**
Mn [b]	Annual Mean	0.0258	17.2%	**0.15**
Ni [b]	Annual Mean	0.0103	51.3%	**0.02**
Screening Criterion		-	**70%**	**-**
Short-Term				
Pollutant	**Averaging Period**	**Maximum PC**		**Adjusted EAL [c]**
		PC	**% of Adjusted EAL**	
SO_2	99.7th%ile of 1-hour Means	55.1496	18.0%	**306.4**
	99.9th%ile of 15-minute Means	**62.5528**	**28.1%**	**222.4**
V [b]	Max Hourly Mean	**0.2975**	**29.8%**	**0.997**
Screening Criterion		-	**20%**	**-**

[a] Where the PEC exceeds the screening criterion it is shown in bold.

[b] Assuming the entire heavy metals emissions to be made up of this one pollutant.

[c] This is the short-term environmental standard minus twice the long-term background concentration.

5.4.18 For the long-term averaging periods, with the exception of arsenic and chromium VI, the PEC is less than 70% of the EAL and the potential for significant impacts can be discounted following the Environment Agency guidance. For the short-term averaging periods, the 15-minute mean sulphur dioxide PC and the maximum hourly vanadium PC are greater than 20% of the short-term environmental standards minus twice the long-term background concentration. However, the PEC for 15-minute mean sulphur dioxide (106.2 µg/m^3 – the PC plus twice the annual mean background) remains well below the EAL (39.9% of it), and thus the impacts for this pollutant can be discounted.

Further Assessment – Arsenic, Chromium VI and Vanadium

5.4.19 PECs of arsenic, chromium VI and vanadium in **Table 5.18** are above the screening criteria, thus further assessment is required. Environment Agency guidance (Environment Agency, 2016b) outlines that the next step in the assessment of heavy metals is to consider more realistic emission rates (see paragraphs A5.6.2 and A5.6.3 in **Appendix 5.6**). The resulting PCs, using the more realistic emission rates recommended, are presented in **Table 5.19**, and then compared to the 1% or 10% screening criteria. The PCs of Chromium VI and Vanadium are below the screening criteria, thus the impacts of the facility’s emissions on these pollutants can be considered insignificant.

Table 5.19: Maximum PCs of Arsenic, Chromium VI and Nickel in the Study Area (µg/m^3) Based on Realistic Emission Rates [a]

Pollutant	Averaging Period	Maximum PC		EAL
		PC	% of EAL	
As	Annual Mean	**0.00038**	**12.68%**	**0.003**
Cr VI	Annual Mean	0.000002	0.99%	**0.0002**
V	Max Hourly Mean	0.00356999	0.36%	**1**

[a] Where the PC exceeds the screening criterion it is shown in bold.

5.4.20 The PC of arsenic in **Table 5.19** remains above the screening criterion of 1%, thus it is necessary to calculate the PEC using the updated PC, and compare this to the screening criterion of 70%. This is presented in **Table 5.20**.

Table 5.20: Maximum PECs of Arsenic in the Study Area (µg/m^3) Based on Realistic Emission Rates

Pollutant	Averaging Period	Maximum PEC		EAL
		PEC	% of EAL	
As	Annual Mean	0.001	36.1%	**0.003**

5.4.21 The PEC of arsenic is below the screening criterion, and as such the potential for significant impacts can be discounted.

5.4.22 The impacts of the Proposed Development’s emissions have, therefore, been shown to be insignificant for all pollutants other than nitrogen dioxide and particulate matter, which are addressed separately below so that road traffic emissions, from which these are the key pollutants, are also taken into account.

Detailed Assessment - Nitrogen Dioxide and Particulate Matter

Nitrogen Dioxide

5.4.23 In considering the annual mean nitrogen dioxide concentrations, it is useful to see where impacts are greatest; a contour plot of the ground-level (1.5 m height) PCs has been generated, and is shown in **Figure 5.8**. The impacts on nitrogen dioxide concentrations cannot be screened out across a relatively large area (i.e. where the PC exceeds 0.2 µg/m^3, the green and orange areas) to the north and east of the Proposed Development, as well as in a much smaller area to the southwest.

5.4.24 The next step in assessing annual mean nitrogen dioxide concentrations is to consider the total annual mean concentrations that sensitive receptors will experience. Given the large area over which there is the potential for impacts, it is sensible to focus on those areas where impacts are likely to be greatest; given that the determination of impact descriptors in the EPUK/IAQM guidance relies upon total concentrations, with impacts greater where total concentrations are higher, it can be assumed that the most significant impacts will occur where total concentrations are highest. This is expected to be at roadside locations for both nitrogen dioxide and particulate matter.

5.4.25 **Table A5.4.1** from **Appendix 5.4** has been adapted so that it relates specifically to annual mean nitrogen dioxide impacts, and is shown in **Table 5.21**.

Table 5.21: Air Quality Impact Descriptors for Individual Receptors for Annual Mean Nitrogen Dioxide (µg/m^3)

Long-Term Average Concentration At Receptor In Assessment Year	**Change in concentration relative to Objective**				
	<0.2	**0.2 – <0.6**	**0.6 - <2.2**	**2.2 - <4.0**	**>4.0**
<30.2	Negligible	Negligible	Negligible	Slight	Moderate
30.2 - <37.8	Negligible	Negligible	Slight	Moderate	Moderate
37.8 - <41.0	Negligible	Slight	Moderate	Moderate	Substantial
41.0 - <43.8	Negligible	Moderate	Moderate	Substantial	Substantial
≥43.8	Negligible	Moderate	Substantial	Substantial	Substantial

5.4.26 Applying the PCs shown in **Figure 5.8** to **Table 5.21**, it can be seen that where PCs are less than 0.2 µg/m^3 the impacts will be negligible, regardless of the total concentration. The impacts will, therefore, be negligible everywhere outside of the green and orange areas in **Figure 5.8**.

5.4.27 Moving on to the area within which the PC of the Proposed Development is between 0.2 µg/m^3 and 0.6 µg/m^3 (green in **Figure 5.8**), **Table 5.21** shows that the impacts here will be negligible provided that total concentrations are below 37.8 µg/m^3. As such, if baseline concentrations in the area were below 37.2 µg/m^3 (37.8 µg/m^3 minus the maximum PC in this area of 0.6 µg/m^3). Sunderland City Council currently has no declared AQMAs, thus it must be concluded that the air quality objectives are not being exceeded at any relevant locations in the area. The proposed development will become operational in 2021 at the earliest, and between the base year of 2016 and the year 2021 it is expected that there will be significant reductions in NOx emissions from road vehicles, thus nitrogen dioxide concentrations are expected to reduce significantly, as evidenced in **Table 5.8** and **Table 5.11**, which show concentrations generally reducing by around 15-25%. If there are no exceedances of the annual mean nitrogen dioxide objective of 40 μg/m^3 in 2016 it is extremely unlikely that the annual mean concentration would be above 37.2 μg/m^3 anywhere in the area in 2021, given the emissions reductions predicted. As such, it can be concluded that total concentrations in this area will be below 37.8 μg/m^3, and thus that the impacts of the Proposed Development's emissions in this area will be negligible.

5.4.28 The maximum annual mean nitrogen dioxide PC anywhere in the local area is 2.1 μg/m^3, and **Table 5.21** shows that where PCs are between 0.6 μg/m^3 and 2.2 μg/m^3 the impacts will be negligible provided that total concentrations are below 30.2 μg/m^3. Total concentrations at all of the selected receptor locations, including those within the area within which the PC will be between 0.6 μg/m^3 and 2.1 μg/m^3 (receptors R2, R11, R12, R13, R14, R15 and R16, in the orange area in **Figure 5.8**) have been established by adding the PC to the predicted roadside concentrations from the road traffic emissions model at all of the selected sensitive receptor locations, which represent worst-case local exposure. Total annual mean nitrogen dioxide concentrations with and without the Proposed Development are set out in **Table 5.22**, together with the impact at each location described using the descriptors given in **Appendix 5.4**. In order to ensure that the full impacts of the scheme are presented, the "With Scheme" concentrations include both the impacts of the stack emissions and the additional road traffic generated by the Proposed Development.

Table 5.22: Predicted Impacts (Stack and Road Traffic Emissions) on Annual Mean Nitrogen Dioxide Concentrations in 2021 (μg/m^3)

Receptor [a]	**Without Scheme**	**With Scheme**	**% Change** [b]	**Impact Descriptor**	***Worst-case Sensitivity Test***			
					Without Scheme	***With Scheme***	***% Change*** [b]	***Impact Descriptor***
R1	17.3	17.9	2	Negligible	*18.7*	*19.3*	*2*	*Negligible*
R2	15.1	15.9	2	Negligible	*16.1*	*16.9*	*2*	*Negligible*
R3	17.6	18.0	1	Negligible	*19.1*	*19.4*	*1*	*Negligible*
R4	19.1	19.4	1	Negligible	*20.8*	*21.2*	*1*	*Negligible*
R5	18.3	18.8	1	Negligible	*19.9*	*20.4*	*1*	*Negligible*
R6	17.6	18.0	1	Negligible	*19.0*	*19.5*	*1*	*Negligible*
R7	18.3	18.6	1	Negligible	*19.8*	*20.2*	*1*	*Negligible*
R8	18.5	18.8	1	Negligible	*20.1*	*20.5*	*1*	*Negligible*
R9	19.1	19.5	1	Negligible	*20.9*	*21.2*	*1*	*Negligible*
R10	18.4	18.8	1	Negligible	*20.1*	*20.4*	*1*	*Negligible*
R11	16.7	17.5	2	Negligible	*18.6*	*19.4*	*2*	*Negligible*
R12	17.4	18.2	2	Negligible	*19.6*	*20.3*	*2*	*Negligible*
R13	17.7	18.4	2	Negligible	*19.9*	*20.5*	*2*	*Negligible*
R14	17.3	18.1	2	Negligible	*19.2*	*20.0*	*2*	*Negligible*

R15	16.6	17.4	2	Negligible	*18.4*	*19.2*	*2*	*Negligible*
R16	16.7	17.5	2	Negligible	*18.5*	*19.3*	*2*	*Negligible*
Objective	**40**		-	-	***40***		-	-

[a] See **Figure 5.2** for Receptor locations.

[b] % changes are relative to the objective and have been rounded to the nearest whole number.

5.4.29 **Table 5.22** shows that the total concentration will not exceed 30.2 μg/m³ at any local sensitive receptor, and thus that the impacts of the development on annual mean nitrogen dioxide concentrations will be *negligible*.

Particulate Matter

5.4.30 While the PM_{10} PCs from the stack emissions have been screened out, the maximum annual mean $PM_{2.5}$ PC requires further assessment. For completeness, total annual mean PM_{10} and $PM_{2.5}$ concentrations are presented in **Table 5.23** both without and with the Proposed Development, together with the impact at each location described using the descriptors given in **Appendix 5.4**. In order to ensure that the full impacts of the scheme are presented, the "With Scheme" concentrations include both the impacts of the stack emissions and the additional road traffic generated by the Proposed Development.

Table 5.23: Predicted Impacts (Stack and Road Traffic Emissions) on Annual Mean PM_{10} and $PM_{2.5}$ Concentrations in 2021 (μg/m^3)

Receptor	Annual Mean PM_{10} ($\mu g/m^3$)				Annual Mean $PM_{2.5}$ ($\mu g/m^3$)			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
R1	16.3	16.4	0	Negligible	10.7	10.7	0	Negligible
R2	15.8	15.9	0	Negligible	10.5	10.5	0	Negligible
R3	14.7	14.8	0	Negligible	10.0	10.0	0	Negligible
R4	15.2	15.2	0	Negligible	10.2	10.3	0	Negligible
R5	14.8	14.9	0	Negligible	10.0	10.1	0	Negligible
R6	14.7	14.8	0	Negligible	10.0	10.0	0	Negligible
R7	15.0	15.0	0	Negligible	10.1	10.2	0	Negligible
R8	15.1	15.1	0	Negligible	10.2	10.2	0	Negligible
R9	15.0	15.1	0	Negligible	10.2	10.2	0	Negligible
R10	14.9	14.9	0	Negligible	10.1	10.1	0	Negligible
R11	14.1	14.2	0	Negligible	9.7	9.7	0	Negligible
R12	14.3	14.4	0	Negligible	9.8	9.8	0	Negligible
R13	14.4	14.4	0	Negligible	9.8	9.9	0	Negligible
R14	15.5	15.5	0	Negligible	10.4	10.4	0	Negligible
R15	15.3	15.4	0	Negligible	10.3	10.3	0	Negligible
R16	15.2	15.2	0	Negligible	10.2	10.2	0	Negligible
Criterion	**32 [b]**		**-**	**-**	**25 [c]**		**-**	**-**

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] While the annual mean PM_{10} objective is 40 $\mu g/m^3$, 32 $\mu g/m^3$ is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2016). A value of 32 $\mu g/m^3$ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

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

5.4.31 Concentrations of PM_{10} and $PM_{2.5}$ are well below the objective at all modelled receptors and the impacts are all *negligible*.

5.4.32 It can, therefore, be concluded that the Proposed Development will not a have a significant impact on concentrations of any pollutant, in terms of human health.

Predicted Impacts on Designated Habitats

5.4.33 **Table 5.24** sets out the maximum PCs to the relevant pollutant concentrations at each of the sensitive ecological sites, and compares them to the Environment Agency’s recommended screening criteria (See paragraphs 5.2.10 and 5.2.13).

Table 5.24: Maximum PCs in the Nearby Sensitive Ecological Sites

Pollutant	Averaging Period	Maximum PC		EAL	Screening Criterion
		PC	% of EAL		
Northumbria Coast SPA and Ramsar Site & Durham Coast SAC					
NH_3 (µg/m^3)	Annual Mean	0.010	0.3%	**3**	**1%**
NOx (µg/m^3)	Annual Mean	0.19	0.6%	**30**	**1%**
	Max 24-hour Mean	2.39	3.2%	**75**	**10%**
SO_2 (µg/m^3)	Annual Mean	0.05	0.3%	**20**	**1%**
HF (µg/m^3)	Max 24-hour Mean	0.012	0.2%	**5**	**10%**
	Max Weekly Mean	0.003	0.6%	**0.5**	**10%**
Nutrient Nitrogen Deposition [a]	Annual Mean	0.07	0.9%	**8**	**1%**
Acid Deposition [b]	Annual Mean	**0.013**	**1.6%**	**0.786**	**1%**
High Wood AW, Wear River Bank Woods SNCI					
NH_3	Annual Mean	0.015	0.5%	**3**	**100%**
NOx	Annual Mean	0.31	1.0%	**30**	
	Max 24-hour Mean	5.14	6.8%	**75**	
SO_2	Annual Mean	0.08	0.4%	**20**	
HF	Max 24-hour Mean	0.026	0.5%	**5**	
	Max Weekly Mean	0.004	0.9%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.18	1.8%	**10**	
Acid Deposition [b]	Annual Mean	0.039	1.4%	**2.734**	
Barmston Pond LNR and SNCI					
NH_3	Annual Mean	0.130	4.3%	**3**	**100%**
NOx	Annual Mean	2.60	8.7%	**30**	
	Max 24-hour Mean	12.40	16.5%	**75**	
SO_2	Annual Mean	0.62	3.1%	**20**	
HF	Max 24-hour Mean	0.062	1.2%	**5**	
	Max Weekly Mean	0.033	6.6%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.94	9.4%	**10**	
Acid Deposition [b]	Annual Mean	0.167	8.3%	**2.008**	
Willows Pond SNCI					

NH_3	Annual Mean	0.019	0.6%	**3**	**100%**
NOx	Annual Mean	0.38	1.3%	**30**	
	Max 24-hour Mean	8.74	11.6%	**75**	
SO_2	Annual Mean	0.09	0.5%	**20**	
HF	Max 24-hour Mean	0.044	0.9%	**5**	
	Max Weekly Mean	0.016	3.2%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.14	1.4%	**10**	
Acid Deposition [b]	Annual Mean	0.025	1.2%	**2.008**	
Usworth Pond SNCI					
NH_3	Annual Mean	0.018	0.6%	**3**	**100%**
NOx	Annual Mean	0.36	1.2%	**30**	
	Max 24-hour Mean	6.07	8.1%	**75**	
SO_2	Annual Mean	0.09	0.5%	**20**	
HF	Max 24-hour Mean	0.030	0.6%	**5**	
	Max Weekly Mean	0.008	1.5%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.13	1.3%	**10**	
Acid Deposition [b]	Annual Mean	0.024	1.2%	**2.008**	
Severn Houses SNCI					
NH_3	Annual Mean	0.110	3.7%	**3**	**100%**
NOx	Annual Mean	2.19	7.3%	**30**	
	Max 24-hour Mean	25.2	33.6%	**75**	
SO_2	Annual Mean	0.53	2.7%	**20**	
HF	Max 24-hour Mean	0.126	2.5%	**5**	
	Max Weekly Mean	0.056	11.2%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.79	7.9%	**10**	
Acid Deposition [b]	Annual Mean	0.142	7.1%	**2.008**	
Peepy Plantation SNCI					
NH_3	Annual Mean	0.076	2.5%	**3**	**100%**
NOx	Annual Mean	1.52	5.1%	**30**	
	Max 24-hour Mean	10.99	14.7%	**75**	
SO_2	Annual Mean	0.37	1.8%	**20**	
HF	Max 24-hour Mean	0.055	1.1%	**5**	

	Max Weekly Mean	0.020	3.9%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.90	9.0%	**10**	
Acid Deposition [b]	Annual Mean	0.189	6.9%	**2.734**	
Hylton Plantation SNCI					
NH_3	Annual Mean	0.065	2.2%	**3**	**100%**
NOx	Annual Mean	1.29	4.3%	**30**	
	Max 24-hour Mean	7.46	10.0%	**75**	
SO_2	Annual Mean	0.31	1.5%	**20**	
HF	Max 24-hour Mean	0.037	0.7%	**5**	
	Max Weekly Mean	0.018	3.6%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.76	7.6%	**10**	
Acid Deposition [b]	Annual Mean	0.160	5.9%	**2.734**	
Washington Wildfowl and Wetlands Centre SNCI					
NH_3	Annual Mean	0.014	0.5%	**3**	**100%**
NOx	Annual Mean	0.27	0.9%	**30**	
	Max 24-hour Mean	4.88	6.5%	**75**	
SO_2	Annual Mean	0.07	0.3%	**20**	
HF	Max 24-hour Mean	0.024	0.5%	**5**	
	Max Weekly Mean	0.008	1.6%	**0.5**	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.10	1.0%	**10**	
Acid Deposition [b]	Annual Mean	0.018	0.9%	**2.008**	

[a] Nutrient nitrogen deposition composed of the nitrogen component of both nitrogen dioxide and ammonia, with units of kgN/ha/yr.

[b] Acid deposition calculated as the sum of the acidifying potentials from nitrogen dioxide, ammonia, sulphur dioxide and hydrogen chloride, with units of keq/ha/yr.

5.4.34 With the exception of acid deposition to the Northumbria Coast SPA and Ramsar site and Durham Coast SAC, all of the PCs can thus be discounted as insignificant. For the Northumbria Coast SPA and Ramsar site, consideration of the acid deposition PEC is required; the features for which the Durham Coast SAC has been declared are not sensitive to acid deposition (see **Table 5.2**). This is shown in **Table 5.25**.

Table 5.25: Acid Deposition PEC in the Northumbria Coast SPA and Ramsar site (keq/ha/yr)

Background Deposition Rate	PEC	% of EAL	Screening Criterion
1.10	1.11	**141.6%**	70%

5.4.35 The acid deposition PEC exceeds the screening criterion, and the EAL, at the Northumbria Coast SPA and Ramsar site. This is primarily because the background acid deposition rate itself is 139.9% of the EAL and is not a direct result of the PC from the REC stack (1.6% of the EAL), which is located 8.8 km to the southwest. The next step in determining the significance of this impact is to consider the sensitivity of the species for which the site has been designated, and its broad habitat, to acid deposition. The APIS database (APIS, 2017) indicates that the site interest features at the Northumbria Coast SPA and Ramsar site are Little Terns, Purple Sandpipers and Ruddy Turnstones, all birds. It states that the broad habitats for Purple Sandpipers and Ruddy Turnstones are not sensitive to acidity, thus these need not be considered further. The broad habitat for Little Terns is listed as being sensitive to acidity, but the database then goes on to state that the species is not sensitive to acidity impacts on its broad habitat and that there is *"no expected negative impact on the species due to impacts on the species' broad habitat"*. As such, it can be concluded that the small change in the acid deposition rate that the Proposed Development will lead to at the Northumbria Coast SPA and Ramsar site will not have an adverse effect on the species for which the sites are designated. Furthermore, the predictions in 2021 are based on worst case assumptions regarding emissions from the REC stack. In reality, the NOx concentrations, and therefore the acid deposition, are likely to be substantially lower than that presented above.

Air Quality Impacts – Emergency Generator Emissions

5.4.36 **Figure 5.9** shows the maximum predicted PC from the diesel generator to annual mean nitrogen dioxide concentrations anywhere within the modelled grid of receptors, in any of the meteorological years, and **Figure 5.10** shows the maximum predicted PC to the 99.79th percentile of 1-hour mean nitrogen dioxide concentrations. The annual mean nitrogen dioxide PC presented has been calculated by multiplying the annual mean nitrogen oxides PC by 0.7, while the 99.79th percentile of 1-hour mean nitrogen oxides PCs has been calculated by multiplying the 99.79th percentile of 1-hour mean nitrogen oxides PCs by 0.35, following the approach recommended by Defra (Defra, 2016).

5.4.37 **Figure 5.9** shows that the PC to the annual mean is less than 0.5% of the EAL (less than 0.2 µg/m^3) in all areas where sensitive receptors are present; in reality this threshold is only exceeded across a very small portion of the industrial estate within which the proposed development is located. The annual mean impacts of the generator emissions can, therefore, be screened out as insignificant.

5.4.38 **Figure 5.10** shows that the 99.79th percentile PC to the hourly mean is less than 10% of the EAL (less than 20 µg/m^3) in all areas where sensitive receptors are present (the residential properties at Severn Houses, at the top of the Figure, are located outside the 20 µg/m^3 contour), and thus can also be considered insignificant. Furthermore, this calculation of the PC to the short term mean has assumed that the generator operates continuously throughout the year; as the generator will only be operational for 52 hours each year, this will have significantly overestimated the PC to the short-term mean.

5.4.39 The emissions from the emergency diesel generator have, therefore, been demonstrated to be insignificant.

Significance of Air Quality Impacts

5.4.40 The assessment has demonstrated that there will be no significant impacts in terms of human health, and that the ecological effects will also not be significant.

5.4.41 Based on the above, and in accordance with the methodology set out in **Appendix 5**, the operational air quality impacts of the Proposed Development are judged to be 'not significant'.

Odour Impacts

Odour Risk Assessment

Process Description

5.4.42 The Proposed Development will see up to 215,000 tonnes of waste fuel per year passed through the gasification process. This waste fuel will all be delivered by HGV, which will enter the intake hall through fast-acting doors. These doors will be open for as little time as possible, and the building will be maintained under negative pressure to ensure that the escape of air is kept to an absolute minimum. The delivered waste will be unloaded into the waste bunker within the intake hall.

5.4.43 Unprocessed waste will be taken from the waste bunker and passed through a shredder before passing underneath an overhead magnet where ferrous metals will be removed, and through an eddy current where the non-ferrous metals will be removed (the recovered metal will be collected in a separate skip and periodically sent for further recycling). The remaining waste will then be shredded again to the size required by the gasification system and conveyed to the fuel bunker.

5.4.44 Overhead fuel cranes operating on a pre-programmed cycle will move the waste around the fuel bunker to create a homogeneous mixture. The cranes will also deliver waste to the fuel delivery chutes serving each gasification unit. From this point onwards the system is sealed, and there should be no escape of gases until they are exhausted from the flues. The air from the portion of the REC building housing the fuel bunker and waste bunker will be extracted and either used in the combustion process or passed through an odour control system, which will remove most of the odorous compounds before exhausting the emissions to the atmosphere.

5.4.45 The thermal conversion then takes place in two stages. Firstly drying, pyrolysis and gasification of the fuel will be carried out in the gasification unit, creating the synthetic gas. The bottom ash produced is discharged from the gasification units and stored in an ash bay before being removed for offsite treatment. This bottom ash is not expected to be especially odorous, and will be stored within the process building. The synthetic gas is passed to the high-temperature oxidation unit, where it is mixed with the air extracted from elsewhere in the building, and there is complete combustion of the synthetic gas.

5.4.46 Having been generated in the dual stage gasification and combustion process and passed through the Heat Recovery Steam Generator, the flue gas will enter a gas cleaning system. This will comprise of a water spray tower where the flue gas temperature is conditioned to that most appropriate for the cleaning process, a reactor where lime and activated carbon is injected into the flue gas, a bag-house filter where the residues are removed and an air pollution control residue silo where these residues are stored. In simple terms the lime and activated carbon will be injected before the inlet of the bag house filter and the lime will absorb acid components in the flue-gas while the activated carbon adsorbs dioxins, organic carbons and heavy metals. These residues are then removed from the gas in the bag-house filter and extracted to the air pollution control residue silo, while the residual flue gas passes out of the flues within the main stack. The residual flue gas is highly unlikely to be especially odorous, as most odorous compounds will be destroyed in the high-temperature combustion process.

Source Odour Potential

5.4.47 The first step of the odour risk assessment is to identify the source odour potential or odour magnitude. This takes into account the scale and nature of the odorous processes; the continuity, intensity and offensiveness of odour releases; and any odour control measures that are used. In essence, it must consider the odour potential of the source with respect to the FIDO part of FIDOR.

5.4.48 The Proposed Development will handle waste, which has the potential to produce highly intense and highly offensive odours. However, the plant will accept a majority of RDF, which will have been well-processed by the time it reaches the facility, and very different to waste handled at a household waste centre, for example. RDF is combustible waste that has been shredded and dried, and will have had most of the potentially odorous organic matter originally mixed in with the waste removed during processing. Some organic matter, and thus odour-generating potential, will undoubtedly remain, and thus the feedstock for the plant remains a potentially significant odour source.

5.4.49 Organic material is biodegradable, and biodegradation can result in odours being produced. The strength and nature of odours produced is dependent on a number of variables including the volume and composition of the waste, the length of time it has been stored, the influence of temperature and moisture, and mechanical action. Typically, fresh organic matter is less odorous than organic matter that is a number of days or weeks old and has had time for biological breakdown to begin (either aerobic or anaerobic). Conversely, organic matter which has been allowed to significantly biodegrade often becomes less odorous again (e.g. mature compost). Any residual organic matter within the RDF is likely to be at least a few weeks old, and could thus be quite odorous.

5.4.50 The feedstock for the plant is the only source of odour, but there are three main ways in which odours may be released during the processes undertaken at the Proposed Development. The first will be from the transport of the fuel to the facility, with odours released from the waste fuel as it is transported by road. The second will be from the process buildings themselves, primarily the intake hall where the waste is deposited and stored, the mechanical pre-treatment area where it is processed, and the fuel bunker where it is stored and mixed prior to being fed into the gasification process. The final potential odour source is the flues in the main stack themselves, although the gases released here, at a height of 57 m, are not expected to be especially odorous, and will be released into a good environment for dispersion.

5.4.51 As explained previously, the portion of the building housing the intake hall, waste bunker and fuel bunker will be maintained under negative pressure to ensure no fugitive releases of odorous air, and the extracted air used in combustion process or passed through an odour control system to remove most of the odorous compounds from the air. Thus the only source of odorous air from these buildings will be the exhausted air from the odour control system (should such a system be installed in addition to the extracted air being used in the combustion process), as well as any small amount of air that may escape the building while the doors are open for deliveries, although the building being maintained under negative pressure should keep this to an absolute minimum.

5.4.52 The section of the building housing the gasifiers, oxidation units and other plant will be naturally ventilated, as it is not expected to be a potential odour source, as the processes here are entirely sealed.

5.4.53 The main potential odour sources and overall source odour potential for the facility are described in **Table 5.28**.

Table 5.28: Identification of Odour Sources and Overall Source Odour Potential

Odour Source	Description	Frequency and Duration	Intensity and Offensiveness
Transport of Feedstock	The delivery of the RDF feedstock to the facility and removal of bottom ash by HGV.	This will take place between the hours of 7am and 7pm on weekdays and between 7am and 2pm on Saturdays including public holidays, with a total of 55 deliveries per day on weekdays. This equates to a delivery every 13 minutes on weekdays.	There is the potential for the waste fuel to produce highly intense, highly offensive odours. Delivery vehicles will, however, be covered to minimise odorous emissions, and any emissions should be fairly fleeting as the vehicles pass by any sensitive receptors on their way to the facility.
Process Buildings	Handling of the waste fuel.	The gasification process will be continuous, so waste will be moved and shredded 24/7.	As outlined above, there is some potential for the waste fuel to produce highly intense, highly offensive odours. However, the process buildings will all be maintained under negative pressure, with extracted air either fed through an odour control system or used in the combustion process, so the potential for these odours to be released will be very low.
Flue Gases	The leftover gases from the combustion process, post-cleaning.	The gasification process will be continuous, so flue gases will be emitted 24/7.	The flue gas is expected to have a low intensity and low offensiveness, as most odorous compounds will be destroyed in the combustion process.
Overall Source Odour Potential	The overall source odour potential of the Proposed Development is judged to be **Small**, as it will have effective, tangible mitigation measures in place leading to little or no residual odour.		

Pathway Effectiveness

5.4.54 In order to consider the effectiveness of the pathway, it is important to consider receptor locations in terms of their proximity to the odour source(s) and the prevailing wind direction. Receptors have been selected to represent all of the local sensitive locations, and are set out **Table 5.29** shown in **Figure 5.11**.

Table 5.29: Odour Risk Assessment Receptors

Receptor ID	Description
O1	Residential Property at Severn Houses
O2	Residential Property on Cherwell
O3	Wearside Farm Restaurant
O4	Johnson Controls Warehouse
O5	Business Units, Spire Road
O6	Business Units, Spire Road
O7	Residential Property on Horsley Road
O8	Fowler Welch Warehouse
O9	Tyne and Wear Fire and Rescue Service
O10	Residential Property on Hollin Hill Road
O11	Elm Tree Farm Garden Nursery and Tea Room
O12	Clays Garden Centre
O13	Vantec Warehouse and Office

5.4.55 Individual wind roses from the Newcastle Airport meteorological station for the years 2012 to 2016 are presented in **Appendix 5.7**. These demonstrate that the prevailing wind in the region is from the west. In general, odours will be transported by the wind and will not be detectable at locations upwind of a source. The exception to this is during very light wind conditions when odours may disperse against the wind direction, although typically only for relatively short distances. Given how dominant the westerly component of winds are, it can be assumed that odours will most often be carried from the site towards the east.

5.4.56 The effectiveness of the odour pathway between the Proposed Development and the nearby sensitive receptors is summarised in **Table 5.30,** which draws upon the guidance set out in **Table 5.3**.

Table 5.30: Effectiveness of Odour Pathway

Receptor	Distance from Source [a]	Downwind Direction [b]	% Winds from Source [c]	Pathway Effectiveness [d]
O1	340 m	180 – 200 °	9.0	Moderately Effective
O2	370 m	120 - 150 °	7.2	Ineffective
O3	740 m	250 - 270 °	24.0	Moderately Effective
O4	695 m	230 - 250 °	16.7	Moderately Effective
O5	145 m	60 - 120 °	13.0	Moderately Effective
O6	175 m	30 - 70 °	8.3	Moderately Effective
O7	570 m	0 - 20 °	10.3	Ineffective
O8	630 m	320 - 340 °	4.4	Ineffective
O9	675 m	280 - 300 °	8.8	Ineffective
O10	1,130 m	80 - 90 °	3.8	Ineffective
O11	365 m	160 - 190 °	11.5	Moderately Effective
O12	300 m	0 - 30 °	11.7	Moderately Effective
O13	95 m	280 - 360 °	23.9	Highly Effective

[a] Measured as the distance to either the reception hall or the RDF bunker, whichever is shortest, rounded to the nearest 5 m.

[b] Rounded to the nearest ten degrees.

[c] Average wind frequency in each 10° sector is 2.7% across all wind directions. The % winds from source figure has been calculated from the full five years of meteorological data.

[d] Overall pathway effectiveness is based on professional judgement, taking account of the distance between source and receptor, and frequency of winds with respect to the average.

5.4.57 Receptor 2 is over 200 m from the sources and in a direction where they will infrequently be downwind, thus the pathway to these receptors is deemed ineffective. Receptors 3 and 4 are a long way from the sources at the Proposed Development (over 500 m), but in a direction where they will relatively frequently be downwind, thus the pathway to these receptors has conservatively been deemed moderately effective. Receptors 5 and 6 are local to the sources (within 200 m), and in directions where they will occasionally be downwind, thus the pathway to these receptors is also deemed moderately effective. Receptors 7, 8, 9 and 10 are all a long way from the sources at the Proposed Development (over 500 m) and in directions where they will infrequently be downwind of the sources; as such the pathway to these receptors is deemed ineffective. Receptors 1, 11 and 12 are relatively local to the sources (within 400 m) and in directions where they will occasionally be downwind, thus the pathway to these receptors is deemed moderately effective. Receptor 13 is very close (relative to the other receptors) to the Proposed Development, and in a direction where it will frequently be downwind, thus the pathway to this receptor is deemed highly effective.

Receptor Sensitivity

5.4.58 Receptor sensitivities are based on the descriptors presented in **Table 5.3**. As residential properties, receptors 1, 2, 7 and 10 would be considered high sensitivity receptors. Receptors 3, 9, 11 and 12 are medium sensitivity receptors, while receptors 4, 5, 6, 8 and 13 are low sensitivity receptors.

Potential Odour Effects

5.4.59 The assessments of the potential odour effects at sensitive receptor locations are presented in **Table 5.31**. This brings together the source odour potential, effectiveness of pathway and receptor sensitivity identified using the criteria described in **Table 5.3**, to identify an overall potential for odour effects, using the matrices set out in **Table 5.4** and **Table 5.5**.

Table 5.31: Assessment of Potential Odour Effects

Receptor	Risk of Odour Impact (Dose)			Receptor Sensitivity	Likely Odour Effect
	Source Odour Potential	Effectiveness of Pathway	Risk of Odour Impact		
O1	Small	Moderately Effective	Negligible	High	Negligible
O2		Ineffective	Negligible	High	Negligible
O3		Moderately Effective	Negligible	Medium	Negligible
O4		Moderately Effective	Negligible	Low	Negligible
O5		Moderately Effective	Negligible	Low	Negligible
O6		Moderately Effective	Negligible	Low	Negligible
O7		Ineffective	Negligible	High	Negligible
O8		Ineffective	Negligible	Low	Negligible
O9		Ineffective	Negligible	Medium	Negligible
O10		Ineffective	Negligible	High	Negligible
O11		Moderately Effective	Negligible	Medium	Negligible
O12		Moderately Effective	Negligible	Medium	Negligible
O13		Highly Effective	Low	Low	Negligible

5.4.60 The potential odour effects as set out in **Table 5.31** have been identified using the effect ≈ dose x response relationship identified in paragraph 5.2.66. The process is described as follows:

1) Identify the impact:

5.4.61 Based on a *small* source odour potential, where the pathway is deemed to be *moderately effective* or *ineffective*, the risk of odour impacts is *negligible* (see **Table 5.4**).

2) Consider the response:

5.4.62 Based on the matrix presented in **Table 5.5**, a negligible risk of odour impacts will lead to a *negligible* odour effect regardless of receptor sensitivity.

5.4.63 The final stage of the risk assessment is to make an overall judgement as to the likely significance of effects. In this case it is judged that that overall significance of odour effects is 'insignificant'. This conclusion is based on the findings of the risk assessment that have identified a *negligible* risk of odour effects at all receptor locations, with the resultant odour effects also being *negligible* at all selected receptors.

Bioaerosol Impacts

5.4.64 Fundamental to the breakdown of organic waste is microbiological activity. The storage, handling and physical disturbance of organic waste can lead to the release of airborne micro-organisms known as bioaerosols. While the REC will handle some organic waste, the overall organic content of the waste received by the facility is expected to be low, thus the potential for bioaerosol generation is also low. The consensus of published guidance on bioaerosols is that there is only the potential for significant impacts where large quantities of organic material are stored and handled, such as at large composting sites. The Proposed Development will not process such large quantities of organic matter. It can therefore be concluded that the Proposed Development will not represent a significant source of bioaerosols, and will thus have insignificant effects in terms of bioaerosols.

5.5 MITIGATION AND ENHANCEMENT

Construction

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

5.5.2 The site has been identified as a Low Risk site during earthworks and construction, and Medium Risk for trackout, as set out in **Table 5.16**. Comprehensive guidance has been published by IAQM (Institute of Air Quality Management, 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 and the findings of the dust impact assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in **Appendix 5.9**.

5.5.3 The mitigation measures should be written into a Dust Management Plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring. 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.

Operation

Good Design and Best Practice Measures

5.5.4 The EPUK & IAQM guidance advises that good design and best practice measures should be considered whether or not more specific mitigation is required. While the guidance is aimed at the operational air quality assessment rather than the assessment of construction dust or operational odour and bioaerosols, it is still useful to note where good design and best practice measures have been applied in terms of minimising these impacts, so they are also covered here. The Proposed Development incorporates the following good design and best practice measures:

- adherence to the best practice techniques set out in IAQM guidance during the construction phase;

- the use of the Best Available Technology for the recovery of energy from waste in terms of emissions to air (gasification);
- the installation of appropriate mitigation in the form of a sophisticated gas cleaning system for the exhaust air from the combustion process;
- the use of a tall stack to ensure good dispersion of emissions;
- continuous monitoring of emissions of several pollutants from the stack, allowing immediate identification of any breaches of the emissions limits;
- periodic monitoring of other pollutants to ensure compliance with emissions limits;
- the introduction of a travel plan to minimise the impact of the scheme on local road traffic flows, and thus air quality;
- the use of fast-acting doors to minimise the escape of odorous air during deliveries, along with enclosed lorries making the deliveries;
- the use of an extraction system to maintain the areas where waste is stored and handled under negative pressure and either using this air in the combustion process to destroy odorous compounds and bioaerosols that may be present in the air in this building, or treating it using an odour control system, again minimising the escape of odorous air from the building;
- using the extracted air from the RDF bunker; and
- the implementation of an odour management plan to ensure that odour emissions are kept to an absolute minimum.

Further Mitigation

5.5.5 The Proposed Development already includes extensive mitigation by design, incorporating a highly sophisticated flue gas cleaning system and a 57 m stack to ensure good dispersion of emissions. The assessment has shown that the Proposed Development will not have a significant impact on local air quality in terms of pollutant emissions from the main stack and road traffic generated by the development, and nor will it have a significant effect in terms of odour or bioaerosol emissions. As such, no additional mitigation is proposed for the operational impacts, as none is considered necessary.

5.6 SUMMARY

Introduction

5.6.1 The impacts of dust and PM_{10} emissions during the construction phase have been assessed qualitatively following published guidance. The operational impacts of the Proposed Development on air quality, odour and bioaerosol conditions for local receptors have also been assessed. Air quality impacts have been assessed quantitatively using dispersion modelling, while odour impacts have been assessed qualitatively following a risk assessment technique outlined in published guidance. Bioaerosol impacts have been assessed based upon the levels expected to be generated and the likelihood of their being emitted from the Proposed Development.

Baseline Conditions

5.6.2 Local monitoring, mapping and modelling shows baseline concentrations of every pollutant to be below the objectives or EALs throughout the study area.

Likely Significant Effects

5.6.3 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be 'not significant'. However, the 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'.

5.6.4 The odour risk assessment has demonstrated that the odour effects for all local receptors will be negligible. Overall the risk assessment has judged the Proposed Development to be insignificant in terms of odour effects.

5.6.5 The qualitative bioaerosol assessment has also demonstrated that the Proposed Development will have an insignificant effect on local receptors in terms of bioaerosol concentrations.

5.6.6 Emissions from the emergency diesel generator within the facility have been shown to have an insignificant impact on local air quality.

5.6.7 The assessment of the main stack and road traffic emissions has demonstrated that the Proposed Development will result in an insignificant change in pollutant concentrations at all local sensitive receptor locations for all pollutants and all averaging periods. The Proposed Development will have a *negligible* impact on annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations at all local receptors. The impacts at local sensitive ecological sites have also been shown to be not significant.

5.6.8 The overall air quality impacts of the Proposed Development are deemed 'not significant'.

Mitigation and Enhancement

5.6.9 During construction it will be necessary to apply a package of mitigation measures to minimise dust emissions. With these measures in place, it is expected that any residual effects will be 'not significant'.

5.6.10 No additional mitigation has been proposed for the operational impacts as the assessment has demonstrated that none is necessary. The air quality assessment has employed a number of worst-case assumptions, thus the actual operational impacts are likely to be considerably lower than those set out in this chapter.

Conclusion

5.6.11 The assessment has demonstrated that the Proposed Development will not have a significant impact on dust and PM_{10} levels during construction, provided that the recommended mitigation is applied. Similarly, odour and bioaerosol emissions will be kept to a sufficiently low level that the local effects will be insignificant.

5.6.12 The assessment of the main stack, emergency diesel generator and road traffic emissions has demonstrated that the Proposed Development will result in an insignificant change in pollutant concentrations at all local sensitive receptor locations and ecological sites for all pollutants and all averaging periods. The Proposed Development will have a *negligible* impact on annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations at all local receptors.

5.6.13 The overall operational air quality impacts of the development are judged to be 'not significant'.