Volume 2
Chapter 4
Air Quality and Health
Greengate Energy Recovery Facility

SWECO

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Contents

4. Air Quality and Health

4.1 Introduction

This chapter of the ES assesses the impact of the proposed development on air quality. Potential significant effects are identified for both the construction and operational phases of the proposed development.

The assessment considers a number of pollutants with the potential to impact on human health and on sensitive ecosystems that result from the combustion of waste. It 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 emissions during operation. The assessment also takes into consideration emissions from testing of the emergency diesel generator.

A detailed human health risk assessment (HHRA) has also been carried out in order to identify any potential health risks associated with emissions from the proposed development. The complete HHRA is presented in Appendix A8, ES Volume 3.

This chapter should be read in conjunction with Technical Appendix A, ES Volume 3, which comprises the following:

- Appendix A1 – Glossary;
- Appendix A2 – Construction Dust Assessment Procedure;
- Appendix A3 – Meteorological Data;
- Appendix A4 – Modelling Methodology;
- Appendix A5 – EPUK & IAQM Planning for Air Quality Guidance;
- Appendix A6 – Professional Experience;
- Appendix A7 – Construction Mitigation;
- Appendix A8 – Human Health Risk Assessment; and
- Appendix A9 – Stack Height Tests.

4.2 Policy and Guidance

4.2.1 International Guidance

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

The European Union (EU) 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, 2015 for $PM_{2.5}$, and 2005 for all other pollutants.

4.2.1.2 Waste Framework Directive, 2008

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:

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

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

(b) without causing nuisance through noise or odours; and

(c) without adversely affecting the countryside or places of special interest." (The Waste Framework Directive (2008/98/EC, 2008)).

4.2.1.3 European Industrial Emissions Directive, 2010

The Industrial Emissions Directive (IED) (2010/75/EU, 2010) brings together seven existing directives, including the Waste Incineration Directive, into one piece of legislation. The IED outlines total emission limit values (ELVs) for a number of pollutants typically emitted during waste incineration. These are NOx, CO, total dust, HCl, HF, SO_2, organic substances, trace metals, and dioxins and furans. The design and operation of all new waste incineration facilities must ensure compliance with the ELVs.

4.2.1.4 European Policies to Protect Ecosystems

European Council Directive 92/43/EEC (The Council of the European Communities, 1992)on the Conservation of Natural Habitats and of Wild Fauna and Flora (the 'Habitats Directive') requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (The Air Quality Standards Regulations 2010 (No. 1001), 2010), transpose the Directive into law in England and Wales. The Regulations require the Secretary of State to provide the European Commission with a list of sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Area (SPAs); with these classified under the Council Directive 79/409/EEC on the Conservation of Wild Birds (Directive 2009/147/EC of the European Parliament and of the Council, 2009). These sites form a network termed 'Natura 2000'.

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

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

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

4.2.2 National Legislation and Policy

4.2.2.1 The Environmental Permitting Regulations in England and Wales, 2016

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

4.2.2.2 The Waste (England and Wales) Regulations 2011

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).

4.2.2.3 The UK Air Quality Strategy, 2007

The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) 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.

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.

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

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

4.2.2.5 Air Quality Standards Regulations, 2010

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.

4.2.2.6 Draft Clean Air Strategy 2018

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

4.2.2.7 Reducing Emissions from Road Transport: Road to Zero Strategy

The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government’s pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

4.2.2.8 National Policies to Protect Ecosystems

Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act (1949), SSSIs have been re-notified under the Wildlife and Countryside Act (1981). Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way Act (2000) (the “CROW” act). If a development is “*likely to damage*” a SSSI, the CROW act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW act also provides protection to local nature conservation sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs and European sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

4.2.2.9 National Planning Policy Framework, 2018

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

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

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

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

And:

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

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

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

The Revised NPPF is supported by National Planning Practice Guidance (NPPG) (DCLG, 2018), which 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 NPPG stating that local authority Air Quality Action Plans should: "*identify measures that will be introduced in pursuit of the objectives*". The NPPG makes clear that: *"Air quality can also affect biodiversity and may therefore impact on our international obligation under the Habitats Directive".* In addition, the NPPG makes clear that: *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

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)".

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

4.2.2.10 Odour Guidance

4.2.2.10.1 Defra Guidance

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:

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

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.

4.2.2.10.2 Environment Agency Guidance

The Environment Agency has produced a horizontal guidance note (H4) on odour assessment and management (Environment Agency, 2011a), 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.

4.2.2.10.3 Institute of Air Quality Management Guidance

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.

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, as detailed in Section 4.3.4.5.

4.2.3 Regional Policy and Guidance

4.2.3.1 Merseyside and Halton Joint Waste Local Plan

The Merseyside and Halton Joint Waste Local Plan (Halton Council, Knowsley Council, Liverpool City Council, Sefton Council, St. Helens Council and Wirral Council, 2013) contains Policy WM12: Criteria for Waste Management Development, which states that:

"All proposals for new waste management development (including landfill) and alterations/amendments to existing facilities will be expected to submit a report covering the general details of the proposed development and a written assessment and mitigation of the short, medium, long-term and cumulative impacts on its neighbours and the surrounding environment in terms of the:

- Social, economic and environmental impacts on the area;
- Amenity Impacts;
- Traffic (& transport) Impacts;
- Heritage & Nature Conservation Impacts;
- Overall Sustainability of the proposals (including carbon and energy management performance)."

4.2.4 Local Policy and Guidance

The St. Helens Local Plan Core Strategy (St. Helens Council, 2012) was adopted in 2012 and includes Policy CP 1: Ensuring Quality Development in St. Helens, which states that:

"*Development that is located within or would impact Air Quality Management Areas will require special consideration with regard to their impacts on air quality."*

St. Helens Council is currently preparing a new Local Plan, which is expected to be adopted in 2019. The Preferred Options consultation document (St. Helens Council, 2016) includes Policy LPD09: Air Quality, which states that:

"Development proposals must demonstrate that they will not:

- *Hinder the achievement of Air Quality Management Area (AQMA) objectives and the measures set out in an Air Quality Management Area Action Plan; or*
- *Hinder the revocation of an Air Quality Management Area by:*
  - *Introducing significant new sources of air pollutants, or*
  - *Introducing new development whose users will be especially susceptible to air pollution; or*
- *Lead to the declaration of an Air Quality Management Area; or*
- *Lead to a material decline in air quality.*

Where appropriate Major developments must incorporate measures to reduce air pollution and minimise exposure to harmful levels of air pollution to both occupiers of the site and occupiers of neighbouring sites."

4.2.5 Guidance Notes

4.2.5.1 Environment Agency Guidance Notes

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-term and short-term Assessment Levels for releases to air derived from a number of published UK and international sources.

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

4.2.6 Air Quality Action Plans

4.2.6.1 National Air Quality Action Plan

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

4.2.6.2 Local Air Quality Action Plan

St. Helens Council has produced an Air Quality Action Plan (St. Helens Council, 2013) which sets out measures to improve air quality as follows:

"Tier 1: AQMA specific initiatives are targeted within the AQMA itself and aim to reduce the pollutant at source or change variables within the AQMA to ensure that the higher levels do not impact on the local receptors.

Tier 2: Borough-wide initiatives are more general measures that may individually have a small impact on air pollution but collectively have a larger benefit and aim to reduce the higher background levels within the surrounding area. These measures fall into the broad categories of traffic management improvement, land use planning, sustainable transport measures and other miscellaneous options."

4.2.7 Assessment Criteria

4.2.7.1 Criteria to Protect Human Health

Table 4.1 sets out the Environmental Assessment Levels (EALs) for human health used in this study. The EALs for nitrogen dioxide and PM_{10} are AQOs, which were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ AQO is to be achieved by 2020. Where there is no AQO, the Environment Agency's Assessment Levels have been used as EALs.

The EALs apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the EAL. Defra explains where the AQOs apply in its Local Air Quality Management Technical Guidance (Defra, 2018c) and the Environment Agency applies the same approach with its Assessment Levels. Annual mean EALs apply anywhere with residential exposure. The 24-hour objective for PM_{10} is taken to apply at residential properties as well as in the gardens of residential properties. The EALs for periods of 8 hours or less have been taken to potentially apply anywhere within the study area, even though, in practice, members of the public would need to be regularly exposed in a non-occupational setting for the averaging period of the EAL.

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

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

Table 4.1 shows that 18 exceedances of 200µg/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 200µg/m^3 standard shows whether the 1-hour mean nitrogen dioxide objective would be exceeded. Similarly, the 90.4th percentile of 24-hour mean PM_{10} concentrations represents the 36th highest 24-hour period, the 99.7th percentile of 1-hour mean SO_2 concentrations represents the 25th highest hour, the 99.9th percentile of 15-minute SO_2 concentrations represents the 36th highest 15-minute period, and the 99.18th percentile of 24-hour mean SO_2 concentrations represents the 4th highest 24-hour period.

Table 4.1 Relevant air quality objectives and environmental assessment levels for the protection of human health

Pollutant	Averaging Period	Concentration (µg/m^3)	Number of periods allowed to exceed per year	AQO [a]
Nitrogen dioxide	Annual	40	n/a	X
	1 hour	200	18	X
PM_{10}	Annual	40	n/a	X
	24 hours	50	35	X
$PM_{2.5}$ [a]	Annual	25	n/a	X
SO_2	24 hours	125	3	X
	1 hour	350	24	X
	15 minutes	266	35	X
CO	8 hour rolling	10,000	n/a	X
HF	Annual	16	n/a	
	1 hour	160	n/a	
HCl	1 hour	750	n/a	
Benzene	Running annual	16.25	n/a	X
	Annual	5 [b]	n/a	X
1,3-butadiene	Annual	2.25 [b]	n/a	X
Cd	Annual	0.005	n/a	
Hg	Annual	0.25	n/a	

Pollutant	Averaging Period	Concentration (µg/m3)	Number of periods allowed to exceed per year	AQO [a]
	1 hour	7.5	n/a	
Sb	Annual	5	n/a	
	1 hour	150	n/a	
As	Annual	0.003	n/a	
Cr (III)	Annual	5	n/a	
	1 hour	150	n/a	
Cr (VI)	Annual	0.0002	n/a	
	1 hour	15	n/a	
Cu	Annual	10	n/a	
	1 hour	200	n/a	
Pb	Annual	0.25	n/a	X
Mn	Annual	0.15	n/a	
	1 hour	1,500	n/a	
Ni	Annual	0.02	n/a	
V	Annual	5	n/a	
NH_3	Annual	180	n/a	
	1 hour	2,500	n/a	

[a] Those EALs which have the status of an air quality objective are indicated in this column.
[b] TOCs assessed against the EALs for benzene and 1,3-butadiene, since these are the most stringent EALs for any VOCs.

4.2.7.2 Criteria to Protect Ecological Sites

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 20km 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, apply across most of the study area.

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, but do not have the same legal standing. Typically, the potential for exceedances of the critical levels and critical loads is considered in the context of the level of protection afforded to the ecological site as a whole. For example, the level of protection afforded to an internationally-designated site (such as a SAC) 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.

The Air Pollution Information System (APIS) database (APIS, 2018) has been searched to obtain critical levels and critical loads. Where APIS does not provide critical levels for a given pollutant, they have been taken from Environment Agency guidance (Environment Agency, 2016a). For NH_3 and SO_2, there are more stringent critical levels which only apply for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity. Different critical loads are available for different habitats; and in the case of acidity, different locations. The relevant critical levels and critical loads for this assessment are set out in Table 4.2, being applicable to Thatto Heath LNR, the only designated site considered (see Section 4.3.4.1.1).

The approach currently recommended by APIS for assessing acid deposition only refers to nitrogen and sulphur. In order to account for the acidifying input from HCl, 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 4.2 Relevant assessment criteria for the protection of sensitive ecosystems

Pollutant and Averaging Period	EAL [a]
Annual Mean NH_3 (µg/m³)	1
Annual Mean NOx (µg/m³)	30
24-hour Mean NOx (µg/m³)	75
Annual Mean SO_2 (µg/m³)	20
Daily Mean HF (µg/m³)	5
Weekly Mean HF (µg/m³)	0.5
Nutrient Nitrogen Critical Loads (kg-N/ha/yr)	10
Acid Critical Load (N_{max}) (keq/ha/yr) [b]	1.298

[a] Taken from the APIS website (APIS, 2018) .

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

4.2.7.3 Odour Criteria

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.

It is widely 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".

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

4.2.7.4 Construction Dust Criteria

There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the IAQM[1] (2014a) has been used. Full details of this approach are provided in Appendix A2, ES Volume 3.

4.3 Assessment Methodology and Significance Criteria

4.3.1 Consultation

An EIA Scoping Report was provided to the Council, setting out the potential air quality impacts and how they would be addressed, including details of the proposed assessment methodology. The Council responded that they were satisfied with the approach set out in the Scoping Report, thus no further consultation was considered necessary.

4.3.2 Scope of the Assessment

The 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 primary 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);

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

- 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).

In terms of road traffic emissions, the primary pollutants of concern are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

In addition, the Thatto Heath Local Nature Reserve (LNR) is sufficiently close to the application site to warrant assessment. 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).

During construction, the focus is on dust and particulate matter (PM_{10}) emissions.

Waste handling during operation could also potentially lead to emissions of odorous compounds.

The proposed development would have a diesel-powered emergency generator installed, which would only be used in earnest in the unlikely event of a major failure of the electrical distribution system within the facility. It is unlikely that it would ever be required to operate for this purpose. It would, 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.

The health risk assessment focuses on the uptake of polychlorinated dibenzo-para-dioxins and polychlorinated dibenzofurans, often abbreviated to 'dioxins and furans'. The assessment covers exposure through the direct inhalation of dioxins and furans as gases and fine airborne particles, as well as indirect exposure following the deposition of contaminants to land and subsequent transfer by biogeochemical processes through soils and vegetation into the food chain.

4.3.3 Method of Baseline Data Collection

Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. The background concentrations across the study area have also been defined using the national pollution maps published by Defra (2017a). These cover the whole country on a 1x1km grid. Background deposition fluxes have been taken from the APIS website (APIS, 2018). These cover the whole country on a 5x5km grid.

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 (these maps were published for a baseline year of 2015 and for the future years of 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, 2018d), which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

4.3.4 Assessment Methodology

4.3.4.1 Stack Emissions

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.

4.3.4.1.1 Study Area

The study area for the consideration of the health impacts of emissions from the stack covers a 10km x 10km area centred on the proposed development.

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). Applying these criteria, the only relevant site for this assessment is the Thatto Heath LNR, approximately 250 m to the south of the application site.

4.3.4.1.2 Meteorology

Five years of hourly-sequential meteorological data (2012 to 2016 inclusive) from Liverpool Airport have been used. This meteorological station is located approximately 14 km to the south-west of the application site. It is the nearest station operated to Meteorological Office standards that measures all of the required parameters. Both the application site and the Liverpool Airport meteorological station are located in the North West of England where they will be influenced by the effects of estuarine meteorology. The specific setting of the meteorological station is closer to the estuary than the application site, which is more urban. The different meteorological parameters used in the model for the application site and the meteorological site (such as surface roughness) are intended to account for these differences.

Appendix A3, ES Volume 3, 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 concentrations during any of the five years modelled have been reported throughout this assessment.

4.3.4.1.3 Building Wake Effects

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 is assessed, modelling has been carried out for two scenarios: 1) no buildings included in the model; 2) the main on-site buildings included in the model. The modelled buildings are shown in Figure A4.1 of Appendix A4, ES Volume 3. The maximum predicted concentrations from either scenario have been used throughout this assessment.

4.3.4.1.4 Terrain Effects

The terrain within the study area is largely flat and is not expected to have a significant impact on dispersion. The ADMS-5 model user guide advises that *"it is not always necessary to include the effects of surrounding terrain in a modelling calculation. Usually terrain height effects are only included if the gradient exceeds 1:10"*. Ordnance survey terrain data indicates that the study area contains only a few small, isolated locations where the gradient exceeds 1:10; it has therefore, been judged that it is not necessary to include terrain effects in the modelling. A topographical grid has not, therefore, been included in the model runs.

4.3.4.1.5 **Emissions**

The plant manufacturer has provided data on efflux volumes in Nm^3/s(2), as well as flue/stack dimensions and the actual release conditions. The release parameters are set out in Table A4.1 in Appendix A4, ES Volume 3. The pollutant emission rates (shown in Table A4.2 in Appendix A4) used in the assessment have been derived from IED limits, which are set out in Table 4.1. The modelled emission rates are, therefore, the maximum permissible; actual operational emissions rates are likely to be well below the IED limits for most of the time, thus this approach is worst-case and will have over-predicted the impacts of the facility's emissions.

4.3.4.1.6 **Post-Processing**

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, as well as to the 99.79^{th} percentile of 1-hour mean nitrogen oxides concentrations, 90^{th} percentile of 24-hour mean PM_{10} concentrations, 99.7^{th} percentile of 1-hour mean sulphur dioxide concentrations, 99.9^{th} percentile of 15-minute sulphur dioxide concentrations and 99.18^{th} percentile of 24-hour mean sulphur dioxide concentrations.

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

- Annual mean nitrogen dioxide concentrations = Annual mean nitrogen oxides x 0.7; and
- 99.79^{th} percentiles of 1-hour mean nitrogen dioxide concentrations = 99.79^{th} percentiles of 1-hour mean nitrogen oxides x 0.35.

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 grassland taken from AQTAG06 (Environment Agency, 2011b):

- NO_2 – 0.0015 m/s;
- NH_3 – 0.02 m/s;
- SO_2 – 0.012 m/s; and
- HCl – 0.025 m/s.

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

2 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.

calculations required to present the data as kg/ha/yr of nitrogen and as keq/ha/yr for acidity follow basic chemical and mathematical rules[3].

4.3.4.1.7 Stack Height Testing

The required stack height, such that the proposed development has no significant impacts anywhere within the study area, has been determined by modelling annual mean NO_2 concentrations for a variety of stack heights ranging from 60 m to 120 m. The results of this modelling have been combined with those from the baseline road traffic model, and the minimum stack height for which all annual mean nitrogen dioxide impacts can be described as *negligible* following the significance criteria set out in Table 4.8, as well as impacts for all other pollutants being 'not significant' following Environment Agency guidance, has been determined. An 80 m stack is the lowest stack for which the impacts are negligible at all sensitive receptor locations, and all results presented in this chapter are based on modelling emissions at this height. Further details of the stack height tests are provided in Appendix A9, ES Volume 3.

4.3.4.2 Emergency Diesel Generator

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

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 A4.5 of Appendix A4, ES Volume 3. Where parameters have been estimated the approach has been to use reasonable worst-case assumptions, i.e. the combination of parameters that would lead to the highest ground-level concentrations has been assumed. The buildings included in the model are shown in Figure A4.1 of Appendix A4, ES Volume 3.

The generator will operate for 25 hours each year in total (for testing) and the model-output concentrations have been adjusted accordingly.

4.3.4.3 Road Traffic Emissions

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 increases in road traffic as a result of the proposed development are greatest, and where the impacts of the stack emissions will be greatest.

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

4.3.4.3.1 Traffic Data

Traffic data have been provided by Sweco, who have undertaken the Transport Assessment for the proposed development. The proposed development will increase traffic flows by up to 136 Heavy Duty Vehicles (HDVs – Heavy Goods Vehicles (HGVs) plus buses and coaches) per day. This exceeds the screening criterion published by Environmental Protection UK (EPUK) & IAQM (Moorcroft and Barrowcliffe et al., 2017), thus a detailed modelling assessment of road traffic impacts is required.

4.3.4.3.2 Assessment Scenarios

Predictions of nitrogen dioxide concentrations have been carried out for a base year (2016, the most recent year for which a full set of monitoring data was available at the time the assessment was carried out), and the proposed year of opening (2023). For 2023, predictions have been made assuming both that the development does proceed (with development), and does not proceed (without development). 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 predicted by Defra, using Air Quality Consultants' (AQC) Calculator Using Realistic Emissions for Diesels (CURED v3A) tool (AQC, 2017).

4.3.4.3.3 Modelling Methodology

Details of the model inputs, assumptions and the verification are provided in Appendix A4 (ES Volume 3), 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.

4.3.4.4 Construction Dust

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 (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 A2 (ES Volume 3) explains the approach in more detail.

4.3.4.5 Odour

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 (and thus not already present), then assessment methods such as sniff testing and odour sampling are less relevant than predictive methods such as odour risk assessment.

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).

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 (i.e. people) to be affected by the odour.

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

Effect ≈ Dose x Response

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.

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.

Odour emissions from the proposed facility 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)

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 is outlined below; it describes a Source-Pathway-Receptor approach to odour risk assessment, and includes tables and matrices to assist in determining the likely risk of odour effects. It includes an element of professional judgement.

The assessment examines the source odour potential (source magnitude) of the proposed facility, and then identifies the effectiveness of the pathway and receptor sensitivity at sensitive locations.

Table 4.3 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 4.3 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.

The risk ratings for source magnitude and pathway effectiveness (for each receptor) identified using the criteria in Table 4.3 are then combined using the matrix shown in Table 4.4 to estimate an overall risk of odour impact at each specific receptor location.

Table 4.4 Assessment of risk of odour impact at a specific receptor

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**

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 4.5, which combines the overall odour impact risk descriptor for each receptor with the receptor sensitivity determined using the criteria in Table 4.3.

Table 4.5 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**

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.

4.3.4.6 Human Health Risk Assessment

Her Majesty's Inspectorate of Pollution (HMIP) previously published a dioxin and furan congener profile based on measurements at municipal waste incinerators (HMIP, 1996). This provides the most robust dataset to describe the proposed development at this time and has thus been used to define the relative quantities of each congener that would be emitted. This congener profile has been combined with toxic equivalence factors (TEQs) provided by the IED (2010/75/EU, 2010) and the volumetric emission rate from the proposed development to calculate g/s mass emissions of the individual congeners. These calculations are shown in Table A8.1 of Appendix A8, ES Volume 3.

The transport of emissions though air, and dry and wet deposition of particle-bound and vapour-phase congeners, have been simulated within the ADMS-5 model. Modelling has been carried out over the same Cartesian grid of receptors, and using the same meteorological datasets, as was used for the main air quality assessment. For each receptor, the maximum predicted concentration, dry deposition flux, and wet deposition flux during any year was taken and used for the health risk assessment.

The HHRA has used the Industrial Risk Assessment Program-Human Health (IRAP) model, which is based on the United States Environmental Protection Agency (USEPA) Human Health Risk Assessment Protocol (HHRAP). This approach is current best-practice in the UK and is often recommended by the UK Environment Agency. The inputs to the IRAP model are described in detail in Appendix A8, ES Volume 3.

4.3.5 Identified Sensitive Receptors

4.3.5.1 Stack Emissions

Impacts have been predicted across three nested Cartesian grids:

- A 4 km x 4 km inner grid, centred on the application site, with receptors spaced 20 m apart;
- A middle grid, extending to 5 km from the application site in each cardinal direction, with receptors spaced 50 m apart; and
- An outer grid, extending to 10 km from the application site in each cardinal direction, with receptors spaced 100 m apart.

The gridded receptors have been modelled at a height of 1.5 m, to represent ground-level human exposure, and are shown in Figure 4.1.

SWECO

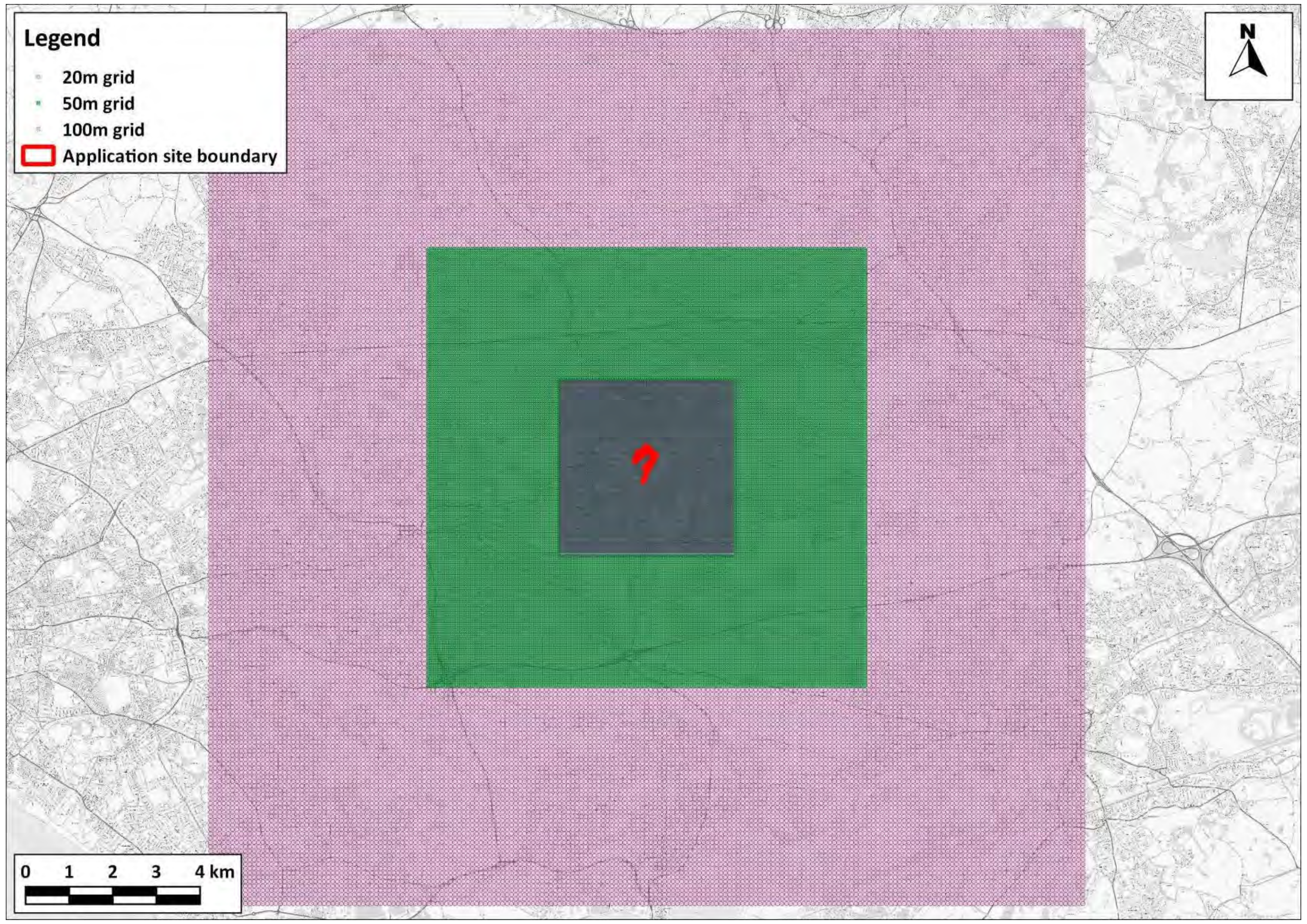

Figure 4.1 Nested cartesian grid

4.3.5.2 Road Traffic Impact Assessment

Nitrogen dioxide concentrations have been predicted at a number of sensitive locations in local areas where the road traffic impacts of the proposed development are expected to be greatest, and where the impacts of the stack emissions will 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.

Fifteen existing residential properties have been identified as receptors for the assessment, shown in Figure 4.2. In addition, concentrations have been modelled at a number of monitoring sites in St. Helens, in order to verify the model output concentrations (see Appendix A4 for the road traffic model verification method).

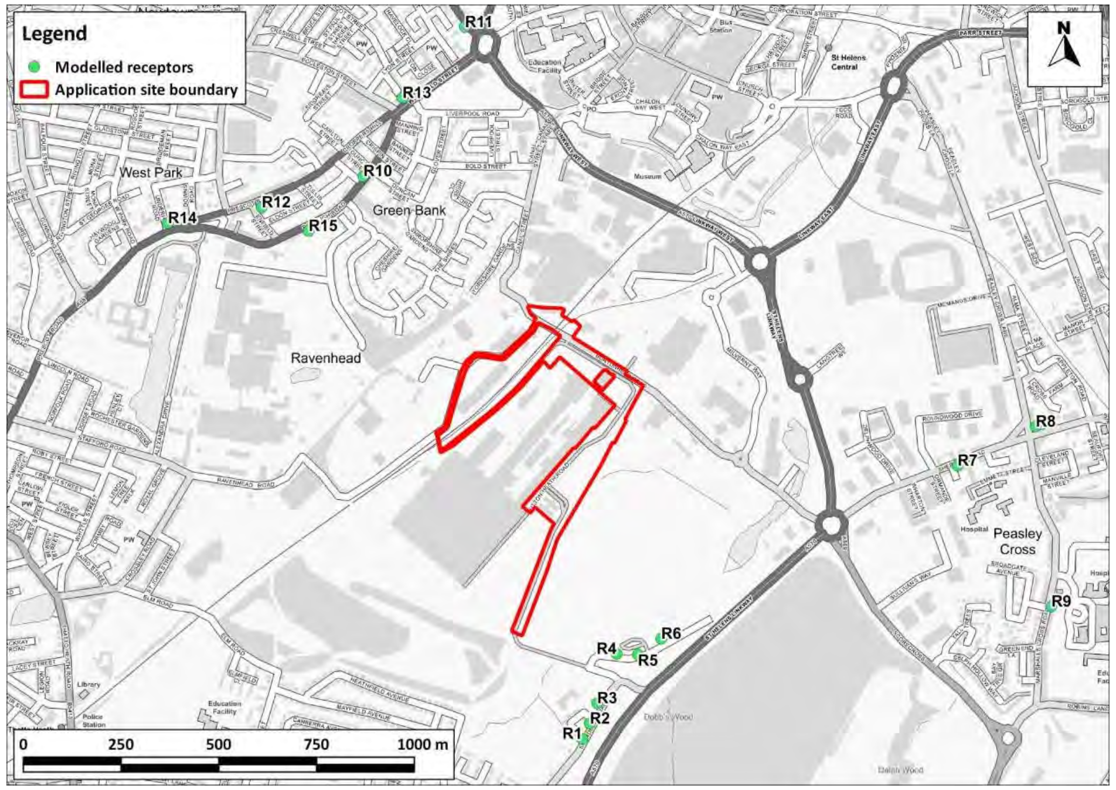

Figure 4.2 Receptor locations

4.3.5.3 Odour Risk Assessment

Receptors have been selected to represent the nearest local sensitive locations in a variety of directions, and are set out Table 4.6 and shown in Figure 4.3.

Table 4.6 Odour risk assessment receptors

Receptor ID	Description
O1	Costa Coffee Shop
O2	Residential Property on Yorkshire Gardens
O3	Residential Property on Elm Road
O4	Subway Restaurant
O5	Residential Property on Berkshire Gardens
O6	Residential Property on Ravenhead Road
O7	Residential Property on Heathfield Avenue
O8	Residential Property on Sherdley Road
O9	McDonald's Restaurant

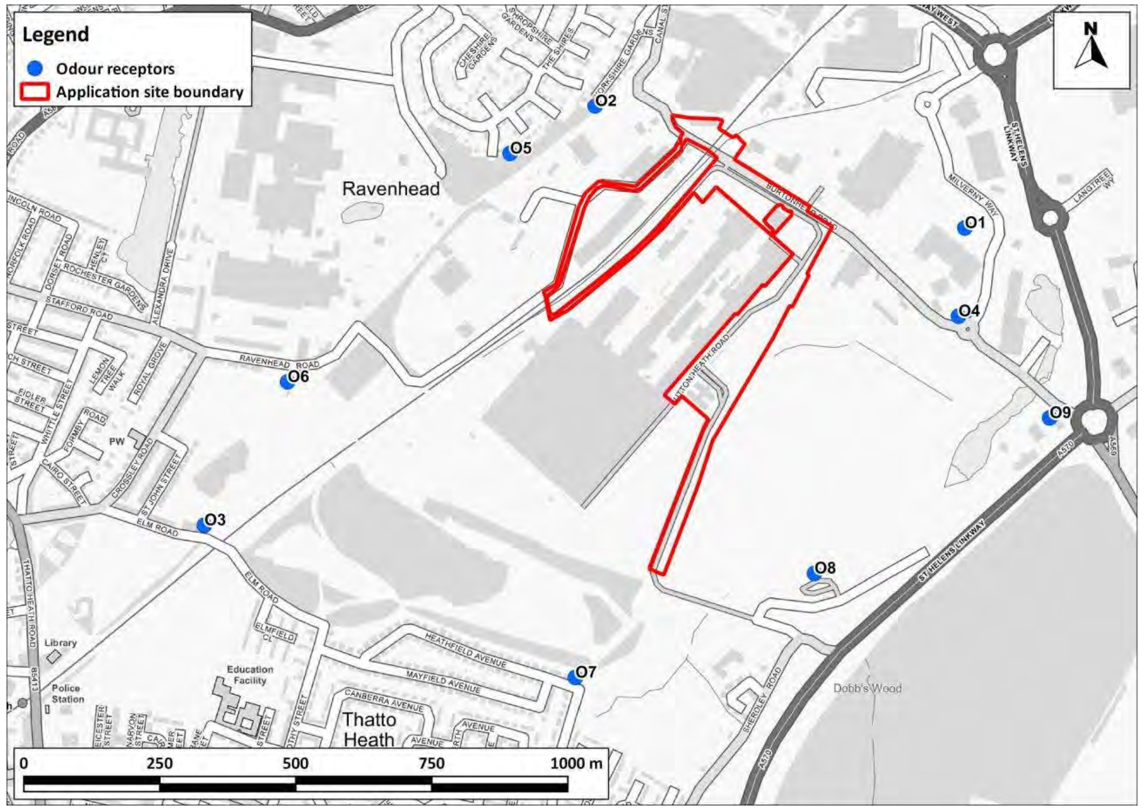

Figure 4.3 Receptors for odour risk assessment

4.3.5.4 Human Health Risk Assessment

Within the IRAP model, there are four receptor types of relevance to this assessment:

- Resident adult;
- Resident child;
- Farmer adult; and
- Farmer child.

Resident receptors are assumed to have the potential to intake pollutants via inhalation, by eating above-ground home-grown vegetables and by eating soil[4]. Farmer receptors are assumed to intake pollutants by these same pathways, but also from eating home-reared beef, chicken and pork, drinking milk from cows kept at home, and eating home-produced eggs. It is important to recognise that, when a receptor is included as a farmer, the assumption is made that the location is an active farm at which only beef, pork, poultry, eggs, milk and vegetables produced at that farm are consumed. It is unlikely that there are any such locations in the vicinity of the application site. The receptors used in the HHRA are described in and shown in Figure 4.4.

Table 4.7 Receptors used in the HHRA

Receptor	Description	Type
H1	Allotments on Alder Hey Road	Farm
H2	Allotments on Recreation Street	Farm
H3	Allotments on Bedford Street	Farm
H4	Allotments on Sherdley Road	Farm
H5	Allotments on Main Avenue	Farm
H6	Allotments on Old Eccleston Lane	Farm
H7	The Mansion House	Residential
H8	Property on Heathfield Avenue	Residential
H9	Reeve Court Village	Residential
H10	Arable land adjacent to Elton Head Road	Farm
H11	Arable land adjacent to St Helens Road	Farm
H12	Arable land adjacent to Eccleston Gardens	Farm
H13	Arable land adjacent to Reginald Road	Farm

[4] This is usually accidental and associated with home-grown vegetables.

Receptor	Description	Type
H14	Arable land adjacent to St Helens Canal	Farm
H15	Property on Yorkshire Gardens	Residential
H16	Property on Berkshire Gardens	Residential
H17	Property on Heathfield Avenue	Residential
H18	Property on Sherdley Road	Residential
H19	Property on Sherdley Road	Residential
H20	Property on Tall Trees	Residential
H21	Property on Shropshire Gardens	Residential

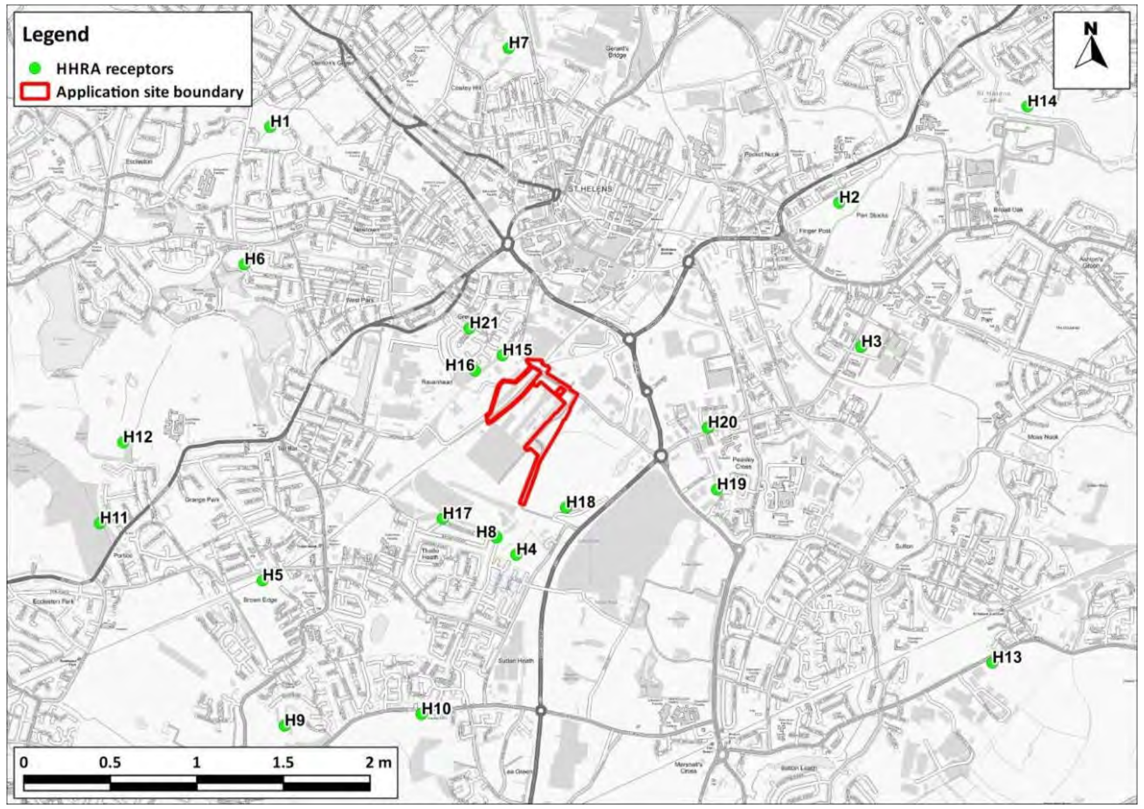

Figure 4.4 Receptors for the HHRA

4.3.6 Significance Criteria

4.3.6.1 Construction Dust Significance

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

4.3.6.2 Operational Air Quality Criteria Issued by the Environment Agency

The Environment Agency has adopted criteria (Environment Agency, 2016a) that allow health-related Process Contributions (PCs[5]), and those contributions to national or international ecological sites, to be screened out as not significant regardless of the baseline environmental conditions. The emissions from a process can be considered to be not significant if:

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

It should be recognised that these criteria determine when an effect can be screened out as not significant. They do not imply that effects will necessarily be significant above these levels, but that above these levels 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, the next step is to compare the PC against the short-term environmental standard minus twice the long-term background concentration. The emissions are not significant 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.

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

In terms of locally-designated ecological sites (as opposed to those with national or European designation), the Environment Agency discounts the possibility of significant effects where the PC is less than 100% of the long-term or short-term EAL (Environment Agency, 2016a).

4.3.6.3 Operational Air Quality Criteria Issued by the Institute of Air Quality Management and Environmental Protection UK

To accompany the assessment using the Environment Agency screening criteria, a separate analysis has also been carried out for annual mean NO_2 and PM_{10} concentrations following guidance developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al., 2017). These criteria provide a means of describing the annual mean impacts of any type of scheme and are not specifically designed for industrial developments. They take account of the magnitude of change, as well as the total predicted concentration in relation to the air quality objectives, and are set out in Table 4.8. Further details are given in Appendix A5, ES Volume 3. The EPUK/IAQM guidance relies on an element of professional judgement. The professional expertise of the chapter's authors is summarised in Appendix A6, ES Volume 3.

Table 4.8 Air quality impact descriptors for individual receptors for all pollutants [a]

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

a Values are rounded to the nearest whole number.
b This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.
c AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

The EPUK and IAQM guidance (Moorcroft and Barrowcliffe et al., 2017) also sets out criteria to define the volume of additional traffic that a development would need to generate in order to require a quantitative air quality assessment. This states that, outside of an AQMA, a development would need to increase traffic flows by more than 500 light duty vehicles per day or more than 100 heavy duty vehicles per day (both as Annual Average Daily Traffic flows (AADTs)) in order to require such assessment. Inside an AQMA, these numbers reduce to 100 vehicles per day and 25 vehicles per day respectively. If a development generates fewer than these numbers of vehicles on any road, then it can be concluded that there will be no likely significant effects from road traffic emissions and that there is no need for a more detailed assessment.

4.3.6.4 Operational Air Quality Criteria Used in this Assessment

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?

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

4.3.6.5 Operational Odour Significance

The IAQM guidance document (IAQM, 2014) method for estimating the significance of potential odour effects has been used. The guidance relies on professional judgement. The professional expertise of the chapter's authors is summarised in Appendix A6, ES Volume 3.

4.3.6.6 Human Health Risk Assessment

The assessment criteria used in the HHRA are summarised below. Further details are provided in Appendix A8, ES Volume 3.

4.3.6.6.1 Cancer Risk

One definition of 'acceptable risk' that has been widely used in the UK, is if exposure to a substance increases a person's chance of dying in any one year by one chance in a million (1:1,000,000 or 1×10^{-6}) or less[6] (Hunter and Fewtrell, 2010). HHRAP uses a value of one in one hundred thousand (1:100,000 or 1×10^{-5}) for lifetime cancer risk. This is effectively more stringent than the 1 in 1 million annual risk figure and has thus been used for this study.

4.3.6.6.2 Hazard Risk

The 'Hazard Quotient' is a way of expressing the ratio of the predicted exposure level and a 'reference dose' which represents the level at which no adverse effects are expected. If the Hazard Quotient is less than 1 (i.e. the predicted exposure is less than the reference dose), then no adverse health effects are expected. If the Hazard Quotient is greater than 1, then adverse health effects are possible. It is important to note that a Hazard Quotient exceeding 1 does not necessarily mean that adverse effects will occur; it simply indicates the potential for an effect.

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[6] By way of comparison, the likelihood of dying in a road traffic accident is approximately 1 in 17,500 per year http://www.medicine.ox.ac.uk/bandolier/booth/Risk/trasnsportpop.html

4.3.6.6.3 Oral Intake of All Congeners

The World Health Organisation (WHO) has recommended a range of Tolerable Daily Intakes (TDIs)s from 1 pg-TEQ/kg/day to 4 pg-TEQ/kg/day while, in the UK, the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has recommended a TDI of 2 pg-TEQ/kg/day. Both criteria have been used in this assessment.

4.3.6.6.4 Infant Exposure through Breast Milk

There is no official UK or USEPA assessment criterion for acceptable infant exposure. Two separate approaches have been taken in this assessment. The first is to compare the average daily dose (ADD) for all congeners against an assumed nominal baseline dose of 100 pg-TEQ/kg/day. The second is to compare the ADD for the congener 2,3,7,8-TCDD against the threshold value of 50 pg-TEQ/kg/day.

4.3.6.6.5 Concentrations in Soils

The Environment Agency has developed Soil Guideline Values (SGVs) for dioxins, furans, and dioxin-like PCBs (Environment Agency, 2009). The SGV used in this assessment is 8 µg/kg.

4.3.7 Assumptions and Limitations

4.3.7.1 Stack Emissions

The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters, all of which in reality are variable as the emissions will differ depending on the calorific value of the feedstock. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. The assessment has, however, sought to address these uncertainties by applying worst-case assumptions where possible. These are highlighted below:

- It has been assumed that the facility will operate continuously throughout the year, even though it will be shut down for maintenance for up to five weeks each year. Predicted annual mean concentrations should, therefore, be some 9.5% lower than presented in this chapter;
- It has been assumed that pollutants will be emitted at the maximum rates allowed by the IED for every hour of the year. In practice, the combustion technology is expected to result in emission rates lower than these maxima permitted under IED (and considerably lower for some pollutants); and
- The assessment has been based 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 proposed development will be considerably lower than those described later in this chapter.

4.3.7.2 Road Traffic Modelling

There are many components that contribute to the uncertainty of road traffic emissions dispersion modelling predictions. The 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.

An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A4, ES Volume 3). This can only be done for the road traffic model. The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment (see Appendix A4, ES Volume 3). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2016) concentrations.

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.

European type approval ('Euro') standards for vehicle emissions apply to all new vehicles manufactured for sale in Europe. These standards have, over many years, become progressively more stringent and this is one of the factors that has driven reductions in both predicted and measured pollutant concentrations over time.

Historically, the emissions tests used for type approval were carried out within laboratories and were quite simplistic. They were thus insufficiently representative of emissions when driving in the real world. For a time, this resulted in a discrepancy, whereby nitrogen oxides emissions from new diesel vehicles reduced over time when measured within the laboratory, but did not fall in the real world. This, in turn, led to a discrepancy between models (which predicted improvements in nitrogen dioxide concentrations over time) and measurements (which very often showed no improvements year-on-year).

Recognition of these discrepancies has led to changes to the type approval process. Vehicles are now tested using a more complex laboratory drive cycle and also through 'Real Driving Emissions' (RDE) testing, which involves driving on real roads while measuring exhaust emissions. For HDVs, the new testing regime has worked very well and NOx emissions from the latest vehicles (Euro VI[7]) are now very low when compared with those from older models (ICCT, 2017).

For Light Duty Vehicles (LDVs), which include Light Goods Vehicles (LGVs), cars, taxis and motorcycles, while the latest (Euro 6) emission standard has been in place since 2015, the

7 Euro VI refers to HDVs while Euro 6 refers to LDVs.

new type-approval testing regime only came into force in 2017. Despite this delay, earlier work by AQC (2016) showed that Euro 6 diesel cars manufactured prior to 2017 tend to emit significantly less NOx than previous (Euro 5 and earlier) models. Given the changes to the testing regime, it is reasonable to expect that diesel cars and vans registered for type approval since 2017 will, on average, generate even lower NOx emissions.

As well as reviewing information on the emissions from modern diesel vehicles in the real world (AQC, 2016), AQC has also reviewed the assumptions contained within Defra's latest Emissions Factors Toolkit (EFT) (v8.0.1) (AQC, 2018). One point of note is that the EFT makes a range of assumptions, which appear to be very conservative, regarding the continued use of diesel cars into the future and the relatively slow uptake of non-conventional (e.g. electric) vehicles (AQC, 2018). Thus, despite previous versions of Defra's EFT being over-optimistic regarding future-year predictions, it is not unreasonable to consider that EFT v8.0.1 might under-state the scale of reductions over coming years (i.e. over-predict future-year traffic emissions).

Overall, it is considered that, for assessment years prior to 2020, the EFT provides a robust method of calculating emissions. While there is still some uncertainty regarding any predictions of what will occur in the future, there are no obvious reasons to expect predictions made using the EFT to under-predict concentrations in the future up to and including 2019.

For assessment years beyond 2020, EFT v8.0.1 makes additional assumptions regarding the expected performance of diesel cars and vans registered for type approval beyond this date, reflecting further planned changes to the type approval testing. While there is currently no reason to disbelieve these assumptions, it is sensible to consider the possibility that this future-year technology might be less effective than has been assumed. A sensitivity test has thus been carried out using AQC's CURED v3A model (AQC, 2017), which assumes that this, post-2020, technology does not deliver any benefits. Further details of CURED v3A are provided in a report available on AQC's website (2018). CURED v3A is considered to provide a worst-case assessment.

It is also worth noting that the fleet projections incorporated within the EFT do not appear to reflect the Government's ambitions as set out in the Road to Zero Strategy, predicting a relatively low proportion of zero tailpipe emission vehicles in years up to and including 2030. If the Government's ambitions relating to the uptake of zero tailpipe emission vehicles are realised then the EFT's emissions projections for NOx are likely to be overly-conservative for the latter part of the 2020s, if not the entire decade.

4.4 Baseline Conditions and Receptors

4.4.1 Current Baseline

4.4.1.1 Industrial Sources

Within the industrial area immediately surrounding the proposed development there are a number of industrial facilities, including:

- Pilkington Greengate Works;
- Knauf Insulation;
- Scottish Power; and
- Ravenhead Waste Recycling Centre.

The Council has identified this area as having significant emission sources, which will contribute to elevated local nitrogen dioxide baseline concentrations as measured at the monitoring sites in Table 4.9.

4.4.1.2 Air Quality Management Areas

St. Helens Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. In April 2009 two AQMAs were declared for exceedances of the annual mean nitrogen dioxide objective. Two further AQMAs were declared for exceedances of the annual mean nitrogen dioxide objective in 2011. The closest AQMA is located 270 m north of the application site. The declared AQMAs close to the application site are shown in Figure 4.5.

In terms of PM_{10}, St. Helens Council concluded that there are no exceedances of the objectives. It is, therefore, reasonable to assume that existing PM_{10} levels will not exceed the objectives within the study area.

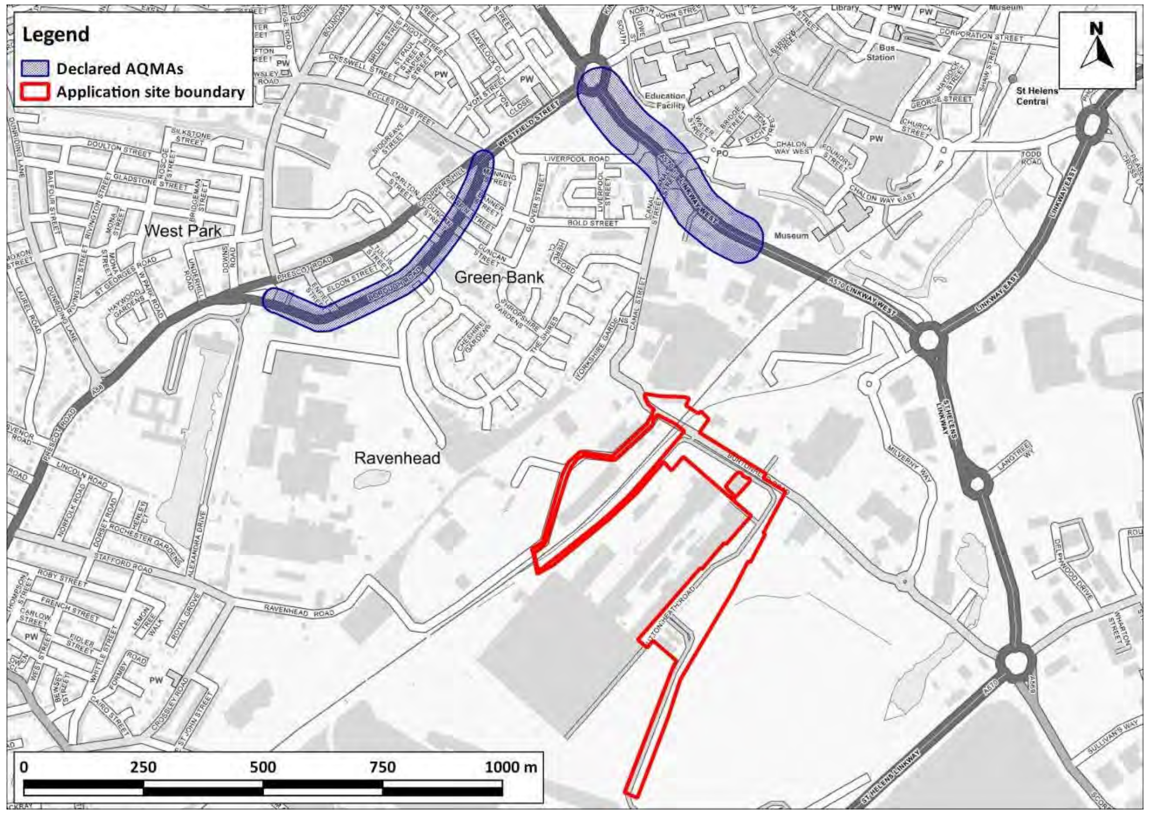

Figure 4.5 Declared AQMAs near to the proposed development

4.4.1.3 Local Air Quality Monitoring

St. Helens Council operates four automatic monitoring stations within the borough, two of which are within 500 m of the application site. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by ESG Scientifics (using the 50% triethanolamine (TEA) in acetone method). Data for these sites have been provided by St. Helens Council. Results for the years 2013 to 2017 are summarised in Table 4.9 and the monitoring locations are shown in Figure 4.6.

Table 4.9 Summary of nitrogen dioxide (NO_2) monitoring (2013 – 2017) [a]

Site No.	Site Type	Location	2013	2014	2015	2016	2017
Automatic Monitors - Annual Mean (µg/m3)							
AN1	Roadside	Linkway	41	37	38	38	34
AN4	Roadside	**Borough Road**	36	35	38	39	29
Objective			40				

Site No.	Site Type	Location	2013	2014	2015	2016	2017
Automatic Monitors - No. of Hours > 200 µg/m³							
AN1	Roadside	Linkway	2	0	0	0	0
AN4	Roadside	Borough Road	0	0	0	0	0
Objective			18				
Diffusion Tubes - Annual Mean (µg/m³)							
T3	Urban Background	Taylor Park	17.6	15.5	13.6	14.9	13.5
T19/T24	Roadside	55 Borough Road	**45.3**	**43.1**	**41.7**	**47.8**	**44.0**
T22	Roadside	Linkway Monitor	-	-	29.8	30.0	31.5
T28	Roadside	206 Borough Road	-	-	25.5	25.8	25.9
T29	Roadside	25 Prescot Road	28.8	28.7	24.5	26.5	25.0
Objective			40				

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

The annual mean nitrogen dioxide objective was exceeded at the 55 Borough Road site in every year for which data are presented, and at the Linkway automatic monitor in 2013. No exceedances of the 1-hour mean objective have been recorded in the past five years. There are no clear trends in the overall monitoring data over the past five years, although concentrations at the Linkway site (AN1) do appear to have fallen appreciably, and the urban background concentrations measured at site T3 also appear to show a downward trend.

2017 concentrations at the automatic monitors were especially low, while concentrations in 2016 were relatively high at most monitoring sites, compared to the other years presented. Using 2016 as the verification year may, therefore, have resulted in an over-prediction of roadside concentrations when compared to the concentrations that would have been predicted had 2017 been used for the model verification.

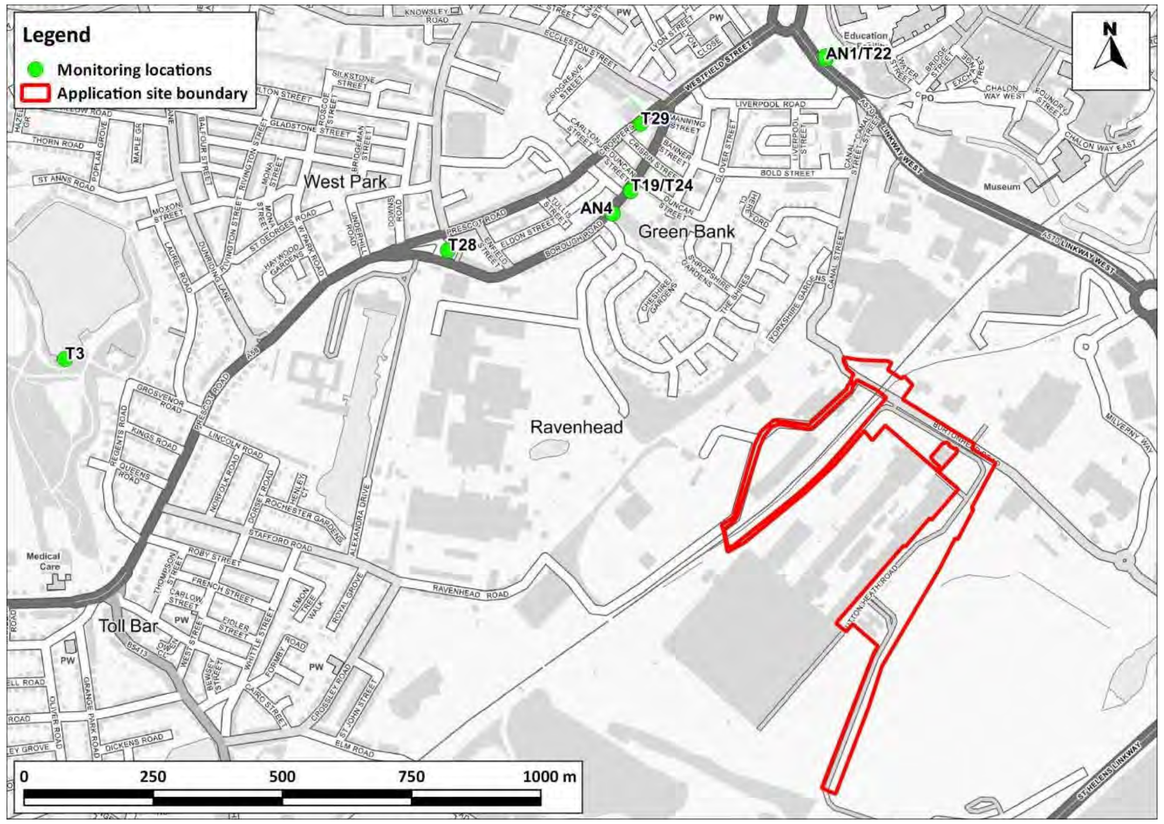

Figure 4.6 Monitoring locations

The Linkway automatic monitor also measures PM_{10} concentrations. Results for the years 2013 to 2017 are summarised in Table 4.10. Concentrations were below the objectives in every year for which data are presented, and appear to show a downward trend over the five years. No monitoring of $PM_{2.5}$ is undertaken in St. Helens.

Table 4.10 Summary of PM_{10} automatic monitoring (2013 – 2017)

Site No.	Site Type	Location	2013	2014	2015	2016	2017
PM_{10} Annual Mean (µg/m³)							
AN1	Roadside	Linkway	24	21	19	19	16
Objective			40				
PM_{10} No. of Days > 50 µg/m³							
AN1	Roadside	Linkway	2	5	8	3	0
Objective			18				

4.4.1.4 Exceedances of EU Limit Value

The Linkway monitor is part of Defra's AURN network that is used to report compliance with the EU limit values to the European Commission. Measurements from this site have shown no exceedances of the annual mean nitrogen dioxide limit value since 2013 (see Table 4.9). Defra's model of roadside annual mean nitrogen dioxide concentrations (Defra, 2017b), which is used to report exceedances of the limit value to the EU, and which has been updated to support the 2017 Air Quality Plan, did not identify any exceedances within the study area in 2015. Defra predicts that concentrations will fall into the future and, as such, there is considered to be no significant risk of a limit value exceedance in the vicinity of the application site by the time that it is operational.

4.4.1.5 Background Concentrations

Where necessary (i.e. where total concentrations have been calculated in the impact assessment), estimated baseline concentrations in the study area have been determined, all of which include a background component.

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 2023 (without development) (Table 4.11) using Defra's background maps (Defra, 2018b). 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 A4, ES Volume 3. The background concentrations are all well below the human health objectives.

Table 4.11 Estimated annual mean background concentrations across the study area in 2016 and 2023 (µg/m³)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2016	16.5 – 46.0	11.1 – 27.7	10.7 – 16.6	7.1 – 10.7
2023 [a]	11.9 – 32.3	8.2 – 20.1	10.3 – 16.4	6.7 – 10.4
2023 Worst-Case Sensitivity test [b]	*12.4 – 33.7*	*8.5 – 20.9*	*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 A4.
[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.

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. Table 4.12 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 4.12 Annual mean background pollutant concentrations taken from Defra's background maps (Defra, 2018b)

Pollutant	Maximum Background Concentration	EAL (μg/m³)
Sulphur Dioxide (SO_2)	10.5 μg/m³	N/A [a]
Carbon Monoxide (CO)	0.223 mg/m³	N/A [a]
Benzene	0.743 μg/m³	5
1,3-butatiene	0.182 μg/m³	2.25

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

Defra has undertaken monitoring of trace elements at a number of locations in the UK since 1976 as part of the UK Urban and Rural Heavy Metals Monitoring Network. Measurements from the Runcorn site have been used in this assessment, as this site is considered to be most representative of the area surrounding the application site, being located 13 km to the south. It should, however, be noted that this monitor is located to a number of heavy industrial sites in Runcorn, and would be expected to experience higher heavy metals concentrations than would St. Helens.

Measured annual mean concentrations of selected heavy metals are summarised in Table 4.13. These data have been downloaded from the Defra website (Defra, 2018b). All concentrations are below the EALs.

Table 4.13 Trace metal annual mean background concentrations in 2016 (ng/m³) [a]

Pollutant	Runcorn	EAL (ng/m_3)	% of EAL
As	0.62	3	20.7
Cd	0.09	5	1.80
Cr	1.6	5,000	0.0320
Co	0.19	1,000	0.0190
Pb	4.9	250	1.96
Mn	3.2	150	2.13
Ni	1.1	20	5.50
V	1.1	5,000	0.0220

[a] 1,000 ng = 1 μg

4.4.1.6 Baseline Dispersion Model Results

4.4.1.6.1.1.1 Human Health Receptors

Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the roadside receptor locations (see Figure 4.2). The results, which cover both the existing (2016) and future year (2023) baseline (without development), are set out in Table 4.14 and Table 4.15. 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 A4, ES Volume 3). 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 A4).

Table 4.14 Modelled annual mean baseline NO_2 concentrations at existing receptors in 2016 and 2023 (µg/m³)

Receptor	2016	2023 Without Development	
		'Official' Prediction [a]	*Worst-case Sensitivity Test* [b]
R1	26.2	19.1	*20.6*
R2	27.5	20.6	*22.1*
R3	26.3	19.8	*21.1*
R4	23.5	17.8	*18.8*
R5	24.4	18.4	19.5
R6	24.8	18.7	19.7
R7	31.5	22.2	23.7
R8	30.8	23.3	25.0
R9	26.9	20.9	22.3
R10	36.5	21.6	22.6
R11	47.2	33.0	35.6
R12	30.0	21.3	22.6
R13	40.6	28.4	30.4
R14	28.2	22.1	23.7
R15	30.7	22.4	23.7
Objective	40		

[a] In line with Defra's forecasts.
[b] Assuming higher emissions from modern diesel vehicles as described in Appendix A4.

Table 4.15 Modelled annual mean baseline concentrations of PM_{10} and $PM_{2.5}$ at existing receptors in 2016 and 2023 (μg/m³)

Receptor	PM_{10}		$PM_{2.5}$	
	2016	2023	2016	2023
R1	14.6	14.2	9.4	8.8
R2	14.4	14.0	9.2	8.7
R3	14.0	13.6	8.9	8.4
R4	13.1	12.7	8.4	7.9
R5	13.4	13.0	8.6	8.1
R6	13.5	13.1	8.6	8.1
R7	15.3	14.8	9.8	9.2
R8	14.6	14.1	9.5	8.8
R9	14.7	14.3	9.3	8.8
R10	16.6	14.1	10.7	8.9
R11	18.6	17.8	12.0	11.0
R12	14.9	14.3	9.6	9.0
R13	17.5	16.7	11.2	10.4
R14	16.0	15.5	10.4	9.8
R15	15.1	14.6	9.7	9.1
Objective / Criterion	32 [a]		25 [b]	

[a] While the annual mean PM_{10} objective is 40 μg/m³, 32 μg/m³ 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, 2018c). A value of 32 μg/m³ 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.

The predicted annual mean nitrogen dioxide concentrations exceed the objective in 2016 at receptors R11 and R13, but are below the objective at all other modelled receptors in this year. Annual mean nitrogen dioxide concentrations in 2023, the year the proposed development is anticipated to become operational, are below the objective at all receptors. The results from the upper-bound sensitivity test for nitrogen dioxide are not materially different from those derived using the 'official' predictions.

The predicted annual mean concentrations of PM_{10} and $PM_{2.5}$ are below the objectives at all receptors in both 2016 and 2023. The annual mean PM_{10} concentrations are below 32 μg/m³ and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

4.4.2 Summary of Baseline Conditions

St. Helens Council has declared two AQMAs within 500 m of the application site and there are a number of industrial facilities in the area immediately surrounding the proposed development. The annual mean nitrogen dioxide objective has been exceeded at the 55 Borough Road monitoring site in every year since 2012, and at the Linkway automatic monitor in 2013, but not in more recent years. Both of these sites are within the declared AQMAs. Baseline conditions outside the AQMAs are generally good with concentrations of all pollutants below the relevant assessment levels. There are no exceedances of the EU limit value within the study area, and the majority of the modelled baseline concentrations are below the objectives.

It is predicted that, by 2023 (the year the proposed development is anticipated to become operational), concentrations of all pollutants will be below the objectives throughout St. Helens.

4.5 Potential Significant Effects

The potential effects of the proposed development have been considered for the demolition and construction phase, and the operational phase.

4.5.1 Construction Phase

4.5.1.1 Construction Traffic Emissions

It is anticipated that the construction programme will last approximately 48 months. During that time, the areas adjacent to the application site will be used as temporary car parking and site office accommodation. Traffic generated by construction staff is anticipated to be approximately 260 vehicles arriving and departing during peak hours (amounting to approximately 520 vehicle movements per day). The temporary car park for construction staff will be provided on an adjacent site or on land to the north of Burtonhead Road, both of which would be accessed from Burtonhead Road. The daily heavy vehicle construction traffic to the application site is anticipated to peak at approximately 32 heavy duty vehicle (HDV - Heavy Goods Vehicles (HGVs) plus buses and coaches) movements per day.

Although the construction works will generate a large number of vehicle movements, these vehicles will access the application site via Burtonhead Road and the A570. The closest sensitive receptors to either of these roads are set back approximately 60 m from the A570 and are shielded from the road by a tree-covered embankment. It is, therefore, considered that the impacts of construction traffic emissions on these worst-case receptors will be ‘not significant’, and thus that there is no requirement for further assessment of construction traffic emissions.

4.5.1.2 Construction Dust

The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. Step 1 of the assessment procedure is to screen the need for a detailed assessment. There are receptors within the distances set out in the guidance (see Appendix A2, ES Volume 3), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

4.5.1.2.1 Potential Dust Emission Magnitude

4.5.1.2.1.1 Demolition

There will be a requirement to demolish the existing office buildings on the application site, with an approximate total volume of 3,525 m^3. Based on the example definitions set out in Table A2.1 in Appendix A2 (ES Volume 3), the dust emission class for demolition is considered to be *small.*

4.5.1.2.1.2 Earthworks

The characteristics of the soil at the development site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2018), as set out in Table 4.16. Overall, it is considered that, when dry, this soil has the potential to be highly dusty.

Table 4.16 Summary of soil characteristics

Category	Record
Soil Layer Thickness	Deep
Soil Parent Material Grain Size	Mixed (Argillaceous [a])
European Soil Bureau Description	Glacial Till
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Loam [b] to Clayey Loam

[a] grain size < 0.06 mm.
[b] loam is composed mostly of sand and silt.

The area of the application site to undergo earthworks is currently unknown, but the total area of the application site is approximately 68,000 m^2, and it has been assumed that most of this will be subject to earthworks. The earthworks will involve site clearance and breaking up of paved areas, and may involve some removal and movement of topsoil and subsoil. 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 A2.1 in Appendix A2, the dust emission class for earthworks is considered to be *large*.

4.5.1.2.1.3 Construction

Construction will involve seven concrete- and steel-built sections forming one building, with a total building volume of around 330,550 m^3. Hardcore and road surfacing materials will also be used. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials, and from the cutting of concrete. Piling will be used for the building foundations. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for construction is considered to be *large*.

4.5.1.2.1.4 Trackout

The number of heavy vehicles accessing the construction site, which may track out dust and dirt, will be a maximum of 16 inward and 16 outward heavy vehicle movements per day. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for trackout is considered to be *medium*.

Table 4.17 summarises the dust emission magnitude for the proposed development.

Table 4.17 Summary of dust emission magnitude

Source	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Large
Trackout	Medium

4.5.1.2.2 Sensitivity of the Area

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.

4.5.1.2.2.1 Sensitivity of the Area to Effects from Dust Soiling

The IAQM guidance explains that long-term car parks are 'high' sensitivity receptors to dust soiling, while places of work are 'medium' sensitivity receptors (Table A2.2 in Appendix A2, ES Volume 3). There are approximately four industrial and commercial places of work and one long-term car park within 20 m of the application site (see Figure 4.7). Using the matrix set out in Table A2.3 in Appendix A2, the area surrounding the onsite works is of 'medium' sensitivity to dust soiling.

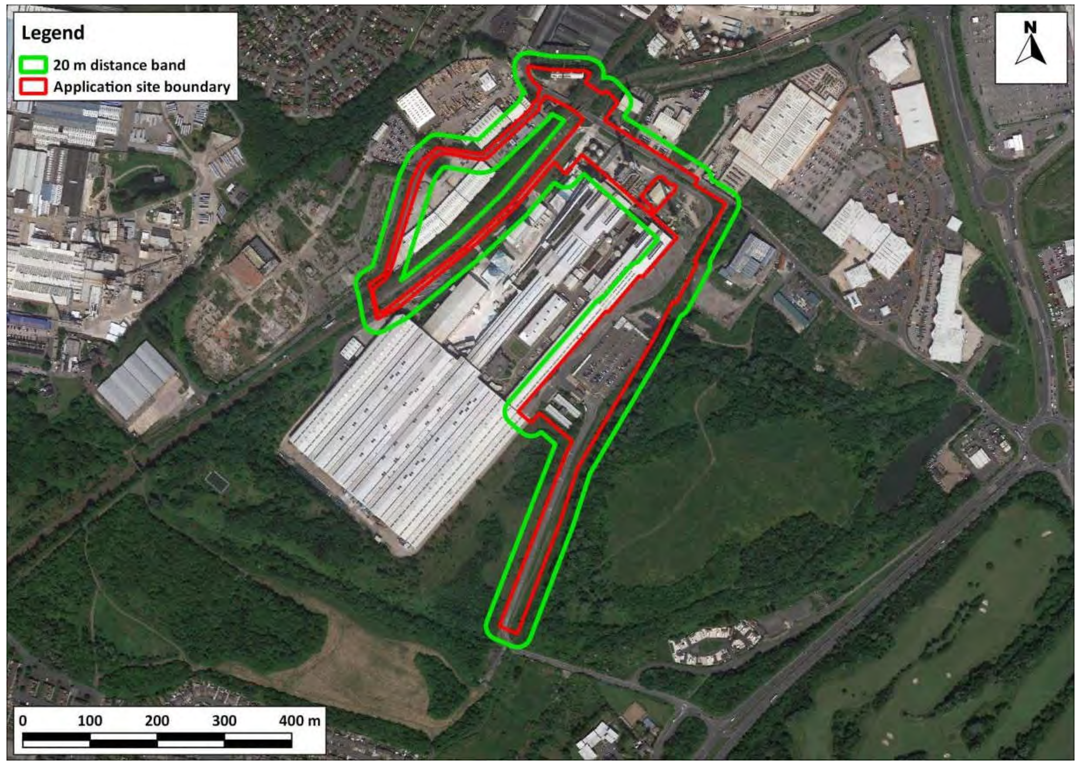

Figure 4.7 20 m distance band around site boundary

Table 4.17 shows that the dust emission magnitude for trackout is *medium* and Table A2.3 in Appendix A2 thus explains that there is a risk of material being tracked 200 m from the site exit. Construction vehicles will use the A570 St. Helens Linkway, Sutton Heath Road and the existing access serving the Greengate Works. There are no sensitive receptors within 20 m of the roads along which material could be tracked (see Figure 4.8), and Table A2.3 in Appendix A2 thus indicates that the area is not sensitive to dust soiling due to trackout.

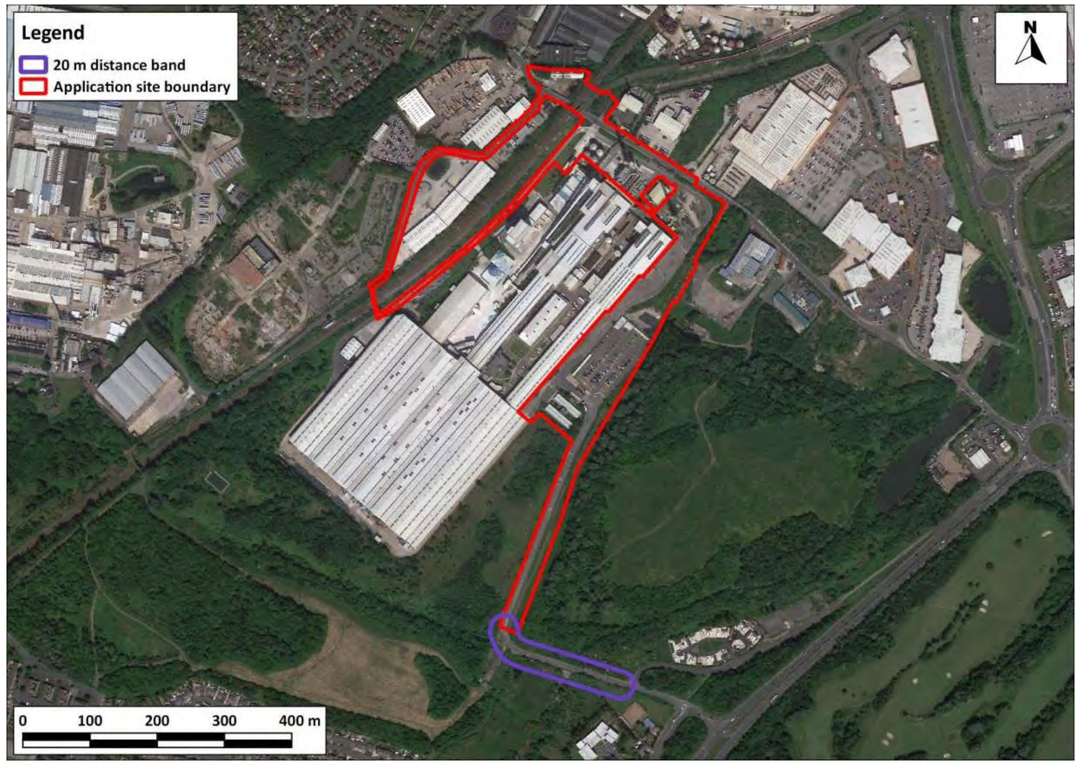

Figure 4.8 20 m distance band around roads used by construction traffic within 200 m of the site exit

4.5.1.2.2.2 Sensitivity of the Area to any Human Health Effects

Places of work are classed as being of 'medium' sensitivity to human health effects. The matrix in Table A2.4 in Appendix A2 requires information on the baseline annual mean PM_{10} concentration in the area. It is considered that the modelled baseline PM_{10} concentration at Receptor R4 in Table 4.15 best represents conditions near to the site. Using the matrix in Table A2.4 in Appendix A2, the area surrounding the onsite works is of 'low' sensitivity to human health effects while the area surrounding roads along which material may be tracked from the site is not sensitive to human health effects.

4.5.1.2.2.3 Sensitivity of the Area to any Ecological Effects

The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. As detailed in Chapter 7 (Ecology), 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.

4.5.1.2.2.4 Summary of the Area Sensitivity

Table 4.18 summarises the sensitivity of the area around the proposed construction works.

Table 4.18 Summary of the area sensitivity

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

4.5.1.3 Risk and Significance

The dust emission magnitudes in Table 4.17 have been combined with the sensitivities of the area in Table 4.18 using the matrix in Table A2.6 in Appendix A2 (ES Volume 3), 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 4.19. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 4.6 (step 3 of the assessment procedure).

Table 4.19 Summary of risk of impacts without mitigation

Source	Dust Soiling	Human Health	Ecology
Demolition	Low Risk	Negligible	N/A
Earthworks	Medium Risk	Low Risk	N/A
Construction	Medium Risk	Low Risk	N/A
Trackout	N/A	N/A	N/A

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

4.5.2 Operational Phase

4.5.2.1 Stack Emissions

4.5.2.1.1 Predicted Concentrations Relevant to Human Health

4.5.2.1.1.1 Screening of Maximum PCs

Table 4.20 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 (see Section 4.3.7.1).

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 not significant (see sections 4.3.6.2 to 4.3.6.4 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 that 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 in Section 4.5.2.1.1.3.

Table 4.20 Maximum predicted PCs in the study area (µg/m³) based on maximum emission rates [a]

Pollutant	Averaging Period	Maximum PC		EAL
		PC	% of EAL	
NO_2	Annual Mean	**1.35**	**3.4%**	40
	99.79th%ile of 1-hour Means	**25.4**	**12.7%**	200
SO_2	99.7th%ile of 1-hour Means	**35.8**	**10.2%**	350
	99.18th%ile of 24-hour Means	3.70	3.0%	125
	99.9th%ile of 15-minute Means	**39.8**	**15.0%**	266
PM_{10}	Annual Mean	0.0944	0.2%	40
	90.4th%ile of 24-hour Means	0.278	0.6%	50
$PM_{2.5}$	Annual Mean	0.0944	0.4%	25
CO	Rolling 8-hour Mean	0.0168	0.2%	10,000
HCl	Annual Mean	0.0964	0.5%	20
	Max Hourly Mean	16.6	2.2%	750
HF	Annual mean	0.00964	0.1%	16
	Max Hourly Mean	1.11	0.7%	160
VOCs (as benzene)	Annual Mean	**0.0964**	**1.9%**	5
VOCs (as 1,3-butadiene)	Annual Mean	**0.0964**	**4.3%**	2.25
Cd	Annual Mean	**0.000482**	**9.6%**	0.005
Tl	Annual Mean	0.000482	0.0%	1
	Max Hourly Mean	0.0103	0.0%	30
Hg	Annual Mean	0.000482	0.2%	0.25
	Max Hourly Mean	0.0103	0.1%	7.5
Sb	Annual Mean	0.00482	0.1%	5

Pollutant	Averaging Period	Maximum PC		EAL
		PC	% of EAL	
	Max Hourly Mean	0.103	0.1%	150
As	Annual Mean	**0.00482**	**160.6%**	0.003
Pb	Annual Mean	**0.00482**	**1.9%**	0.25
Cr III	Annual Mean	0.00482	0.1%	5
	Max Hourly Mean	0.103	0.1%	150
Cr VI	Annual Mean	**0.00482**	**2409.3%**	0.0002
	Max Hourly Mean	0.103	0.7%	15
Co	Annual Mean	0.00482	0.5%	1
	Max Hourly Mean	0.103	0.3%	30
Cu	Annual Mean	0.00482	0.0%	10
	Max Hourly Mean	0.103	0.1%	200
Mn	Annual Mean	**0.00482**	**3.2%**	0.15
	Max Hourly Mean	0.103	0.0%	1,500
Ni	Annual Mean	**0.00482**	**24.1%**	0.02
V	Annual Mean	0.00482	0.1%	5
	Max Hourly Mean	**0.103**	**10.3%**	1
NH_3	Annual Mean	0.0964	0.1%	180
	Max Hourly Mean	2.05	0.1%	2500
Dioxins and furans	Annual Mean	0.0000000010	0.3%	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.

4.5.2.1.1.2 Screening of Maximum PECs

For 1-hour and 15-minute mean sulphur dioxide, annual mean VOCs, cadmium, arsenic, lead, Chromium VI, manganese and nickel, and 1-hour mean vanadium, the PC in Table 4.20 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 4.12 and Table 4.13) to the PC, as shown in Table 4.21; it is considered appropriate to use background concentrations of these pollutants to represent baseline concentrations as Defra's published maps of background concentrations are representative of the local area and the concentrations of heavy metals measured at the Runcorn monitoring site are worst-case. Short-term emissions have been considered by comparing the PC to the short-term environmental standards minus twice the long-term background concentration, as recommended by the Environment Agency. The PCs for annual mean and short-term nitrogen dioxide concentrations also cannot be screened out at this stage, but these are considered separately in section 4.5.2.1.1.4.

Table 4.21 Maximum long-term and short-term PECs in the study area for pollutants where the PC exceeds the screening criteria (μg/m³) based on maximum emission rates [a]

Long-Term				
Pollutant	Averaging Period	Maximum PEC		EAL
		PEC	% of EAL	
VOCs (as benzene)	Annual Mean	0.840	16.8%	5
VOCs (as 1,3-butadiene)	Annual Mean	0.278	12.4%	2.25
Cd	Annual Mean	0.000567	11.3%	0.005
As [b]	Annual Mean	**0.00543**	**181.1%**	0.003
Pb [b]	Annual Mean	0.00968	3.9%	0.25
Cr VI [b]	Annual Mean	**0.00645**	**3226.6%**	0.0002
Mn [b]	Annual Mean	0.00799	5.3%	0.15
Ni [b]	Annual Mean	0.00589	29.5%	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	35.8	10.5%	340
	99.9th%ile of 15-minute Means	39.8	15.6%	256
V [b]	Max Hourly Mean	0.103	10.3%	0.998
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.

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

PC is less than 20% of the short-term environmental standard minus twice the long-term background concentration for all pollutants, and thus all short-term impacts can be discounted.

4.5.2.1.1.3 Further Assessment – Arsenic and Chromium VI

PECs of arsenic and chromium VI in Table 4.21 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 A4.2 and A4.3 in Appendix A4, ES Volume 3). The resulting PCs, using the more realistic emission rates recommended, are presented in Table 4.22, and then compared to the 1% screening criterion. The PC of Chromium VI is below the screening criterion, thus the impacts of the facility's emissions on this pollutant can be considered not significant.

Table 4.22 Maximum PCs of arsenic and chromium VI in the study area (µg/m³) based on realistic emission rates [a]

Pollutant	Averaging Period	Maximum PC		EAL
		PC	% of EAL	
As	Annual Mean	**0.00024**	**8.0%**	0.003
Cr VI	Annual Mean	0.000001	0.6%	0.0002

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

The PC of arsenic in Table 4.22 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 4.23.

Table 4.23 Maximum PEC of arsenic in the study area (µg/m³) based on realistic emission rates

Pollutant	Averaging Period	Maximum PEC		EAL
		PEC	% of EAL	
As	Annual Mean	0.001	28.5%	0.003

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

The impacts of the emissions from the proposed development have, therefore, been shown to be not significant for all pollutants other than nitrogen dioxide, which is addressed separately in Section 4.5.2.1.1.4 so that road traffic emissions, from which this is a key pollutant, are also taken into account.

4.5.2.1.1.4 Detailed Assessment – Nitrogen Dioxide

In considering the annual mean nitrogen dioxide concentrations, it is useful to see where impacts are greatest; a contour plot of the combined ground-level (1.5 m height) PCs from the stack and the diesel generator has been generated, and is shown in Figure 4.9. 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, orange and red areas).

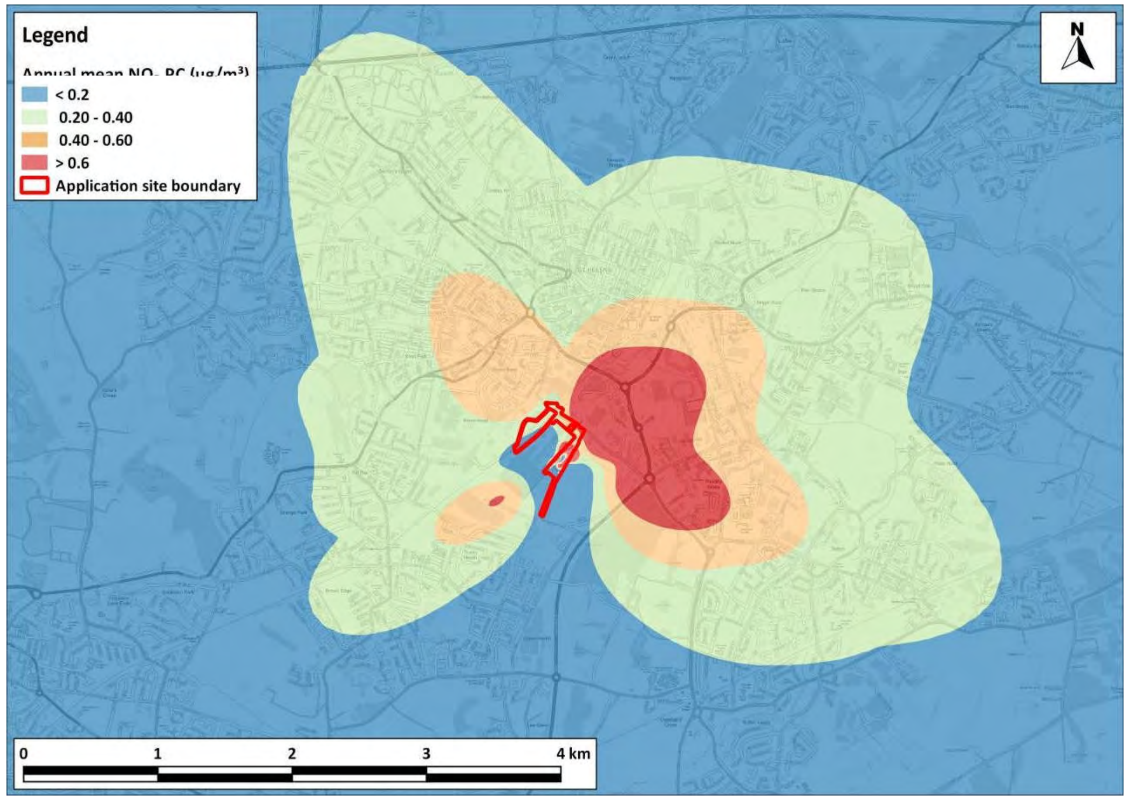

Figure 4.9 Stack and generator PC to annual mean nitrogen dioxide concentrations

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 nitrogen dioxide.

Table A5.1 from Appendix A5 (ES Volume 3) has been adapted so that it relates specifically to annual mean nitrogen dioxide impacts, and is shown in Table 4.24.

Table 4.24 Air quality impact descriptors for individual receptors for annual mean nitrogen dioxide (µg/m³)

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 - <4.2	>4.2
<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

Applying the PCs shown in Figure 4.9 to Table 4.24, it can be seen that where they 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, orange and red areas in Figure 4.9.

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 and orange in Figure 4.9), Table 4.24 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), the impacts would be negligible. St. Helens Council has declared two AQMAs within this area, thus the highest baseline concentrations are expected to be within these areas.

Road traffic modelling has been undertaken to determine the baseline concentrations close to sensitive receptors within the AQMAs in the planned opening year on 2023. A contour plot of the baseline nitrogen dioxide concentrations resulting from the combination of road traffic emissions and existing background concentrations at ground-level (1.5 m height) close to the declared AQMAs is shown in Figure 4.10. Figure 4.10 shows that the locations at which baseline concentrations exceed 37.2 µg/m^3 are not at or within the facades of residential properties; baseline concentrations are below 37.2 µg/m^3 at the sensitive locations representative of relevant exposure within the AQMA. As such, it can be concluded that the impacts of the emissions from the proposed development at sensitive locations in this area will be negligible.

Figure 4.10 Baseline annual mean nitrogen dioxide concentrations close to the declared AQMAs

For the area within which the PC as a result of the proposed development is between 0.6 µg/m^3 and 2.2 µg/m^3 (red in Figure 4.9), Table 4.24 shows that the impacts here will be negligible provided that total concentrations are below 30.2 µg/m^3. As such, if baseline concentrations in the area were below 28.9 µg/m^3 (30.2 µg/m^3 minus the maximum PC in this area of 1.35 µg/m^3), the impacts would be negligible. With the exception of the area around the Peasley Cross junction, there are no sensitive receptors in areas where the PC is greater than 0.6 µg/m^3. A contour plot of the baseline nitrogen dioxide concentrations close to the Peasley Cross junction is shown in Figure 4.11, and a contour plot of the PC from the stack and generator in the same area is shown in Figure 4.12. Figure 4.11 and Figure 4.12 show that, with the exception of the centre of the junction (at which the stack PC is below 0.6 µg/m^3), the baseline concentrations are all below 28.9 µg/m^3. As such, it can also be concluded that the impacts of the proposed development's emissions at sensitive locations representative of relevant exposure in this area will also be negligible.

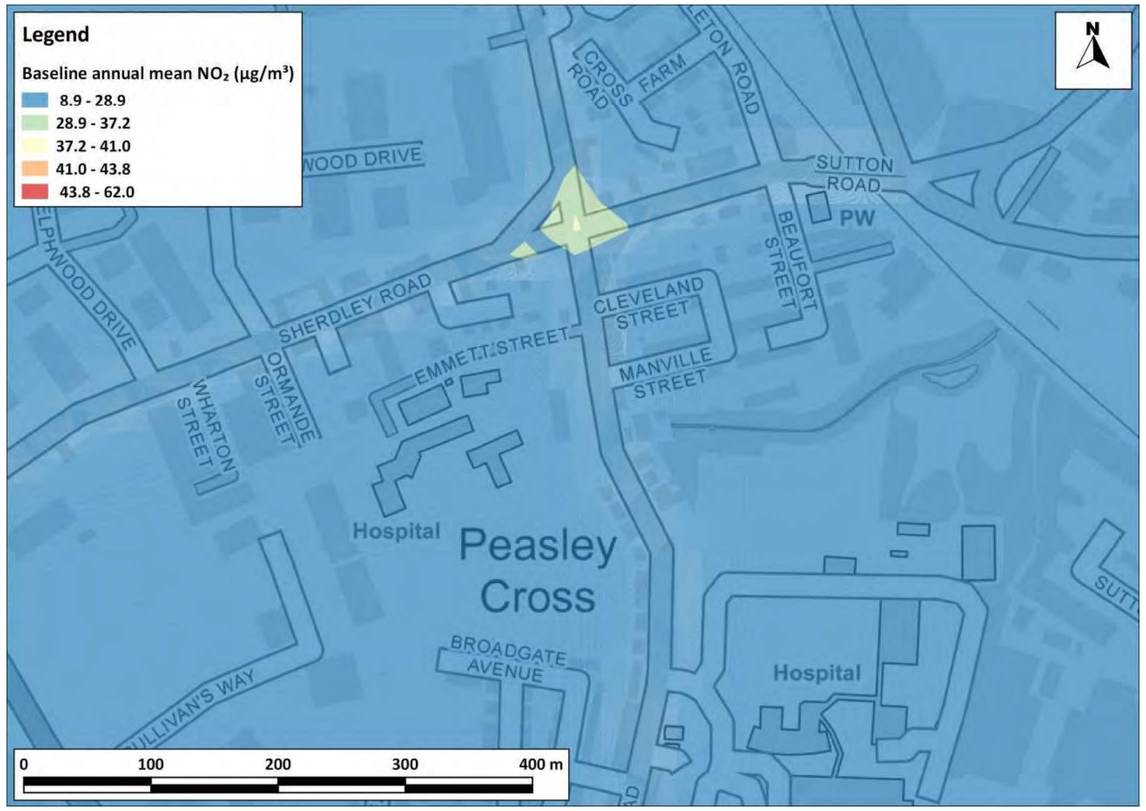

Figure 4.11 Baseline annual mean nitrogen dioxide concentrations in the Peasley Cross area

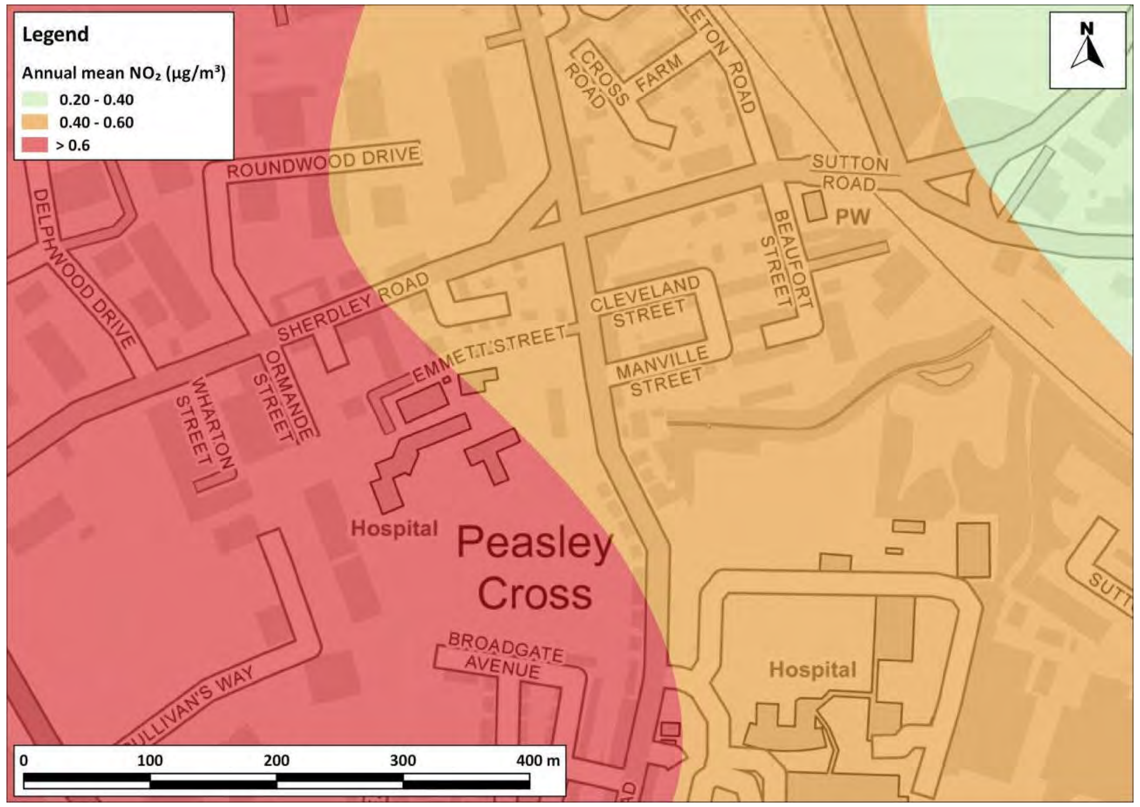

Figure 4.12 Stack and generator PC to annual mean nitrogen dioxide concentrations in the Peasley Cross area

4.5.2.1.2 Predicted Impacts on Designated Habitats

Table 4.25 sets out the maximum PCs to the relevant pollutant concentrations at the Thatto Heath LNR, and compares them to the Environment Agency's recommended screening criterion (see section 4.3.6.2). All of the PCs are below the screening criteria, thus ecological impacts can be discounted as 'not significant'.

Table 4.25 Maximum PCs in Thatto Heath LNR

Pollutant	Averaging Period	Maximum PC		EAL	Screening Criterion
		PC	% of EAL		
NH_3	Annual Mean	0.012	1.2%	1	100%
NOx	Annual Mean	0.24	0.8%	30	
	Max 24-hour Mean	9.14	12.2%	75	
SO_2	Annual Mean	0.06	0.3%	20	
HF	Max 24-hour Mean	0.046	0.9%	5	
	Max Weekly Mean	0.011	2.1%	0.5	
Nutrient Nitrogen Deposition [a]	Annual Mean	0.09	0.9%	10	
Acid Deposition [b]	Annual Mean	0.016	1.2%	1.298	

[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.

4.5.2.2 Diesel Generator Emissions

The maximum predicted PC from the testing of the diesel generator to annual mean nitrogen dioxide concentrations, in any of the meteorological years, is included in Figure 4.9. Section 4.5.2.1.1.4 shows that the annual mean impacts of the generator emissions, in combination with those from the main stack, will be 'not significant', with all individual impacts being negligible.

The short-term impacts from testing of the generator are complex to assess, given that the objective is based on the number of hours (18) that a threshold concentration (200 µg/m^3) can be exceeded in a year. The 1-hour mean nitrogen dioxide objective is often assessed by considering the 99.79th percentile of 1-hour concentrations, which represents the 19th highest hourly concentration from a full year of hourly values (a full year is 8,760 hours). In most cases, especially where specific operating hours are not defined, it is important to run the model for a full year of continuous operation, in order to capture the varied meteorological conditions that can occur throughout the year. However, when the operation of the plant is not continuous and annual operation is significantly lower than a full year this approach is too worst-case. Instead, an approach using hypergeometric distribution can be adopted that considers the number of hours of operation.

A hypergeometric distribution is a discrete probability distribution which can be used to determine the probability that the operation of a source for a limited number of hours in a year will cause an exceedance of a given threshold condition. In the case of the 1-hour mean nitrogen dioxide objective, the hypergeometric distribution is used to determine the probability that, from a set of mutually exclusive randomly selected hourly values from a full year's dataset (8,760 hours), there will be 19 hourly nitrogen dioxide concentrations which will exceed the threshold concentration of 200 µg/m^3. The probability is dependent on the number of proposed hours of operation, such that the lower the number of operating hours, the lower the probability that 19 or more of the randomly selected hours will exceed the threshold.

This approach can be used in reverse so that, when selecting a limited number of hourly values that corresponds to the number of hours of operation, there is a less than 5% chance that more than 18 of the selected hourly values exceed the 1-hour threshold. This is done by calculating the number of hourly values from a full dataset (8,760 hourly values) that can exceed the 1-hour threshold in order for there to be a less than 5% chance.

The number of hours that exceed the threshold in the full dataset can be used to calculate representative percentiles for the operational scenario. The calculated percentile is shown in Table 4.26.

Table 4.26 Maximum percentile for 25 hours of operation, which represents a less than 5% chance of the objective being exceeded

Proposed hours of operation (per annum)	Number of hourly concentrations from the full dataset that can exceed 200 µg/m^3, for a <5% probability of more than 18 hours > 200 µg/m^3 [a]	Percentile [b]
25	3,028	65.43th

[a] e.g. if the proposed hours of operation are 25, then the full dataset may contain 3,028 hourly concentrations >200 µg/m^3 to ensure that when 25 hourly values are randomly selected from the full dataset that there is a <5% chance that more than 18 of them will exceed 200 µg/m^3.

[b] this is the relevant percentile of 8,760 hourly concentrations to determine a <5% risk, i.e. for 25 hours of operation, the 65.34th percentile of 8,760 hourly concentrations will return the 3,028th highest value.

For example, assuming 25 operating hours, if fewer than 3,028 hours of a full year (8,760 hours) exceed 200 µg/m^3 then there is a <5% chance that of the 25 selected hourly values, more than 18 hours will exceed the limit.

The maximum predicted 65.34th percentile of hourly mean nitrogen dioxide PCs, from any of the five meteorological years considered, is shown in Figure 4.13. This shows that there are no sensitive receptors in the area within which there is a greater than 5% chance of the hourly mean PC exceeding 10% of the EAL (less than 20 µg/m^3). The short-term impacts of the generator emissions can, therefore, be screened out as not significant.

It is not possible to combine the short-term PCs from the generator with those from the main stack. However, the maximum short-term PCs from both the generator and the main stack occur in locations close to the proposed development, away from sensitive receptors. The combined effects are thus unlikely to have a significant effect at any sensitive receptor locations.

Figure 4.13 65.43th Percentile PC to hourly mean nitrogen dioxide concentrations

4.5.2.3 Road Traffic Emissions

The impact of nitrogen dioxide concentrations from the main stack has been shown in Section 4.5.2.1.1.4 to be negligible. The assessment in Section 4.5.2.1.1.4 does not, however, include the impacts of road traffic generated by the proposed development. In addition to the assessment above, impacts of nitrogen dioxide, PM_{10} and $PM_{2.5}$ emissions from road traffic have been assessed at properties close to major roads and close to roads on which traffic increases as a result of the proposed development will be greatest.

Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ in 2023 for existing receptors (see Figure 4.2 for receptor locations) are set out in Table 4.27 and Table 4.28 for both the 'without development' and 'with development' scenarios. These tables also describe the impacts at each receptor using the impact descriptors given in Appendix A5, ES Volume 3. Nitrogen dioxide concentrations are the sum of road, stack, diesel generator and background emissions, while PM_{10} and $PM_{2.5}$ concentrations are the sum of road, stack and background emissions. For nitrogen dioxide, results are presented for two scenarios so as to include a worst-case sensitivity test.

Table 4.27 Predicted impacts on annual mean nitrogen dioxide concentrations in 2023 (µg/m³)

Receptor	Without Scheme [a]	With Scheme [a]	% Change [a,b]	Impact Descriptor [a]	*Worst-Case Sensitivity Test* [c]			
					Without Scheme	*With Scheme*	*% Change* [b]	*Impact Descriptor*
R1	19.1	19.2	0	Negligible	*20.6*	*20.7*	*0*	*Negligible*
R2	20.6	20.8	0	Negligible	*22.1*	*22.2*	*0*	*Negligible*
R3	19.8	19.9	0	Negligible	*21.1*	*21.2*	*0*	*Negligible*
R4	17.8	18.0	0	Negligible	*18.8*	*18.9*	*0*	*Negligible*
R5	18.4	18.6	0	Negligible	*19.5*	*19.7*	*0*	*Negligible*
R6	18.7	18.9	1	Negligible	*19.7*	*20.0*	*1*	*Negligible*
R7	22.2	22.8	2	Negligible	*23.7*	*24.4*	*2*	*Negligible*
R8	23.3	23.8	1	Negligible	*25.0*	*25.5*	*1*	*Negligible*
R9	20.9	21.5	2	Negligible	*22.3*	*23.0*	*2*	*Negligible*
R10	21.6	22.2	1	Negligible	*22.6*	*23.2*	*1*	*Negligible*
R11	33.0	33.4	1	Negligible	*35.6*	*36.0*	*1*	*Negligible*
R12	21.3	21.8	1	Negligible	*22.6*	*23.0*	*1*	*Negligible*
R13	28.4	28.9	1	Negligible	*30.4*	*30.9*	*1*	*Negligible*
R14	22.1	22.5	1	Negligible	*23.7*	*24.1*	*1*	*Negligible*
R15	22.4	22.9	1	Negligible	*23.7*	*24.2*	*1*	*Negligible*
Objective	**40**		-	-	**40**		-	-

[a] In line with Defra's forecasts.
[b] % changes are relative to the objective and have been rounded to the nearest whole number.
[c] Assuming higher emissions from future diesel cars and vans as described in Appendix A4.

Table 4.28 Predicted impacts on annual mean PM_{10} and $PM_{2.5}$ concentrations in 2023 (μg/m³)

Receptor	Annual Mean PM_{10} (μg/m³)				Annual Mean $PM_{2.5}$ (μg/m³)			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
R1	14.2	14.5	1	Negligible	8.8	9.1	1	Negligible
R2	14.0	14.3	1	Negligible	8.7	9.0	1	Negligible
R3	13.6	13.9	1	Negligible	8.4	8.7	1	Negligible
R4	12.7	12.9	1	Negligible	7.9	8.1	1	Negligible
R5	13.0	13.2	1	Negligible	8.1	8.3	1	Negligible
R6	13.1	13.3	1	Negligible	8.1	8.3	1	Negligible
R7	14.8	15.2	1	Negligible	9.2	9.6	1	Negligible
R8	14.1	14.4	1	Negligible	8.8	9.1	1	Negligible
R9	14.3	14.6	1	Negligible	8.8	9.1	1	Negligible
R10	14.1	14.4	1	Negligible	8.9	9.2	1	Negligible
R11	17.8	18.0	1	Negligible	11.0	11.2	1	Negligible
R12	14.3	14.6	1	Negligible	9.0	9.3	1	Negligible
R13	16.7	17.0	1	Negligible	10.4	10.7	1	Negligible
R14	15.5	15.7	1	Negligible	9.8	10.0	1	Negligible
R15	14.6	14.9	1	Negligible	9.1	9.4	1	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 μg/m³, 32 μg/m³ 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, 2018c). A value of 32 μg/m³ 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.

4.5.2.3.1 Nitrogen Dioxide

The annual mean nitrogen dioxide concentrations are below the objective at all receptors.

The percentage changes in concentrations, relative to the air quality objective (when rounded), are predicted to be zero at five of the receptors, 1% at eight of the receptors and 2% at two of the receptors. Using the matrix in Table A5.1 (Appendix A5, ES Volume 3), these impacts are all described as *negligible.*

The annual mean nitrogen dioxide concentrations are below 60 µg/m^3 at every receptor; it is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded at any roadside locations.

4.5.2.3.1.1 Worst-Case Sensitivity Test

The results from the worst-case sensitivity test are not materially different from those derived using the 'official' predictions.

4.5.2.3.2 PM_{10} and $PM_{2.5}$

The annual mean PM_{10} and $PM_{2.5}$ concentrations are well below the relevant criteria at all receptors, with or without the proposed development. Furthermore, as the annual mean PM_{10} concentrations are below 32 µg/m^3, it is unlikely that the 24-hour mean PM_{10} objective will be exceeded at any of the receptors.

The percentage changes in both PM_{10} and $PM_{2.5}$ concentrations, relative to the applied annual mean criteria (when rounded), are predicted to be 1% at all of the receptors. Using the matrix in Table A5.1 (Appendix A5, ES Volume 3), these impacts are described as *negligible.*

4.5.2.4 Odour Risk Assessment

4.5.2.4.1 Process Description

The proposed development will see approximately 300,000 tonnes of waste fuel per year passed through the combustion process. This waste fuel will all be delivered by HGV, which will enter the tipping 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 within the tipping hall, where it will be stockpiled in a dedicated fuel bunker.

Overhead cranes will deliver waste from the fuel bunker to the moving grate combustion unit. The air from the portion of the building housing the tipping hall and fuel bunker will be extracted and primarily used in the combustion process.

Having been generated in the combustion process, the flue gas will enter a gas cleaning system. This will comprise 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, heavy metals and other pollutants. These residues will then be 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.

4.5.2.4.2 Source Odour Potential

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.

The proposed development will handle waste, which has the potential to produce highly intense and highly offensive odours. The plant will accept a mixture of Refuse Derived Fuel (RDF) and non-recyclable residual municipal, commercial and industrial waste. 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. As some organic matter, and thus odour-generating potential, will also be present, the feedstock for the plant remains a potentially significant odour source.

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 fuel may be at least a few weeks old, and could thus be quite odorous.

The feedstock for the plant is the only real source of odour, but there are three main ways in which these 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 tipping 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 combustion process. The final potential odour source is the flues in the main stack themselves, although the gases released here, at a height of 80 m, are not expected to be especially odorous, and will be released into a good environment for dispersion.

The portion of the building housing the tipping hall 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 to remove most of the odorous compounds from the air. Thus the only source of odorous air from these buildings will be the 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.

The main potential odour sources and overall source odour potential for the facility are described in Table 4.29.

Table 4.29 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 fuel feedstock to the facility and removal of bottom ash by HGV.	This will take place daily over a 12 hour period, with a total of 48 deliveries per day. This equates to a delivery every 15 minutes.	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 combustion 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 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 combustion 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 emissions.		

4.5.2.4.3 Pathway Effectiveness

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 areas in all directions, and are set out Table 4.6 and shown in Figure 4.3.

Individual wind roses from the Liverpool Airport meteorological station for the years 2012 to 2016 are presented in Appendix A3, ES Volume 3. These demonstrate that the prevailing wind in the region is from the north-west, south-west and south- east. 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.

The effectiveness of the odour pathway between the proposed development and the nearby sensitive receptors is summarised in Table 4.30, which draws upon the guidance set out in Table 4.3.

Table 4.30 Effectiveness of odour pathway

Receptor	Distance from Source (m) [a]	Downwind Direction [b]	% Winds from Source [c]	Pathway Effectiveness [d]
O1	500	240 – 250 °	7.0	Ineffective
O2	525	140 - 160 °	11.7	Moderately Effective
O3	1015	60 - 70 °	4.1	Ineffective
O4	435	260 - 280 °	12.0	Moderately Effective
O5	550	120 - 140 °	8.7	Ineffective
O6	805	80 - 90 °	4.6	Ineffective
O7	650	20 - 30 °	1.6	Ineffective
O8	420	330 - 350 °	5.1	Ineffective
O9	605	270 - 290 °	14.0	Moderately Effective

[a] Measured as the distance to either the tipping 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 would be 2.7% if averaged evenly 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.

Receptors O1, O3, O5, O6 and O7 are in directions where they will infrequently be downwind, and are more than 500 m from the source, thus the pathway to these receptors is deemed ineffective. Receptor O8 is closer to the source (420 m) but will be very infrequently downwind, thus the pathway to this receptor is also deemed ineffective. Receptors O2, O4 and O9 are somewhat local to the source (within around 600 m) and in directions where they will more frequently be downwind, thus the pathway to these receptors is deemed moderately effective.

4.5.2.4.4 Receptor Sensitivity

Receptor sensitivities are based on the descriptors presented in Table 4.3. As residential properties, receptors O2, O3, O5, O6, O7 and O8 would be considered high sensitivity receptors, while receptors O1, O4 and O9, as commercial properties, are medium sensitivity receptors.

4.5.2.4.5 Potential Odour Effects

The assessments of the potential odour effects at sensitive receptor locations are presented in Table 4.31. This brings together the source odour potential, effectiveness of pathway and receptor sensitivity identified using the criteria described in Table 4.3, to identify an overall potential for odour effects, using the matrices set out in Table 4.4 and Table 4.5.

Table 4.31 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	Ineffective	Negligible	Medium	Negligible
O2		Moderately Effective	Negligible	High	Negligible
O3		Ineffective	Negligible	High	Negligible
O4		Moderately Effective	Negligible	Medium	Negligible
O5		Ineffective	Negligible	High	Negligible
O6		Ineffective	Negligible	High	Negligible
O7		Ineffective	Negligible	High	Negligible
O8		Ineffective	Negligible	High	Negligible
O9		Moderately Effective	Negligible	Medium	Negligible

The potential odour effects as set out in Table 4.31 have been identified using the effect ≈ dose x response relationship identified in section 4.3.4.5. The process is described as follows:

1) Identify the impact:

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 4.4).

2) Consider the response:

Based on the matrix presented in Table 4.5, a negligible risk of odour impacts will lead to a negligible odour effect regardless of receptor sensitivity.

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 'not significant'. 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.

4.5.2.5 Human Health Risk Assessment

4.5.2.5.1 Cancer Risk

The total lifetime cancer risks associated with the proposed development are set out in Table A8.7 of Appendix A8, ES Volume 3. All risks are well below the assessment criterion and are conventionally considered to be acceptable in the UK.

4.5.2.5.2 Hazard Risk

The hazard quotient for each receptor is set out in Table A8.9 of Appendix A8, ES Volume 3. All of the values are less than 1 and the risk of significant health effects is thus discounted.

4.5.2.5.3 Oral Intake of all Congeners

The predicted oral intake of all congeners for the worst case receptors is set out in Table A8.11 of Appendix A8, ES Volume 3. The predicted intakes are well below 1% of the TDIs, thus the risk of significant health effects can be discounted.

4.5.2.5.4 Infant Exposure through Breast Milk

The estimated ADDs for infant exposure through breast milk at the worst-case receptors are set out in Table A8.12 of Appendix A8, ES Volume 3. All of the ADDs are less than 1% of the respective criteria and the impacts can thus be discounted as insignificant.

4.5.2.5.5 Concentrations in Soils

The maximum process contributions to dioxin and furan concentrations in soils at the worst-case receptors are set out in Table A8.13 of Appendix A8, ES Volume 3. The predicted concentrations are well below 1% of the SGV. The impacts can thus be discounted as not significant.

4.5.3 Cumulative Effects

4.5.3.1 Inter-Development

Table 4.32 provides a summary of the potential likely cumulative effects resulting from the proposed development and the cumulative schemes identified in Chapter 13 (Cumulative Effects).

Table 4.32 Inter-development cumulative effects

	Construction		Operation	
Cumulative Development	Cumulative effects likely?	Reason	Cumulative effects likely?	Reason
Second float line on Greengate site	No	Construction already complete.	No	Vehicle movements are already included in baseline traffic flows, thus have been assessed implicitly.
Land adjacent to former Little Lea Green Farm (up to 180 residential dwellings)	No	The cumulative development is sufficiently distant from the proposed development that the areas potentially affected do not overlap.	No	Vehicle movements are already included in baseline traffic flows, thus have been assessed implicitly. This cumulative development is located further from the proposed development that the worst-case receptors in this assessment, at which there are no significant impacts. There will thus be no significant impacts at the cumulative development either.
Linkway Distribution Park (up to 352 residential dwellings)	No	The cumulative development is sufficiently distant from the proposed development that the areas potentially affected do not overlap.	No	Vehicle movements are already included in baseline traffic flows, thus have been assessed implicitly. This cumulative development is located further from the proposed development that the worst-case receptors in this assessment, at which there are no significant impacts. There will thus be no significant impacts at the cumulative development either.

4.6 Mitigation and Monitoring Measures

4.6.1 Construction Phase

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

The application site has been identified as a *Medium* Risk site during earthworks and construction, and *Negligible* Risk during demolition, as set out in Table 4.19. Comprehensive guidance has been published by IAQM (2016) that describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on monitoring during demolition and construction (IAQM, 2012). This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A7, ES Volume 3.

An Outline Construction Environmental Management Plan (CEMP) is included in Appendix J, ES Volume 3. The mitigation measures outlined above, as well as in Appendices A7 and J, should be written into the detailed CEMP prepared by the Principal Contractor, 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.

4.6.2 Operational Phase

The proposed development already includes extensive mitigation by design, incorporating a highly sophisticated flue gas cleaning system and a minimum stack height of 80 m (determined as described in Section 4.3.4.1.7) to ensure good dispersion of emissions. The emissions will be managed and monitored by the Operator and regulated by the Environment Agency in line with the requirements of the Environmental Permit that will be secured for the proposed development. 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, emergency diesel generator and road traffic generated by the development, and nor will it have a significant effect in terms of odour emissions. As such, no additional mitigation is proposed for the operational impacts, as none is considered necessary.

4.7 Residual Effects

4.7.1 Construction Phase

The IAQM guidance is clear that, with appropriate mitigation in place, the residual effects will normally be 'not significant'. The mitigation measures set out in Section 4.6.1 and Appendix A7 (ES Volume 3) are based on the GLA guidance. With these measures in place and effectively implemented the residual effects are judged to be 'not significant'.

The IAQM guidance does, however, recognise 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. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be 'not significant'.

4.7.2 Operational Phase

The residual effects will be the same as those identified in Section 4.5.2. The overall effects of the proposed development will be 'not significant'.

4.8 Summary and Conclusions

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 emissions will be kept to a sufficiently low level that the local effects will be not significant. The assessment of the main stack, emergency diesel generator and road traffic emissions has demonstrated that the proposed development will result in a 'not significant' change in pollutant concentrations at all local sensitive receptor locations for all pollutants and all averaging periods. The HHRA has shown that all impacts of exposure to dioxins and furans associated with the proposed development will be 'not significant'.

The overall operational air quality impacts of the development are judged to be 'not significant'. A summary of significant effects is provided in Table 4.33.

Table 4.33 Summary of significant effects

Description of Effect	Mitigation Measures	Residual Effect	Risk / Type	Effect Significant?
Construction Phase				
Dust soiling	See Appendix A7 (ES Volume 3)	Occasional short-term dust annoyance	Low / short-term	No
Human health risk	See Appendix A7 (ES Volume 3)	None	N/a	No
Operational Phase				
Stack emissions	Mitigation included by design and an 80 m stack	None	N/a	No
Diesel generator emissions	None required	None	N/a	No
Road traffic emissions	None required	None	N/a	No

Odour emissions	None required – included by design	None	N/a	No
Exposure to dioxins and furans	Mitigation included by design and an 80 m stack	None	N/a	No

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