SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Environmental Risk Assessment

Prepared for: WTI EfW Holdings Limited

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BASIS OF REPORT

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1.0 Introduction

WTI EfW Holdings Limited has instructed SLR Consulting Limited (SLR) to prepare an Environmental Permit (EP) application for the proposed Skelton Grange Energy from Waste (EfW) Facility located at Skelton Grange near Leeds under the Environmental Permitting (England and Wales) Regulations 2016 (as amended). The facility will be operated by WTI UK Limited (WTI). Herein the facility will be referred to as 'the Site'.

1.1 Methodology

This Environmental Risk Assessment (ERA) is an assessment of the risks to the environment and to human health that may be associated with the proposed operations at the Site.

The assessment has been completed in accordance with the Environment Agency (EA) Technical Guidance *'Risk Assessments for your Environment Permit'* dated May 2018. The aim of the assessment is to identify any significant risks and demonstrate that the risk of pollution or harm will be acceptable by taking the appropriate measures to manage these risks.

This ERA uses the following approach for identifying and assessing the risks from the proposed operation:

Step 1 Identify risks and sources of risk from your activity.

Step 2 Where risks are identified from Step 1 then identify the receptors that could be affected

Step 3 Identify potential pathways between the sources of risk and receptors

Step 4 Assess the risks and check that they are acceptable. Justify appropriate measures to control your risks, if necessary.

Step 5 Submit your assessment.

Section 2.0 of this document is a screening step to identify the risks requiring consideration as part of this assessment.

Section 3.0 identifies people or parts of the environment that could be harmed (at potentially significant risk) by the activity. The ERA for an EP application requires all receptors that are near the Site and could reasonably be affected by the activities to be identified and considered as part of the assessment.

For the purposes of this ERA the following distances have been used to identify potentially sensitive receptors:

- A 10km radius from the site's EP boundary has been used to identify potentially sensitive receptors of European ecological importance including RAMSAR sites, Special Areas of Conservation (SAC) and Special Protection Areas (SPA);
- A 2km radius from the Site's EP boundary has been adopted in reviewing potentially sensitive receptors of ecological importance along with features such as sites of cultural and natural heritage. This include National Nature Reserves (NNR), Local Nature Reserves (LNR) and Sites of Special Scientific Interest (SSSI), in line with EA guidance.[1]
- A radius of 500m from the Site's EP boundary has been adopted for all other potentially sensitive receptors (for example, residential, commercial, industrial, agricultural and surface water receptors).

Section 4.0 of this document presents the assessment and demonstrates that any risks of pollution or harm will be mitigated to manage the risk.

This ERA should be read in conjunction with the following documents submitted with this EP application:

[1] EA Guidance: how to complete a location check in OPRA, draft document.

- Non-Technical Summary;
- Drawings
  - 001 Site Location Plan
  - 002 Environmental Permit Boundary & Site Layout
  - 003 Sources, Pathways and Receptors
  - 004 Cultural and natural Heritage
  - 005 Site Drainage

2.0 Identifying the Risks

Step 2 is a screening step to identify the potential risks to the environment from the development. The following are generally considered to require assessment for bespoke operations:

- Amenity and Accidents;
- Site Waste (Installations Only);
- Global Warming Potential;
- Odour;
- Noise; and
- Point source emissions to air, water and land.

The proposed EfW facility presents the potential for impacts on amenity, and as a result of potential accidents or incidents. An Accident and Amenity Risk Assessment (AARA) is therefore provided in this document.

The products of combustion are released as flue gas via two 90m tall stacks. The flue gas contains a number of pollutants which have the potential to cause impacts on human health and the environment. A detailed Air Emissions Risk Assessment (AERA) is provided in Appendix 2 to this document.

The site handles significant quantities of waste from municipal, commercial & industrial, sewage sludge and non-infectious clinical waste sources. A proportion of these waste streams is likely to include potentially odorous material and therefore a detailed odour management plan (OMP) is provided in Appendix ERA 3.

The site has the potential to cause noise impacts on nearby receptors and therefore a Noise Impact Assessment is presented in Appendix ERA 4 of this report.

The site produces significant quantities of waste residues, including Incinerator Bottom Ash (IBA) and Air Pollution Control Residues (APCR). A Solid Residue Management Plan is presented as Appendix ERA 5 to this document.

The activity results in emissions which may have a global warming impact, and these are assessed in the Global Warming Potential (GMP) Assessment in Appendix ERA 6 to this document.

There will be no point source emissions to groundwater, or land resulting from the proposed application. The site does not produce routine process effluent and any potentially contaminated surface water run-off from areas that handle, or store waste is collected and tankered off-site for treatment. Only uncontaminated clean surface water is discharged, via an attenuation pond, to surface water. Therefore, it is not considered that an assessment of emissions to surface water is required.

3.0 Site Setting and Receptors

3.1 Site Setting

The Site is situated in Skelton Grange, near Leeds within an area predominately occupied by commercial/industrial premises, sewage works, derelict ground and areas of woodland/open ground. The Site is accessed via Skelton Grange Road to the southwest. The National Grid Reference (NGR) for the Site is 433423, 431179.

The Site's location is illustrated on Drawing 001. The surrounding land uses and local receptors within 500m and 1km are shown in Drawing 003 and cultural and natural heritage receptors within 2km are illustrated on Drawing 004.

A summary of the Site's immediate surrounding land uses is identified in Table 3-1 below.

Table 3-1
Surrounding Land Uses

Boundary	Description
North	Mix of commercial/industrial premises and derelict land. Beyond is Knostrop sewage works facility.
East	The majority of the land to the east is derelict ground with woodland/open ground beyond.
South	Adjacent to the south of the Site is woodland/open ground, the River Aire and Aire & Calder Navigation, with predominately commercial/industrial premises beyond.
West	To the west of the Site is commercial/industrial premises, a recreational/educational facility and areas of woodland/open ground.

The immediate surrounding land uses are described in further detail below.

3.1.1 Commercial and Industrial Premises

Adjacent to the west of the Site's boundary is Skelton Grange substation. Approximately 130m to the south of the Site beyond the River Aire is Haigh Park Road Industrial estate with the closest properties including Parcelforce Worldwide and Northern Containers.

The majority of the surrounding land to the north is occupied by Knostrop sewage works facility, approximately 150m from the Site's boundary.

3.1.2 Educational/Recreational Facilities

To the west of the Site's boundary, approximately 120m is the TCV Skelton Grange Environment Centre facility and approximately 350m is the Thwaite Mills Watermill Museum.

3.1.3 Surface Water Features

Approximately 50m to the south of the Site's boundary is the River Aire. The River Aire is a designated brown trout and European eel migratory route. Beyond the River Aire is the Aire and Calder Navigation located approximately 100m to the south. Three small surface water features are located to the east, approximately 350m and southeast, approximately 400m from the Site's boundary.

3.1.4 Areas of Woodland/Open Ground

Small areas of woodland/open ground are located to the southeast and west of the Site's Boundary. The closest area of woodland/open ground is adjacent to the south of the Site's boundary.

3.1.5 Local road network

The Site will be accessed from Skelton Grange Road. A local road network surrounds the Site in all directions.

3.1.6 Derelict land

The adjacent land to the north and east of the Site's boundary is derelict ground.

3.2 Geology

A review of the British Geological Survey (BGS) map[2] reveals that the Site is underlain by a bedrock of Pennine Lower Coal Measures Formation (Mudstone, siltstone and sandstone). The bedrock is indicative of an area previously dominated by swamps, estuaries and deltas. There are no superficial deposits recorded for the Site.

3.3 Hydrogeology

3.3.1 Aquifer Designations

The bedrock underlying the Site is classified as a Secondary A Aquifer on the Multi-Agency Information for the Countryside (MAGIC)[3] website.

The Groundwater Vulnerability layer on the MAGIC map reveals that the Site lies within an area known for groundwater vulnerability classified as a Minor Aquifer high.

3.3.2 Source Protection Zones

The Site is not located within a Source Protection Zone (SPZ) or within the vicinity of one.

3.3.3 Groundwater Abstraction

There are no groundwater abstractions located within 500m of the Site's boundary.

3.4 Hydrology

The Site lies within Flood Zone 1 and 2; therefore, the Site has a low/medium probability of flooding[4].

3.5 Ecology

3.5.1 European/International Sites

The MAGIC website has been accessed to determine the presence of any European or Internationally designated sites within a 10km radius from the site's EP boundary. This search confirmed that there are none of the following within 10km of the Site's Boundary:

- RAMSAR sites;
- Special Area of Conservation (SAC); and

[2] British Geological Survey, Available at www.bgs.ac.uk, accessed in June 2019.
[3] Multi-Agency Information for the Countryside – Available at: http://www.magic.gov.uk, accessed June 2019.
[4] Flood Map for Planning https://flood-map-for-planning.service.gov.uk, accessed June 2019

- Special Protection Area's (SPA).

3.5.2 Nationally Designated Sites

The following sites with a national designation for ecology have been identified within a 2km radius from the boundary of the site according to the Nature & Heritage Screen provided by the EA (See Appendix ERA1):

- Halton Moor is designated as a Local Nature Reserve (LNR) and Local Wildlife Site (LWS) and is located approximately 1.3km north of the Site. Halton Moor is the southernmost nature reserve in the Wyke Beck Valley. It is an LNR for its species rich grassland, deciduous woodland and scrub.
- Temple Newsam Estate Wood is designated as a LWS and is located approximately 900m to the northeast of the Site.

The searches confirmed that there are none of the following within 2km of the Site's boundary:

- Site of Special Scientific Interest (SSSI);
- National Nature Reserves;
- Ancient Woodland;
- Areas of Natural Beauty; and
- National Parks.

3.5.3 Protected Species

The Nature and Heritage Conservation Screen conducted by the EA identifies the presence of the following protected species within 500m of the site boundary:

- Brown Trout & European Eel migratory route within the River Aire, 50m to the south of the site boundary.

3.6 Cultural and Heritage

3.6.1 Registered Parks and Gardens

There is one registered park and garden within 2km of the Site's boundary. Temple Newsam is located approximately 900m to the northeast of the Site. Temple Newsam Estate Wood located within the Temple Newsam registered park and garden is a designated LWS.

3.6.2 Listed Buildings

There are six Grade II listed buildings located approximately 400m to the west of the Site's boundary, all six of the listed buildings are in association with Thwaite Mill:

- Thwaite House;
- Thwaite Mill;
- Warehouse, office and drying floor (southeast of Thwaite Mill);
- Bridge over mill stream (east of Thwaite Mill);
- Machine Stop (east of Thwaite Mill); and
- Stable (east of Thwaite Mill).

A further 8 Grade II listed buildings are located approximately 1.8km to the southwest of the Site's boundary:

- Memorial in Hunslet Cemetery;

- Hunslet Cemetery Chapels;
- Lodges, gate piers, gates and walls to Hunslet Cemetery;
- Scotts Almshouses and associated buildings;
- Scotts Almshouses, boundary wall with gate piers; and
- Bust of John Scott, Scotts Almshouses.

The search on MAGIC confirmed that the following features do not lie within 2km of the Site's boundary:

- World Heritage Sites;
- Scheduled monuments; and
- Registered Battlefields.

3.7 Identified Receptors

Table 3-2 and Drawing 003/004 identify the receptors which are considered to be potentially sensitive and could reasonably be affected by activities at the Site.

Table 3-2
Identified Receptors

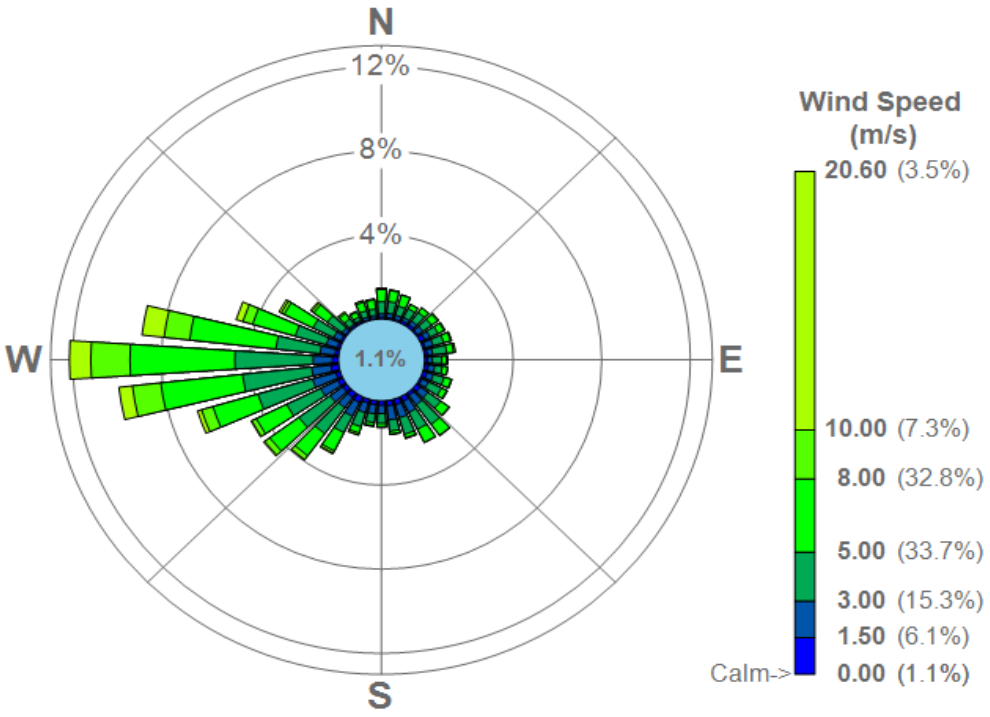
Receptor Name	Receptor Type	Direction from Site	Approximate Distance from Site Boundary at closest point (in metres)
Local receptors located within 500m of the EP boundary as shown on Drawing 003			
Skelton Grange Substation	Commercial/industrial premises	West	Adjacent
Woodland/open ground	Woodland/open ground	South, southeast and west	Adjacent to the south
Derelict land	Derelict land	North and east	Adjacent
River Aire	River and protected species migratory route	South	50
TCV Skelton Grange Environment Centre	Recreational facility	West	120
Haigh Park Road Industrial Estate	Commercial/industrial premises	South	130
Knostrop Sewage Works facility	Commercial/industrial premises	North	150
Thwaite Mills Watermill Museum	Recreational facility	West	350
Surface water feature	Surface water feature	East	350
Surface water feature	Surface water feature	Southeast	400

Receptor Name	Receptor Type	Direction from Site	Approximate Distance from Site Boundary at closest point (in metres)
Ecology and Cultural and Natural Heritage identified within 2km of the EP boundary as shown on Drawing 004			
Thwaite Mill and associated buildings	Grade II listed buildings	West	400
Temple Newsam	Registered Park and Garden and LWS	Northeast	900
Halton Moor	LNR and LWS	North	1300
Hunslet Cemetery and associated buildings and Scotts Almshouses and associated buildings	Grade II listed buildings	Southwest	1800

3.8 Windrose

Figure 3-1 shows the wind patterns in 2017 as identified by the Leeds Bradford meteorological station. The most prominent wind direction is from the west to the east with winds from all other directions being relatively infrequent.

Figure 3-1
Leeds Bradford Meteorological Station, 2017



4.0 Environmental Risk Assessment

4.1 Amenity & Accidents Risk Assessment

The following tables in this section assess the Site in terms of potential hazards posed to amenity and by accidents, the associated receptors and pathways, along with measures to manage the identified risks.

The probability of exposure is the likelihood of the receptors being exposed to the hazard, and is defined as low, medium or high. These terms are qualified as follows;

- Low: exposure is unlikely, barriers in place to mitigate against exposure.
- Medium: exposure is fairly probable, barriers to exposure less controllable.
- High: exposure is probable, direct exposure likely with few barriers.

The methodology outline in Section 1.1 of this report is the basis on which it is determined whether the proposed operations will lead to significant impacts on the surrounding environment. Where a conclusion of 'not significant' has been reached, it is proposed that the mitigation and management measures that will be in place at the Site will be sufficient to ensure that there will be no impact at the surrounding environment.

Table 4-1 Odour Risk Assessment and Management Plan

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Odour from non-hazardous non-biodegradable waste deposited in the tipping bays and waste bunker.	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	All products accepted on Site are subject to strict acceptance procedures and loading/off-loading procedures. The Site will be monitored for odours by Site personnel throughout each shift. If odours are detected, investigations will be undertaken to determine the cause and appropriate mitigation measures implemented. The tipping bays and bunker is located inside the processing facility reducing the potential for odour to travel to receptors in close proximity. Waste bunker management procedures will be in place to ensure that if necessary, waste will be mixed and old waste is processed first to avoid the development of anaerobic conditions developing within the waste. Operational hours are 24 hours so waste will be stored in the waste bunker for a minimal amount of time before it is processed.	Low	Odour Nuisance	**Not significant due to the nature of the products and management procedures in place**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			The dominant wind direction is from the west to east which is in the direction of derelict land and Knostrop sewage works. Full details of odour management on Site is detailed within the Odour Management Plan (OMP) enclosed as appendix ERA3. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			

Table 4-2 Noise Risk Assessment and Management Plan

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Vehicle movements: - Waste delivery to the waste bunker/tipping areas - Removal of IBA Bunker crane movements (loading waste into hoppers) - Fuel reception hall - Waste bunker - Boiler house - Flue gas hall - Turbine hall	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	The Site is located within an area dominated by areas of open ground and industrial/ commercial premises. No residential properties are located within 500m of the Site's boundary. All waste will be delivered to the waste tipping/bunker areas which will be located to the north of the Site, therefore adjacent to derelict land and a sewage works facility. Speed limits will be implemented for vehicles using the Site and traffic calming measures will be implemented to enforce speed limits. Site access and operational areas will be maintained and repaired to minimise emissions of noise due to uneven and poor surfacing. If horns or alarms are deemed to cause unacceptably high levels of noise, alternative technologies will be explored and implemented.	Low	Nuisance during operational hours.	**Not significant**

			Plant will be selected & operated to minimise noise. If deemed necessary, plant will be fitted with noise silencers. All Site plant and machinery will be operated and maintained in accordance with manufacturer's specifications and through a programme of planned preventative maintenance. Auditory inspections will be carried out daily and in response to complaints. If noise levels are deemed a nuisance a full investigation will be carried out and mitigation measures implemented when appropriate. The dominant wind direction is from the west to east which is in the direction of derelict land and Knostrop sewage works, therefore no risk to ecological receptors or human health. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			

Table 4-3 Fugitive Risk Assessment and Management Plan

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
To Air:						
Dust from: - Vehicle movement - Waste handling operations - Removal of IBA Potential release of pollutants (PM10, NOx etc) from traffic. FGT / APCR containment failure	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	A speed limit will be implemented on Site and traffic calming measures to minimise the mobilisation of dust particles from traffic movements. All vehicles/mobile plant will be subject to a programme of planned preventative maintenance and maintained in accordance with the manufacturer's recommendations. Site surfacing will be maintained in good condition to minimise the mobilisation of dust particles. Site operatives will carry out ongoing visual monitoring throughout working day to identify unacceptable dust levels. The Site will be subject to periodic clean downs to minimise the build-up of dusty particles.	Low	Dust nuisance	**Not Significant**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			Visual monitoring will be carried out by all members of the staff throughout their shift and any potential emissions of dust reported to the Site Manager. If dust becomes an issue, or complaints are received, an investigation to establish the cause will be undertaken and action taken accordingly to mitigate the issue. The bottom ash will be quenched and directed to a covered storage area within the facility before being exported offsite. Measures in place to avoid failures of the facilities FGT system include: - Low level reagent alarms fitted to the reagent storage silos; - Programme of preventative maintenance; and - Regular filter bag changes. The dominant wind direction is from the west to east which is in the direction of derelict land and Knostrop sewage works, therefore no risk to ecological receptors or human health.			

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			Refer to the Air Emissions Risk Assessment included as appendix ERA2. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			
To Water						
Runoff from site surfaces - Car park - Access roads - Internal – waste bunker Waste water from quenching of ash and boiler water during routine maintenance.	Surface water and groundwater Receptors as identified in Table 3-2. See Drawing 003 and 004.	Land and surface water	The closest surface water feature is the River Aire which is located approximately 50m south of the Site and beyond is the Aire and Calder Navigation. The following mitigation measures will be implemented to reduce the risk of surface water run-off: - SuDs techniques will be developed and used; - All surfaces will be impermeable, reducing the risk of surface water contamination; - Attenuation pond All of the Site's surfaces (internal and external) and drainage system will be subject to routine inspection to ensure full integrity and to identify where maintenance may be required.	Low – due to preventative management measures in place.	Contamination of surrounding land and water (surface and groundwater)	**Not significant**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			The IBA bunker will be located inside the facility, the conveyors and silos will also be enclosed. Only clear surface water with agreed parameters with the EA will be discharged to the River Aire. With the additional mitigation measures in place it is anticipated that the discharge will have no impact on the water quality and ecological features and therefore the eel and brown trout migratory route will not be impacted. A separate drainage system for waste handling areas and water produced during routine maintenance will be in place in case run-off from these areas is potentially contaminated. Run-off will be collected in and tankered off site. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Percolation of contaminated run-off through site surfaces	Surface water and surrounding land	Land / water	The site benefits from impermeable concrete surfacing to prevent direct percolation to the underlying ground. All processing of waste takes place within an enclosed building. No waste is stored other than in designated bunkers or silos. Fully engineered surface water drainage systems collect run-off and direct this to either the attenuation pond (clean SW from non-waste handling areas) or to be tankered off site (SW from areas where waste is handled/process water produced during planned maintenance).			

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Pests						
Birds, vermin and pests	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Land and Air	The storage of waste within the waste bunker will be maintained in line with the waste bunker management procedures to ensure older waste is processed first and waste is mixed if necessary, to minimise the likelihood of anaerobic conditions developing and potential odours. The waste bunker is located inside the processing facility. Strict waste procedures will limit the amount of waste and storage times to reduce the risk of pest infestations. Daily visual inspections of the site will be conducted to identify any potential causes of infestations and mitigation measures will be implemented where necessary.	Low	Nuisance to human and commercial receptors	**Not Significant**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			In the unlikely event that birds, vermin or pests are identified on Site, a specialist pest control contractor will be employed to undertake measures to remove the animals from the Site. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			
Mud/Litter						
Mud from vehicle movements.	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Land	Site surfacing will be maintained in good condition to minimise the transfer of mud from the Site. The Site will benefit from good housekeeping and all areas of the Site will be cleaned regularly. Daily visual inspection of the Site by Site Management will identify any problem associated with mud and debris which will be cleaned up as soon as possible. Where necessary road cleaning equipment will be deployed. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.	low	Mud on road, road safety	**Not significant**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Litter from waste handling operations. Waste may escape from the waste tipping/bunker area.	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	Waste management procedures will be followed and implemented. The waste will be deposited within the waste bunker which will benefit from impermeable surfacing and the doors to the waste bunker will be kept closed when not in use. Waste will be brought to Site in enclosed refuse collection vehicles and bulk loaders. Any vehicles that are not enclosed will be sheeted/netted to ensure no escape of waste materials during transit. Bins will be provided on Site around welfare areas for the use of Site visitors and personnel. The Site and its immediate surrounding will be inspected daily, and action will be taken to maintain the area free of significant accumulations of litter and debris. Any excessive litter material at the Site or on the highways will be cleared using a mechanical sweeper and/or litter picker if required.	Low	Nuisance from litter	**Not significant**

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
			Fast shutting doors will assist in the prevention of litter escaping the buildings. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			

Table 4-4 Accidents Risk Assessment and Management Plan

What do you do that can harm and what could be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Consequence**	**What is the overall risk**
What has the potential to cause harm?	What is at risk what do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? – Who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence
Unauthorised waste receipt and processing	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air and overland to sewers, surface and groundwater,	Only waste authorised by the permit will be accepted on Site. Upon delivery, waste will be subject to strict waste acceptance procedures to identify, reject and/or segregate potentially non-conforming wastes. All waste will be subject to inspection and checking against the declaration on the waste transfer note. In the event that unauthorised waste is accepted at the Site, the waste will be segregated and will be stored in a designated quarantine/isolation area prior to export from Site. The Site Manager will be responsible for implementing risk management measures to prevent the acceptance of unauthorised wastes.	low	Odour nuisance Water contamination	**Not significant**
Spillage and Leakage from various chemicals/fuels.	Local land quality, surface water and groundwater	Runoff and percolation through ground	Tanks containing potentially polluting liquids will be constructed so that any leaks/spillage will be contained. They will also be surrounded by a leakage containment bund capable of containing at least 110% of the volume of the largest tank.	Medium	Contamination of land, groundwater and surface water	**Not significant**

	Receptors as identified in Table 3-2. See Drawing 003 and 004.		Spill kits will be positioned around Site in suitable locations. All internal surfaces will be impermeable with sealed drainage to retain any internal spillages. Should the spill reach external areas, the surface water management system will be provided with cut off valves to isolate the system in the event of a spill and prevent discharge to surface water. All oils/greases/chemicals stored on Site will be in dedicated storage with suitable segregation measures in place. Site staff will undertake daily monitoring for evidence of spillage and leakage. In the event of a major spillage immediate action will be taken to contain the spillage and prevent liquid from entering surface water drains. The spillage will be cleared immediately and placed in containers for off-site disposal and the EA will be notified. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			
Fire	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air (smoke) Ground (spillages and firewater)	To prevent and minimise the potential impact of fire within the proposed facility, a Fire Prevention Plan (FPP) will be in place. Measures include; - Fire detection measures; - Fire suppression measures; - Firefighting equipment (extinguishers)	Low	Harm and nuisance	**Not significant – due to the comprehensive mitigation and management methods outlined in the EMS emergency**

			- Training of staff in prevention and fire management; - Preventative maintenance on electrical systems; - Waste acceptance, segregation and handling procedures; - Other measures as described in the FPP. The Site will be managed in accordance with the Site's EMS emergency preparedness and response plan and following procedures detailed in the Site's Fire Prevention Plan.			**preparedness and response plan and Fire Prevention Plan.**
Vandalism and Security	Harm to Human Receptors, Ecological Receptors, Commercial/industrial receptors, Land and Water Receptors as identified in Table 3-2. See Drawing 003 and 004.	Land and air.	The Site will benefit from the presence of staff 24 hours a day 7 days a week, due to the continuous operations. Security on Site will include: • Fencing surrounding the entirety of the Site; • Lockable entrance gates; • Lockable doors to all buildings on Site; and • CCTV (internally and externally). Security infrastructure will be inspected daily by the operations staff to identify deterioration and the need for any repairs. In the event that damage is identified, unauthorised access will be prevented, and temporary repairs will be made within 24 hours. Permanent repairs will be made as soon as practicable.	low	Theft, harm to human health.	**Not significant**

			All visitors to the Site will be required to register in the visitor's book and sign out again on exit. This minimises the risk of unauthorised visitors being present at the Site. The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			
Flooding	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Flood waters over land	The Site lies within flood zone 1 and 2 and therefore has a low/medium probability of flooding. The following mitigation measures will be implemented to control and manage surface water: - SuDs techniques will be developed and used; - All surfaces will be impermeable, reducing the risk of surface water contamination; - Attenuation pond. The Site Manager will be responsible for implementing any required risk management measures in conjunction with the Operating Techniques.	Very Low	Contaminated flood waters impacting land in residential, ecological and commercial areas	**Not significant**
Plant Failure	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	All equipment will be subject to pre-planned preventative maintenance checks and maintained to manufactures recommendations. Should any problems, malfunctions or breakdowns occur, which affects the ability to safely process waste, waste acceptance and treatment will stop until the problem is rectified.	Low	Nuisance	**Not significant**

			The EfW facility employs primary and secondary pollution control techniques which are designed to ensure that emissions comply with the limit values (BAT-AELs) for significant pollutants as specified in the Waste Incineration Bref (December 2018). The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques.			
Explosion Explosive mixture of methane	Receptors as identified in Table 3-2. See Drawing 003 and 004.	Air	All electrical equipment will be subject to inspections and marked appropriately to conform with applicable regulations and legislation. 'Flammable gas' and 'No Smoking' signs will be erected, as appropriate. The site will operate a permit to work system and any 'hot works' will only be permitted if the atmosphere is free from explosive gases. An assessment to comply with the Dangerous substances and Explosive Atmosphere's Regulations 2002 (DSEAR) will be carried out at the design stage and a zoning study will be undertaken. All electrical and mechanical equipment located in zoned areas will be complaint with DSEAR regulations (as required). The Site Manager will be responsible for implementing risk management measures in conjunction with the Operating Techniques and health and safety procedures.	Low	Air pollution Contaminated land	**Not significant**
Asphyxiation and toxicity	Site personnel	Air	The Site will operate a permit to work system to ensure entry into confined space is controlled and	low	low	**Not significant**

			appropriate inspections, monitoring and other safety measures as appropriate are carried out prior to entry into enclosed spaces. Employee training will ensure awareness of risks associated with working alongside biogas and working practices are implemented. The Site Manager will be responsible for implementing the training and permit to work system.			

4.2 Air Emissions Risk Assessment

An Air Emissions Risk Assessment (AERA) has been carried out to determine the potential effect of emissions from the proposed EfW on the air quality environment by comparison to relevant guidelines for the protection of human health and the environment. The risk assessment has been undertaken on 'worst case' assumptions and includes assessment under abnormal operating conditions, cumulative impacts with other large emitters in the vicinity and a sensitivity analysis.

The conclusions of the detailed atmospheric dispersion modelling assessment of the emissions from the EfW facility are as follows:

- There are no predicted exceedances of short-term or long-term standards at the point of maximum ground level impact or at relevant exposure locations for any of the scenarios assessed;
- The predicted impact on designated sensitive habitats are considered insignificant and will cause *'no significant pollution'* according to EA/Natural England guidance; and
- The model sensitivity assessment indicates none of the variations in the parameters investigated lead to exceedances of the standards or any material change to the overall conclusions of the assessment.

The AERA is enclosed as appendix ERA 2.

4.3 Odour Management Plan

An Odour Management Plan (OMP) has been prepared to assess, reduce and prevent potentially odorous emissions. The OMP considers sources, releases and impacts and identifies appropriate odour management measures.

The OMP concludes that with the odour control measures, monitoring and contingency and emergency plans and locations of receptors in relation to the Site odour pollution is not likely to be significant and no further assessment is required.

The OMP is enclosed as appendix ERA 3.

4.4 Noise Impact Assessment

A noise impact assessment (NIA) has been undertaken in accordance with BS4142:2014, whereby the sound sources under investigation have been compared to the existing background levels.

The specific sound levels generated by the operation of the site have been predicted at the closest receptors and has indicated that there is only a 'negligible' risk of adverse impact. For most receptors, the predicted specific noise level is very low and is unlikely to be noticeable against the residual noise environment. The assessment also demonstrates compliance with the conditions imposed within the planning consent.

Furthermore, with respect to noise from HGVs and staff cars travelling in and out of the site and onto surrounding roads, there is again only a 'negligible' risk of adverse impact.

The NIA is enclosed as Appendix ERA 4.

4.5 Solid Residue Management Plan

A Solids Residue Management Plan (RMP) has been prepared to demonstrate how residue management and minimisation is carried out to minimise environmental risks.

The RMP is enclosed as appendix ERA 5.

4.6 Global Warming Potential Assessment

The Global Warming Potential Assessment (GWP) has assessed the emissions of greenhouse gases from different waste treatment technologies and operating techniques to establish that BAT is used for to control emissions with global warming potential. The assessment finds that the combustion of waste in this case is an effective and efficient means of waste management as a solution to the treatment of residual wastes. In addition, that the facility results in a significantly positive impact when compared with the global warming impacts of fossil fuel electricity generation.

The GWP is enclosed as Appendix ERA 6.

5.0 Conclusion

This ERA has been undertaken in accordance with EA guidance. The assessment is provided as part of the EP application for the EfW Facility at Skelton Grange for WTI.

A qualitative risk assessment has considered risks to amenity and from potential accidents, and detailed assessments have been carried out for air emissions, odour, noise, solid residues and global warming potential. The assessments conclude that with the implementation of the risk management measures described within, potential hazards from the proposed development are not likely to be significant.

APPENDIX ERA 1

Environment Agency Conservation Screening Report

Nature and Heritage Conservation

Screening Report: Bespoke installations

Reference	**EPR/UP3904PA/A001**
NGR	**SE 33446 31178**
Buffer (m)	**210**
Date report produced	**22 May 2019**
Number of maps enclosed	**3**

The nature conservation sites identified in the table below must be considered in your application.

Nature and heritage conservation sites	Screening distance (km)	Further information
Local Nature Reserve (LNR) **Halton Moor (LNR)**	2	Natural England
Local Wildlife Sites (LWS) **Halton Moor** **Temple Newsam Estate Wood**	2	Appropriate Local Record Centre (LRC)

Protected Species	Screening distance (m)	Further Information
Brown trout **European eel migratory route**	up to 500m	Natural England Environment Agency. Dial 03708 506 506 for your local Fisheries and Biodiversity team

Where protected species are present, a licence may be required from Natural England or the Welsh Government to handle the species or undertake the proposed works.

The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

Please note we have screened this application for protected and priority sites, habitats and species for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

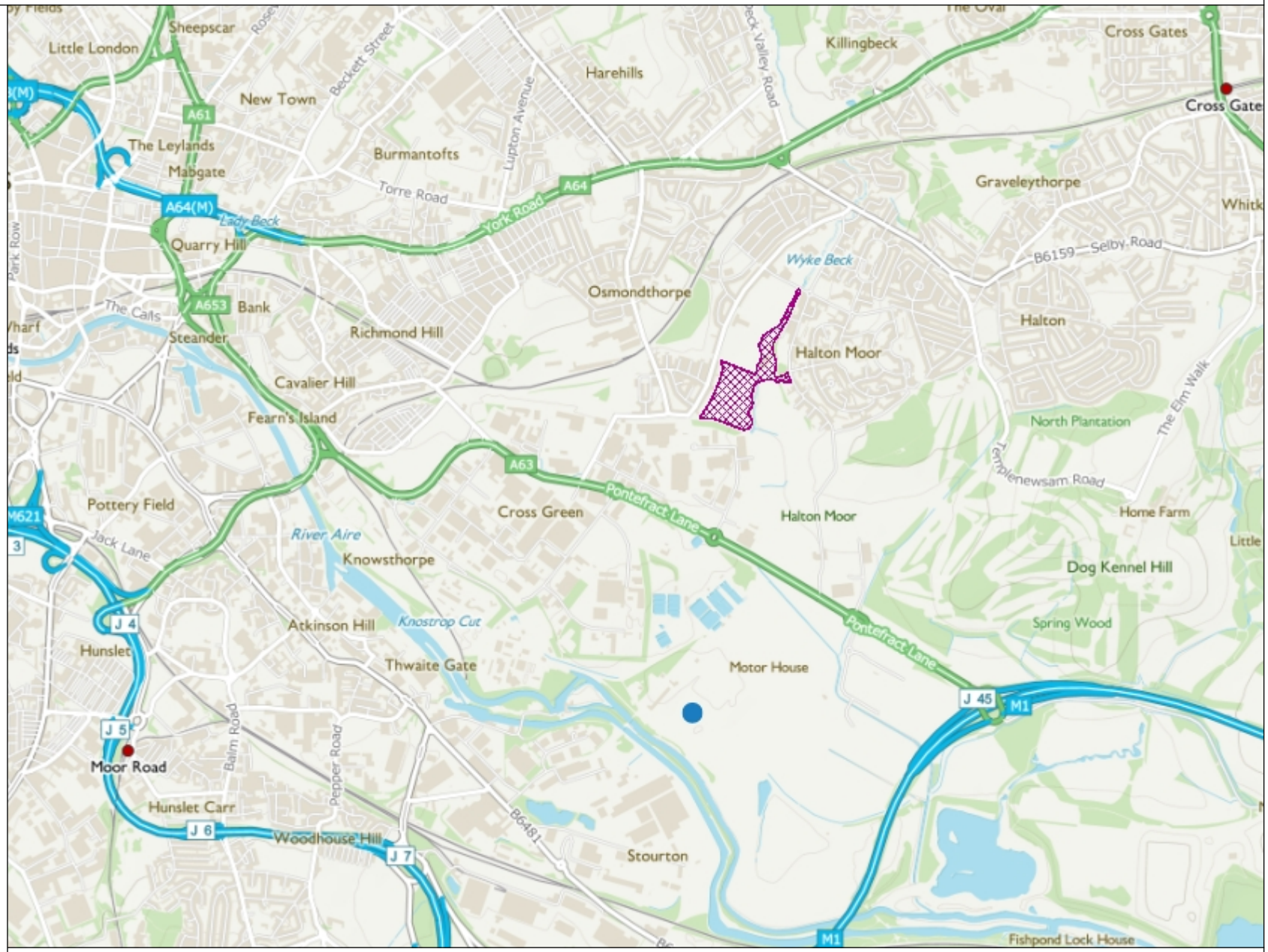
Please note, the enclosed pre-application map(s) is valid for a period of **6 months**. If you plan to submit your application more than 6 months after the map(s) was generated, you must request that the screen is re-run. This will ensure that you have used the most current information on heritage and nature conservation interests in your application.

LNR

Environment Agency

Legend

- LNR (England)
- LNR (Wales)



0 294 588 882

Metres

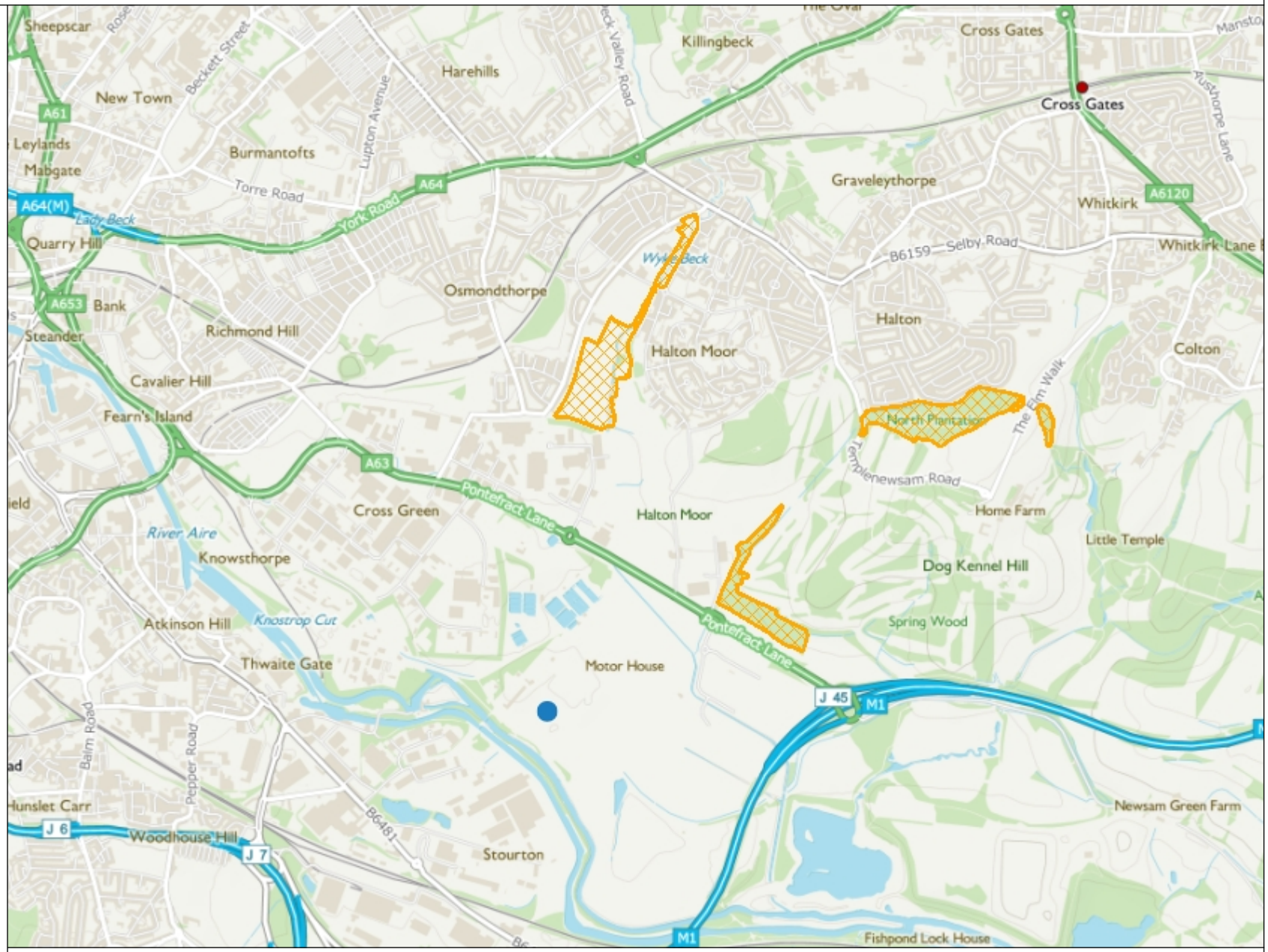
N
W E
S

LWS

Environment Agency

Legend

Local Wildlife Sites



0 294 588 882

Metres

N
W E
S

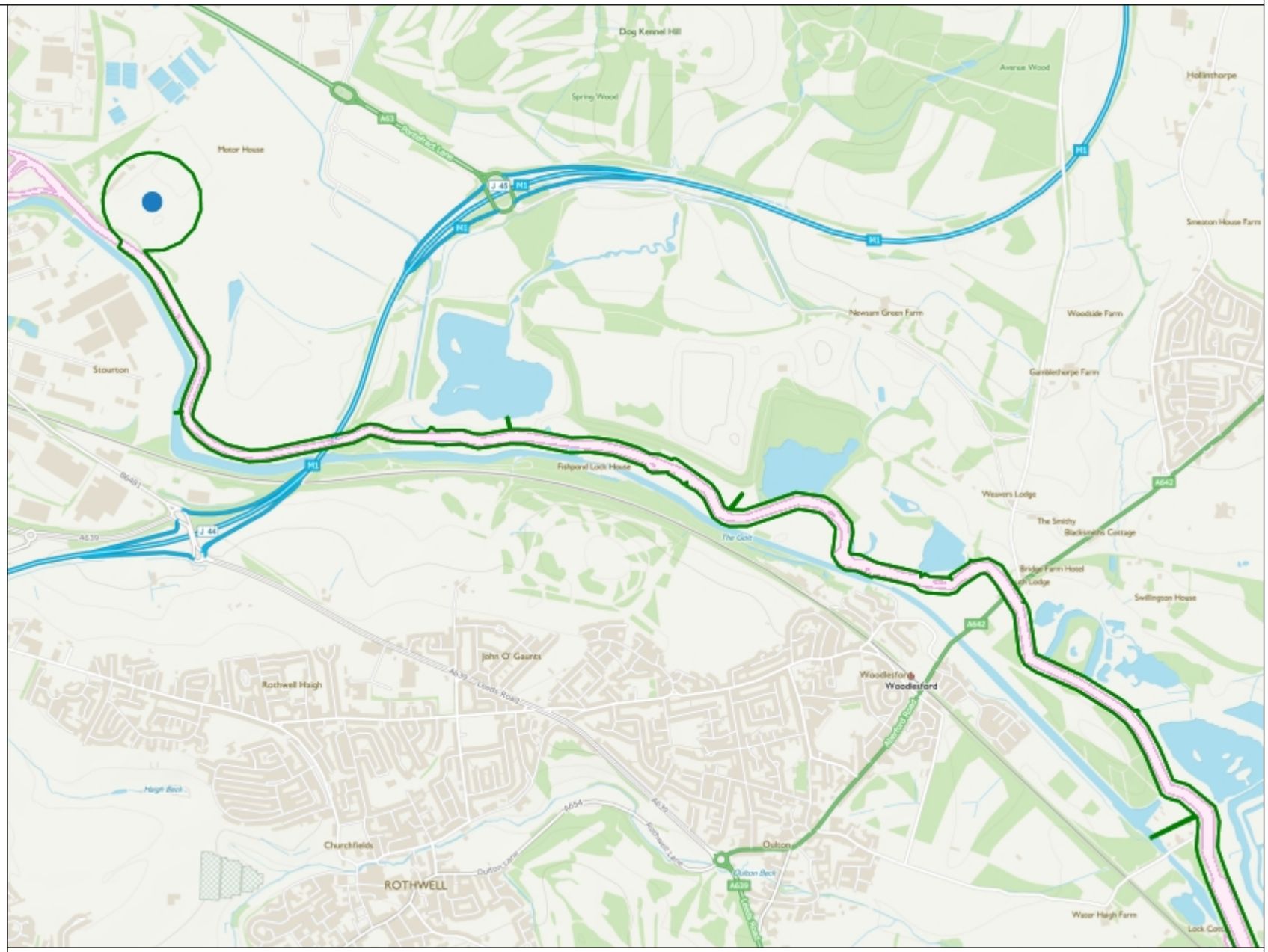
Protected Species

Environment Agency

Legend

Protected species screened for Env Permits - complete set

- Protected species, non fish
- Protected fish
- Protected fish migratory route



0 252 503 755

Metres

N
W E
S

APPENDIX ERA 2

Air Emissions Risk Assessment (including model files)

Model files provided separately

SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Appendix ERA 2: Air Emissions Risk Assessment

Prepared for: WTI EfW Holdings Limited

SLR Ref: 416.07232.00002
Version No: Issue 1
August 2019

BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with WTI EfW Holdings Limited (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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1.0 Introduction

1.1 Background

WTI EfW Holdings Limited has retained SLR Consulting to prepare the Environmental Permit (EP) application as required by the Environmental Permitting Regulations 2016 (as amended) for the Skelton Grange Energy from Waste Facility (EfW) located at Skelton Grange Road, Leeds, West Yorkshire (the Site). The facility will be operated by WTI UK Limited (WTI).

This report presents the Air Emissions Risk Assessment undertaken in accordance with Environment Agency guidance and forms Appendix ERA 2 to the Environmental Risk Assessment submitted at Section 5 of the application.

The Non-Technical Summary provided in Section 1 of the application gives a full description of all the EP application and the facility. The key details of relevance to this air quality assessment are that the facility will comprise:

- an EfW receiving up to 410,000 tonnes per annum (tpa) as feedstock;
- twin-line (70MW$_{th}$ input each) furnace/boiler units incorporating moving grate technology and steam boiler with an energy recovery system;
- flue gas treatment (FGT) system comprising selective non catalytic reduction (SNCR – urea/ammonia based nitrogen oxides (NOx) control), reactor (employing lime and activated carbon) and bag house filters; and
- discharge of treated flue gases via 2 stacks at 90m above ground level.

1.2 Scope of Assessment

The scope of this assessment is specifically concerned with emissions from the stacks. The scope incorporates:

- a review of relevant legislation and guidance;
- a review of baseline conditions at the site and potential for cumulative effects with other local emitters;
- quantification of pollutant emissions to air;
- prediction of the impact of emissions to air using atmospheric dispersion modelling techniques;
- consideration of model uncertainties and sensitivities; and
- assessment of the significance of these predicted impacts on air quality.

The objective of the assessment is to determine the potential effect of emissions from the proposed EfW on the air quality environment by comparison to relevant guidelines for the protection of human health and the environment (i.e. protected sensitive habitats).

2.0 LEGISLATION AND RELEVANT GUIDANCE

The following legislation and guidance relates to the assessment of potential air quality impacts from the EfW.

2.1 National Legislation

2.1.1 Air Quality Standards Regulations

The Air Quality Standards Regulations 2010 (the AQSR) transpose the Air Quality Directive (2008/50/EC) and Fourth Daughter Directive (2004/107/EC) into UK legislation. The regulations include Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment. Those relevant to this assessment are presented within Table 2-2.

2.1.2 Air Quality Strategy

The Air Quality Strategy[1] (AQS) sets out a comprehensive strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that the Government, industry, Environment Agency (EA), local government, business, individuals and transport have in protecting and improving air quality. The AQS contains Air Quality Objectives (AQOs) for the protection of both human health and vegetation (ecosystems). Those relevant to this assessment are presented within Table 2-2.

2.1.3 Local Air Quality Management

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any AQALs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed standards are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the standards. As such, Local Authorities (LAs), have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

Defra has published technical guidance for use by local authorities in their LAQM work[2]. This guidance, referred to in this report as LAQM.TG(16), has been used where appropriate in the assessment presented here.

2.1.4 Protection of Nature Conservation Sites

Sites of nature conservation importance at a European, national and local level, are provided environmental protection from developments, including from atmospheric emissions.

The Conservation of Habitats and Species Regulations 2010 introduces the precautionary principle for protected areas, i.e. that projects can only be permitted to proceed; having ascertained that there will be no adverse effect on the integrity of the designated site. It requires an assessment to determine if significant effects (alone or in combination) are likely, followed by an 'appropriate assessment' by the competent authority, if necessary.

---

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007
[2] Department for Environment, Food and Rural Affairs (DEFRA): Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16), 2016.

Similarly, the Countryside and Rights of Way (CRoW) Act 2000 provides protection to Sites of Special Scientific Interest (SSSIs) to ensure that developments are not likely to cause them damage.

Locally important sites (such as National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) or Sites of Importance for Nature Conservation (SINCs) and Ancient Woodland (AW)) are also protected by legislation to ensure that developments do not cause significant pollution.

2.2 Regulation of Industrial Emissions

2.2.1 Industrial Emissions Directive

The Industrial Emissions Directive[3] (IED) recast seven existing directives including the Waste Incineration Directive (WID)[4]. Chapter IV of the IED applies to incineration and co-incineration plants (which accept waste and other fuels such as biomass) which thermally treat waste as defined in the Waste Framework Directive.

The IED defines requirements for facilities classified as waste incinerators under the IED definition including:

- operating conditions, including gas temperatures and residence times, such as 850ºC / 2 seconds;
- emission limit values for a range of substance to air and water; and
- emissions monitoring requirements.

2.2.2 Emission Limit Values to Air

The IED defines emission limit values (ELVs) for emissions to air from installations as described above. These ELVs are detailed in Table 2-1. The final Draft Bref note (December 2018) includes BAT-Associated Emission Levels (BAT-AEL) that are more stringent than the IED ELV's. Although WTI will meet BAT-AELs, the IED as transposed into EP regulations represents the regulatory ELVs which are modelled here.

Table 2-1
IED Chapter IV Emission Limit Values

Pollutant	Emission Limits (mg/Nm^3) [(a)]		
	Daily average values	Half hourly averages	
		100th Percentile	97th Percentile
Continuous Monitoring			
Total Particulate Matter	10	30	10
Total Organic Carbon (TOC)	10	20	10
Hydrogen chloride (HCl)	10	60	10
Hydrogen fluoride (HF)	1	4	2
Sulphur dioxide (SO_2)	50	200	50
Oxides of nitrogen (NOx)	200	400	200
Carbon Monoxide (CO[(b)])	50	150	100
Spot sample measurements			

[3] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
[4] Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste.

Pollutant	Emission Limits (mg/Nm^3) [a]		
	Daily average values	Half hourly averages	
		100th Percentile	97th Percentile
Group 1 metals[c]	0.05		
Group 2 metals[c]	0.05		
Group 3 metals[c]	0.5		
Dioxins and furans[d]	0.0000001		

Table Notes:

a) Concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.

b) 150 mg/Nm^3 of combustion gas for at least 95% of all measurements determined as 10 minute averages or 100 mg/Nm^3 of combustion gas of all measurements determined as half-hourly average values taken in any 24 hour period.

c) Metal groups are as follows:

Group 1: Cadmium (Cd) and thallium (Tl)

Group 2: Mercury (Hg)

Group 3: Antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), and vanadium (V).

d) The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence (TEQ).

2.2.3 Environmental Permitting

In England, the Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No.1154 as amended) transpose the IED in UK legislation. The proposed installation would be regulated by the EA under the Environmental Permitting (EP) Regulations which includes regulating emissions to air.

Guidance Notes produced by Defra provide a framework for regulation of installations and additional Technical Guidance Notes produced by the EA are used to provide the basis for Environmental Permit conditions as regards releases to air and mitigation measures.

Of particular relevance to the assessment of air quality impacts is the EA's '*air emission risk assessment for your environmental permit*' guidance[5] (referred to as the AERA guidance throughout this report). The purpose of this guidance is to assist operators to assess risks to the environment and human health when applying for a permit under the EP Regulations. This guidance sets out Environmental Assessment Levels (EALs) which are taken from the AQS and AQSR but also includes EALs for additional pollutants derived from occupational exposure limits (OEL) and maximum exposure levels (MEL) presented in HSE EH40[6]. Those relevant to this assessment are presented within Table 2-2 below.

2.3 Environmental Standards

The environmental standards for air, taken from the legislation and guidance outlined above, for the protection of human health and sensitive ecological receptors are presented in the sections below.

[5] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[6] HSE (2011) EH40/2005 Workplace Exposure Limits.

2.3.1 Standards for Protection of Human Health

The standards applied in this assessment, taken from the AQSR, AQS and AERA guidance are set out in Table 2-2 below.

Table 2-2
Relevant Standards (µg/m³)

Pollutant		Annual Standard (µg/m³)	Short Term Standard (µg/m³)	Ref
Nitrogen dioxide	(NO_2)	40	200 (1-hour) not to be exceeded more than 18 times per year	AQSR
Particulates	(PM_{10})	40	50 (24-hour) not to be exceeded more than 35 times per year	AQSR
Particulates	($PM_{2.5}$)	25	---	AQSR
Carbon monoxide	(CO)	---	10,000 (Max 8-hour daily mean)	AQSR
			30,000 (Max 1-hour)	AERA
Sulphur dioxide	(SO_2)	---	266 (15-minute) not to be exceeded more than 35 times per year	AQS
			350 (1-hour) not to be exceeded more than 24 times per year	AQSR
			125 (24-hour) not to be exceeded more than 3 times per year	AQSR
Hydrogen chloride	(HCl)	---	750 (1-hour)	AERA
Hydrogen fluoride	(HF)	16 (monthly)	160 (1-hour)	AERA
Total Organic Compounds	(TOC)	5	--	AERA
Benzene	(C_6H_6)	5	--	AQSR
Ammonia	(NH_3)	180	2,500 (1-hour)	AERA
Arsenic	(As)	0.003	---	AERA
Antimony	(Sb)	5	150 (1-hour)	AERA
Cadmium	(Cd)	0.005	---	AQSR
Chromium (II and III)	(Cr)	5	150 (1-hour)	AERA
Chromium (VI)		0.0002	---	AERA
Copper	(Cu)	10	200 (1-hour)	AERA
Lead	(Pb)	0.25	---	AQS
Manganese	(Mn)	0.15	1500 (1-hour)	AERA
Mercury	(Hg)	0.25	7.5 (1-hour)	AERA
Nickel	(Ni)	0.02	--	AQSR
Vanadium	(V)	5	1 (1-hour)	AERA

The regulations[7] state that exceedances of the objectives should be assessed in relation to "the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or

[7] The Air Quality (England) Regulations 2000 2000 No. 928

below ground, and where members of the public are regularly present". LAQM.TG(16) provides guidance on relevant exposure locations that are summarised in Table 2-3 below.

Table 2-3
Relevant Public Exposure

Averaging Period	Relevant Locations	AQO's should apply at:	AQO's don't apply at:
Annual mean	Where individuals are exposed for a cumulative period of 6 months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
8-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	Where individuals might reasonably expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15-minutes or longer		-

2.3.2 Standards for the protection of Ecosystems and Vegetation

Environmental Quality Standards exist for nature conservation sites known as Critical Levels (for airborne concentrations) and Critical Loads (for deposition of nitrogen or acid forming compounds).

Critical Levels (CLe)

CLe's are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. CLe's for the protection of vegetation and ecosystems are specified within relevant European air quality directives and corresponding UK air quality regulations (see Table 2-4).

Table 2-4
Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg/m^3)	Habitat and Averaging Period
Ammonia (NH_3)	1	Annual mean. Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity
	3	Annual mean. For all higher plants (all other ecosystems)
Sulphur dioxide (SO_2)	10	Annual mean. Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the

Pollutant	Concentration (µg/m^3)	Habitat and Averaging Period
		ecosystem's integrity
	20	Annual mean. For all higher plants (all other ecosystems)
Nitrogen oxides (NO_x)[1]	30	Annual mean (all ecosystems)
	75	Daily mean (all ecosystems)
Hydrogen fluoride (HF)	5	Daily Mean.
	0.5	Weekly Mean

Table note: 1) APIS states that *'the critical level for NO_X should only be applied where levels of SO_2 and O_3 are close to their critical levels'*.

Critical Loads (C_{Lo})

C_{Lo}'s are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. C_{Lo}'s are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions, C_{Lo}'s for eutrophication and acidification are relevant which can occur via both wet and dry deposition, however on a local scale only dry (direct deposition) is considered significant.

Empirical C_{Lo}'s for eutrophication (derived from a range of experimental studies) are assigned based on different habitats, including grassland ecosystems, mire, bog and fen habitats, freshwaters, heathland ecosystems, coastal and marine habitats, and forest habitats and can be obtained from the UK Air Pollution Information System (APIS) website (www.apis.ac.uk/).

C_{Lo}'s for acidification have been set in the UK using an empirical approach for non-woodland habitats on a 1km grid square based upon the mineralogy and chemistry of the dominant soil series present in the grid square, and the simple mass balance (SMB) equation for both managed and unmanaged woodland habitats.

The C_{Lo}'s relevant to this assessment are presented in Section 4.7.

3.0 ASSESSMENT METHODOLOGY

3.1 Approach

The assessment has been undertaken as a 'detailed assessment' using dispersion modelling. The assessment incorporates:

- identification of sensitive receptors and compilation of the existing air quality baseline;
- quantification of emissions from the installation;
- atmospheric dispersion modelling to determine process contribution to ground level concentrations and calculate deposition rates; and
- assessment of impacts by comparison to standards for protection of human health and ecological receptors.

3.2 Dispersion Modelling

3.2.1 Dispersion Model

The model used is the US American Meteorological Society and Environmental Protection Agency Regulatory Model (AERMOD[8]) dispersion model. This model is commonly used for assessments of this kind and has been accepted as suitable for use by the EA on similar projects. An assessment of the sensitivity of model results to various inputs is presented in Section 7.0.

3.2.2 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across an Ordnance Survey map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the site boundary to be assessed. A receptor grid was applied as follows:

- 2000m x 2000m at 50m grid resolution;
- 4000m x 4000m at 100m grid resolution;
- 8000m x 8000m at 200m grid resolution; and
- 12000m x 12000m at 500m grid resolution

In addition, the modelling of discrete sensitive receptor locations as described in Section 4.1 was undertaken to facilitate the discussion of results.

3.2.3 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission

[8] Software used: Lakes AERMOD View, (Executable Aermod_18081)

(SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

3.2.4 Building Downwash

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics.

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. All buildings input to the model are represented in Figure 3-1. The key building effecting downwash are buildings that have a maximum height equivalent to at least 40% of the emission height (i.e. 36m) and which are within a distance defined as five times the lesser of the height or maximum projected width of the building. The structure modelled is presented in Figure 3-1.

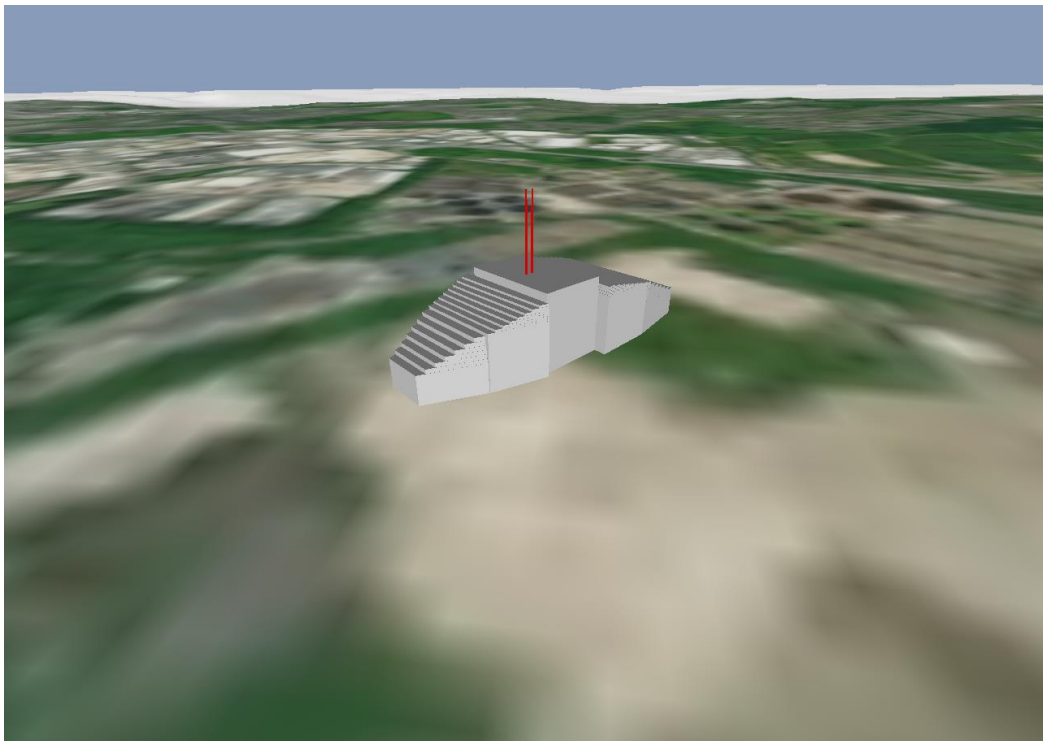

Figure 3-1
Modelled Buildings

3.2.5 Dispersion Coefficients

The 'rural' option for dispersion coefficients was selected in accordance with AERMOD guidance[9].

3.2.6 Meteorological Data

Following consultation with the meteorological data provider, it was concluded that Leeds-Bradford Airport, located approximately 14km to the north west of the Site, would provide the most complete and representative meteorological data set for purposes of this assessment. Meteorological data used in this

[9] EPA, AERMOD Implementation Workgroup, Aermod Implementation Guide (August 3, 2015)

assessment was for the years 2013 to 2017 (inclusive). This accounts for inter-year variability in meteorological conditions. From the dataset used, a total of 197 missing hours occur (i.e. representing 0.45% data loss), were recorded over the 5-year period. A windrose is presented in Figure 4-2.

The meteorological data was obtained in .met format from the data supplier and converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor. Surface characteristics were assigned for the rural surroundings as presented in Table 3-1.

Table 3-1
Applied Surface Characteristics

Zone (Start)	Zone (end)	Albedo	Bowen	Roughness
0	200	0.28	0.75	0.15
200	280			0.38
280	320			0.02
320	0			0.38

3.3 Assessment of Impacts on Standards for Air Quality

3.3.1 Treatment of Model Output and Significance

The assessment of impacts against the standards as defined in Section 2.3 was undertaken using model outputs as described in Table 3-2 below.

With respect to NOx emissions the EA Air Quality Modelling and Assessment Unit (AQMAU) guidance[10] on conversion ratio for NO_x and NO_2 has been followed, i.e. a worst case scenario has been applied in that 70% of NO_x is present as NO_2 in relation to long term impacts and 35% of NOx is present as NO_2 in relation to short-term impacts.

Table 3-2
Model Outputs

Averaging Period	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
1 hour mean. Not to be exceeded more than 18 times a calendar year	99.79%ile of 1-hour means	PC + 2 x annual mean background
15 minute mean. Not to be exceeded more than 35 times a calendar year	99.9%ile of 1 hour means for SO_2 multiplied by 1.34	PC + 2 x annual mean background
1 hour mean. Not to be exceeded more than 24 times a calendar year	99.73%ile of 1 hour means for SO_2	PC + 2 x annual mean background
24 hour mean. Not to be exceeded more	99.18%ile of 24 hour means for	PC + 2 x annual mean

[10] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NOx and NO_2' (no date)

than 3 times a calendar year	SO_2	background
24 hour mean. Not to be exceeded more than 35 times a calendar year	90.4%ile of 24 hour means for PM_{10}	PC + annual mean background
1-hour maximum	Maximum 1-hour mean	PC + 2 x annual mean background
8-hour rolling mean	Maximum 8-hour mean	PC + 2 x annual mean background
Calendar year	Annual Mean	PC + annual mean background

In accordance with AERA guidance, the impact is considered to be insignificant or negligible if:

- the long term process contribution <1% of the long term EAL; and
- the short term process contribution is <10% of the short term EAL.

For process contributions that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant EAL.

3.4 Assessment of Impacts on Vegetation and Ecosystems

In addition to the AERA guidance, the EA's Operational Instruction 66_12[11] details how the air quality impacts on ecological sites should be assessed. This guidance provides risk based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)' for European sites, 'no likely damage' for SSSI's and 'no significant pollution' for other sites, as follows:

- PC does not exceed 1% long-term C_{Le} and/or C_{Lo} or that the PEC <70% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs;
- PC does not exceed 10% short-term C_{Le} for NOx and HF (if applicable) for European sites and SSSIs;
- PC does not exceed 100% long-term C_{Le} and/or C_{Lo} other conservation sites; and
- PC does not exceed 100% short-term C_{Le} for NOx and HF (if applicable) for other conservation sites.

Where impacts cannot be classified as resulting in 'no likely significant effect', more detailed assessment may be required depending on the sensitivity of the feature in accordance with EAs Operational Instruction 67_12 ('*Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation*'). This can require the consideration of the potential for in-combination effects, the actual distribution of sensitive features within the site, and local factors (such as the water table).

The guidance provides the following further criteria:

- if the PEC<100% of the appropriate limit it can be assumed there will be no adverse effect;
- if the background is below the limit, but a small PC leads to an exceedance – decision based on local considerations;
- if the background is currently above the limit and the additional PC will cause a small increase – decision based on local considerations;

[11] NRW/EA Working Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation

- if the background is below the limit, but a significant PC leads to an exceedance – cannot conclude no adverse effect; and
- if the background is currently above the limit and the additional PC is large - cannot conclude no adverse effect.

Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[12]. Dry deposition flux was calculated using the following equation:

Dry deposition flux ($\mu g/m^2/s$) = ground level concentration ($\mu g/m^3$) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow, and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are as shown in Table 3-3.

Table 3-3
Applied Deposition Velocities

Chemical Species	Recommended deposition velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.003
SO_2	Grassland	0.012
	Woodland	0.024
NH_3	Grassland	0.02
	Woodland	0.03
HCl	Grassland	0.025
	Woodland	0.06

Critical Loads - Eutrophication

The contribution to critical loads for nitrogen deposition (N) are recorded as kgN/ha/yr. The units are converted from $\mu g/m^2/s$ to units of kgN/ha/year by multiplying the dry deposition flux by standard conversion factors as summarised in Table 3-4.

Table 3-4
Applied Deposition Conversion Factors

Chemical Species	Conversion factor [$\mu g/m^2/s$ to kgN/ha/year]	
NO_2	of N:	95.9
NH_3	of N:	260

[12] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014 version.

Critical Loads - Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying the dry deposition flux (µg/m^2/s) by standard conversion factors as presented in Table 3-5.

Table 3-5
Applied Acidification Conversion Factors

Chemical Species	Conversion factor [kg/ha/year to keq/ha/year]
NO_2	6.84
NH_3	18.5
SO_2	9.84
HCl	8.63

Calculation of PC as a percentage of Acid Critical Load Function

The calculation of the process contribution of N, S and Cl to the critical load function has been carried out according to the guidance on APIS, which is as follows:

> *'The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:*
>
> *Where PEC N Deposition < CLminN*
>
> *PC as % CL function = (PC S deposition/CLmaxS)*100*
>
> *Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.*
>
> *Where PEC N Deposition > CLminN*
>
> *PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100'*

The predicted dry N, sulphur (S) and chlorine (Cl) deposition (k_{eq}/ha/year) are summed to determine total acid deposition.

4.0 BASELINE ENVIRONMENT

4.1 Site Setting and Sensitive Receptors

The Site is located in Skelton at National Grid Reference (NGR) SE 334 312. The Site is approximately 4.5km south east of Leeds city centre in an industrial area. The closest residential areas in the surrounding environment are Hunslet (approximately 1.3km northwest), Belle Isle (approximately 2.0km west), Rothwell (approximately 2.0km south), and Halton (approximately 1.6km north east).

There are also a number of sensitive habitats within the AERA screening distances of the Site which are detailed in the section below.

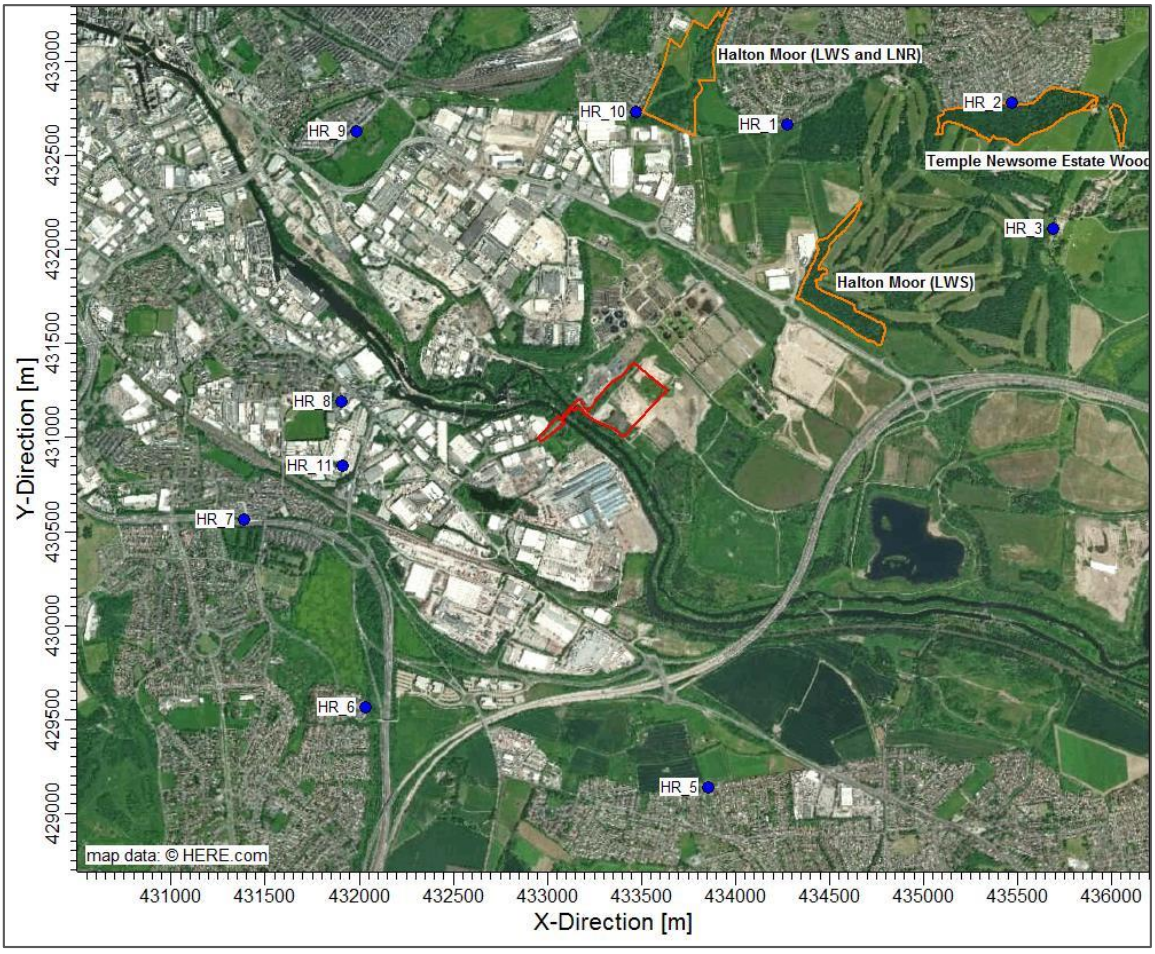

Figure 4-1
Site Setting and Modelled Human and Ecological Receptors

4.1.1 Human Receptors

According to LAQM.TG(16), air quality standards should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant standard as summarised in Table 2-3. The dispersion modelling has been completed using a receptor grid, as such the impact concentration has been assessed at all potential exposure locations surrounding the site. Ten discrete sensitive receptors have been modelled (shown in Figure 4-1 and listed in Table 4-1) representing the closest human locations (relevant to annual mean exposure). The receptor grid allows the maximum ground level impact to be assessed including potential short-term exposure locations.

Table 4-1
Assessed Annual Mean Exposure Locations

Ref.	Description	NGR X	NGR Y
HR1	Halton Moor Road (Halton Moor)	434278	432666
HR2	Templegate Avenue (Halton)	435473	432780
HR3	Temple Newsam House	435687	432110
HR4	Newsam Green Farm	436682	430692
HR5	Mill Pit Lane (Rothwell)	433854	429138
HR6	Middlecroft Rd (Belle Isle)	432036	429565
HR7	Woodhouse Hill Road (Stourton)	431385	430562
HR8	Sussex Avenue (Stourton)	431903	431194
HR9	Cross Green Lane (Cross Green)	431983	432629
HR10	Halton Moor Avenue (Newmarket)	433474	432735
HR11	Daycare Nursery (Stourton)	431912	430852

4.1.2 Ecological Receptors

The EA AERA guidance states that ecological habitats should be screened against relevant standards if they are located within the following set distances from the facility:

- SPAs, SACs or Ramsar sites within 10km of the installation; and
- SSSIs, NNRs, LNRs, local wildlife sites (LWS or SINCs) and AW within 2km of the location of the installation.

The sites identified using the EA screening service are detailed in Table 4-2 and termed ER1 to ER2 in the assessment (shown in Figure 4-1).

Table 4-2
Designated Sites Requiring Assessment

Ref.	Site (Designation)	Habitat Type (APIS categories)
ER1	Temple Newsome Wood (LWS)	Broadleaved deciduous woodland
ER2	Halton Moor (LNR and LWS)	Broadleaved deciduous woodland

4.2 Other Combustion Emissions

The majority of combustion emissions in the local area (e.g. traffic emissions, local boiler plant etc) will be incorporated into the baseline data applied in the assessment. Veolia opened a waste incinerator in 2016 situated in Newmarket (known as the Recycling and Energy Recovery Facility (RERF)), approximately 1.4km north west from the Site. All emissions from this facility may not be adequately incorporated into the baseline data. As such emissions from this facility have been explicitly modelled in a cumulative impact assessment (emissions are detailed in Section 5.6 and impacts in Section 6.5).

4.3 Meteorological Conditions

A windrose for Leeds-Bradford station for a 5 year period (hourly sequential data), providing the frequency of wind speed and direction, is presented in presented in Figure 4-2. The windrose shows winds from the west are most frequent with winds from the south east least frequent.

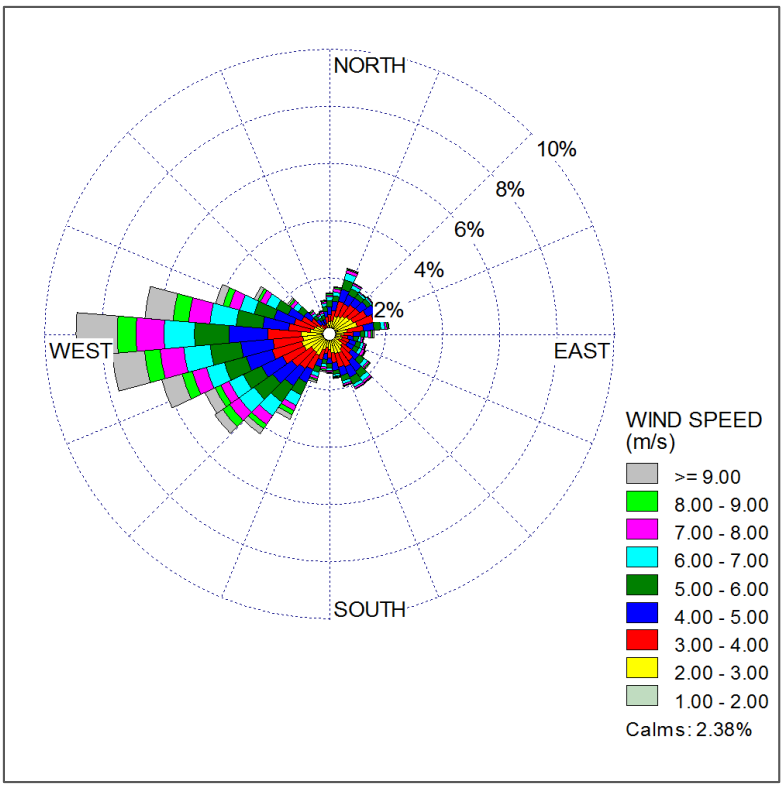

Figure 4-2
Windrose for Leeds-Bradford Airport Meteorological Station (2013-17)

4.4 Topography

The Site lies on a flat area at approximately 25m AOD close to the River Aire. Within approximately 2km the land is relatively flat to the north west and south east along the river plain. To the north east and south west the terrain rises with hill tops up to 120m AOD at approximately 2.5km distance. The local topography is illustrated in Figure 4-3.

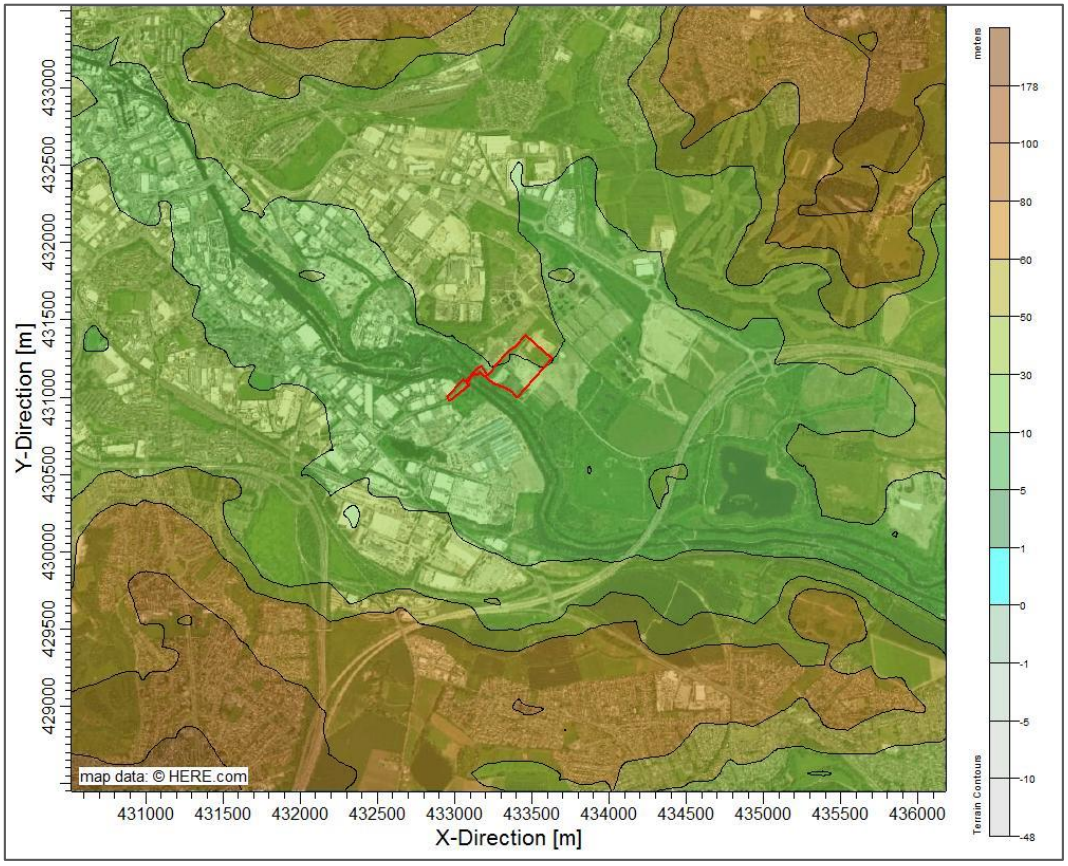

Figure 4-3
Local Topography

4.5 Baseline Air Quality

This section reviews the existing baseline air quality and deposition in the vicinity of the proposed installation according to monitoring and/or modelling from LCC, Defra, and APIS.

4.5.1 Local Air Quality Management and Monitoring

The Site lies within LCC's area of jurisdiction with respect to LAQM, who have declared six AQMAs for risk of exceedances of the annual mean standard for NO_2. To the south (south of the M62) lies Wakefield Borough Council who have also declared AQMAs for NO_2. The positions of the AQMA's in relation to the Site are illustrated in Figure 4-4 below.

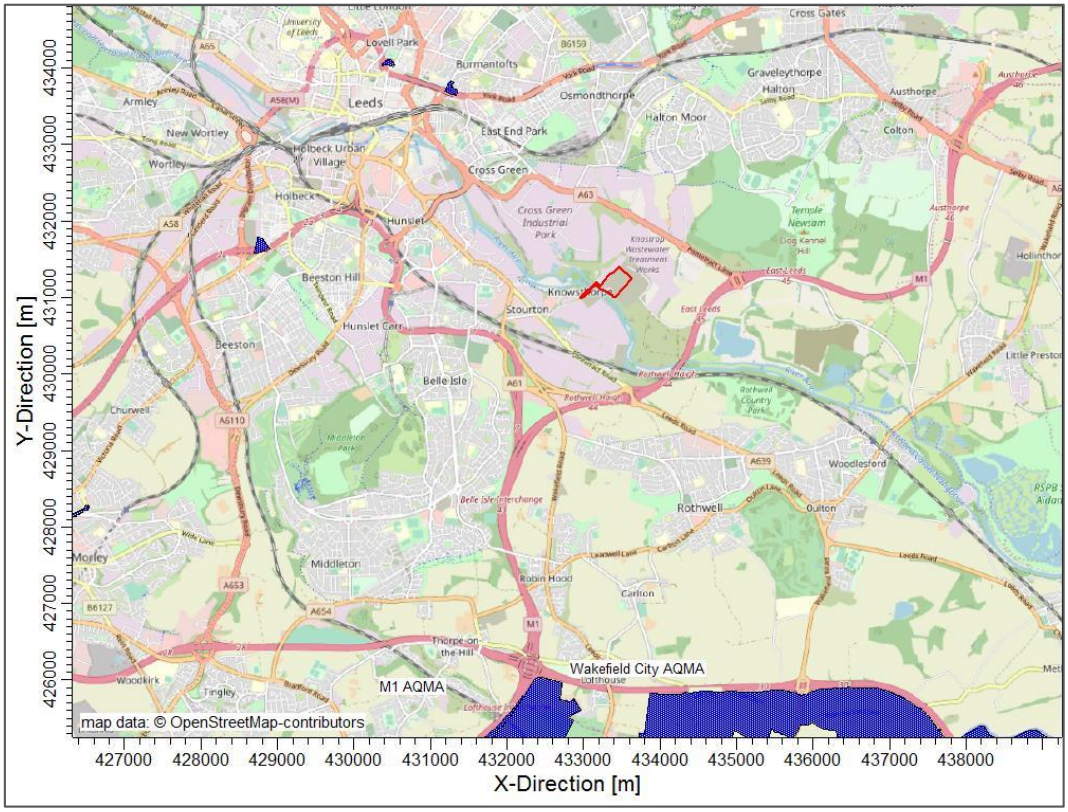

Figure 4-4
Location of AQMAs

LCC's latest LAQM report[13] has been reviewed for monitoring data close to the Site (within circa 2.5km based upon the ground level impacts) from both background and roadside locations. The recent results are presented in Table 4-3 below; the locations are presented in Figure 4-5. The monitoring shows that background concentrations range between 22 and 24µg/m^3. Two roadside monitoring locations (D265 and D267) show exceedances of the limit value however there is no relevant exposure.

Table 4-3
LCC NO_2 Diffusion Tube Monitoring Results

ID	Type	Distance to kerb (m)	Distance to Relevant exposure (m)	2016 µg/m^3	2017 µg/m^3
D70	Roadside	7	0	35	35
D126	Roadside	2	0	32	32
D199	Industrial	25	N/A	N/M	29
D232	Urban Background	100	0	N/M	22
D233	Urban Background	150	0	N/M	22

[13] Leeds City Council, 2018 Air Quality Annual Status Report (ASR), (June 2018)

D234	Urban Background	115	0	N/M	24
D239	Roadside	2	N/A	N/M	20
D240	Roadside	3	N/A	N/M	18
D241	Roadside	3	N/A	N/M	23
D263	Roadside	3	N/A	N/M	35
D264	Kerbside	0	N/A	N/M	31
D265	Roadside	2	N/A	N/M	**44**
D266	Roadside	15	0	N/M	27
D267	Roadside	3	N/A	N/M	**46**
D268	Roadside	4	N/A	N/M	35
D274	Roadside	3	8	N/M	30
D275	Roadside	2	8	N/M	25
D276	Roadside	2	10	N/M	26
D277	Roadside	3	12	N/M	20

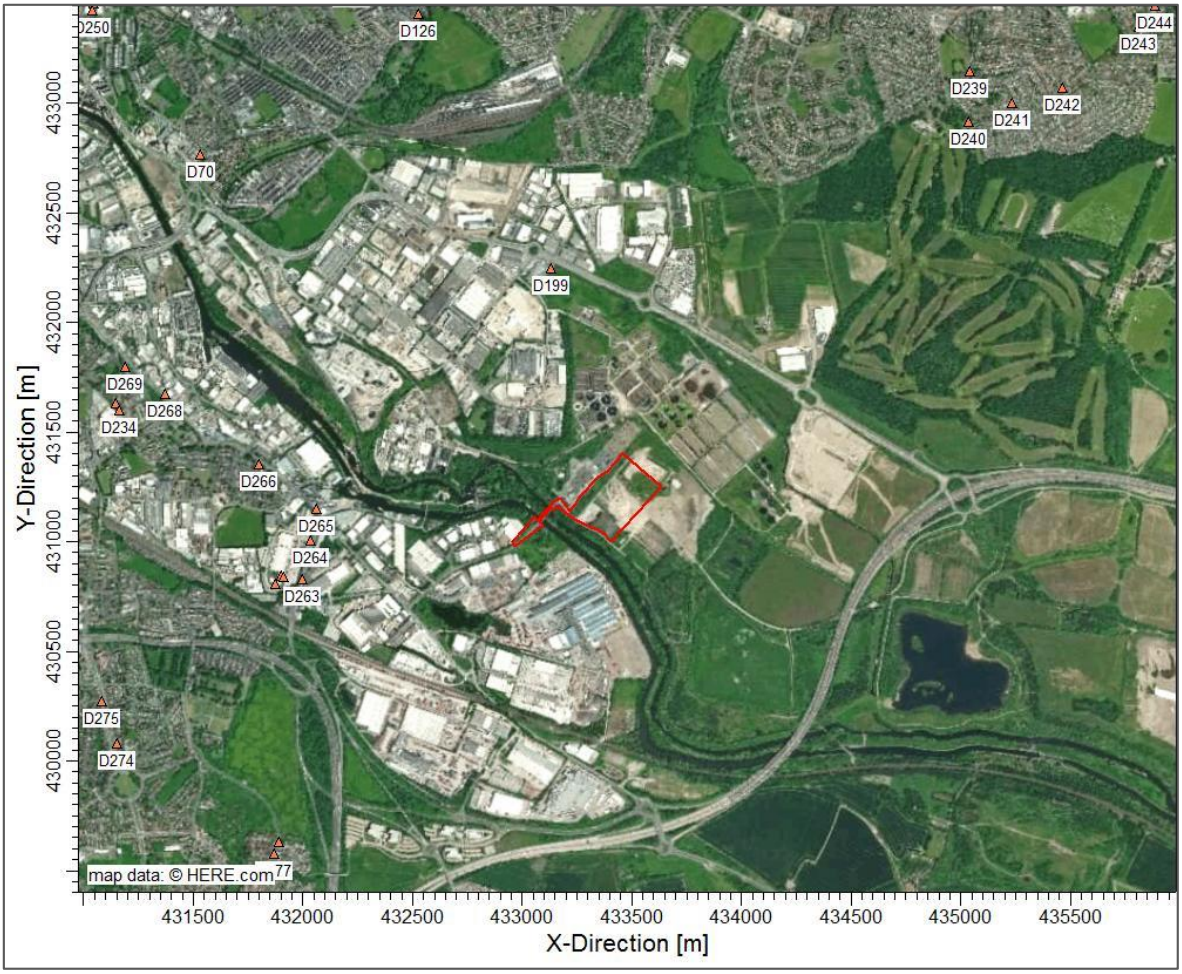

Figure 4-5
Local Diffusion Tube Monitoring Locations

4.5.2 UK AIR Modelled Data

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by Defra through the UK AIR website and is routinely used to support LAQM and Air Quality Assessments.

Background pollutant concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ are based upon a 2015 base year[14] and background pollutant concentrations of CO and Benzene are based upon a 2001 base year. Projection factors for SO_2 are not provided in LAQM.TG(16) since 2001 therefore values are likely to be an over prediction. For this reason the more up-to-date APIS modelled 3 year average values (2013-2015) have been applied, for the 5km grid square containing the site the APIS background value is 1.13µg/m^3.

The mapped background concentrations for the 9 grid squares containing the Site (centred on x433500,y431500) and nearby receptors are shown in Table 4-4. The NO_2 background monitoring data shows reasonable agreement with the 2015 base year data.

[14] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home, accessed November 2017.

Table 4-4
Modelled 2015 Annual Mean Background Concentrations (µg/m³)

X – NGR	Y-NGR	NO_2	PM_{10}	$PM_{2.5}$	Benzene	CO
432500	430500	23.6	15.9	11.1	0.54	444
433500	430500	19.4	13.4	8.9	0.51	430
434500	430500	19.9	14.9	9.5	0.49	413
432500	431500	23.6	14.4	9.3	0.61	484
433500	431500	17.7	13.2	8.8	0.55	454
434500	431500	17.2	14.3	9.2	0.50	421
432500	432500	22.6	14.0	9.7	0.67	524
433500	432500	18.8	13.3	8.8	0.64	501
434500	432500	16.9	13.0	8.5	0.58	464

4.5.3 Metals

Monitoring of metals is currently carried out on behalf of Defra at 24 sites around the UK (termed the Heavy Metals Monitoring Network). The closest location to the Site at which heavy metals have been monitored is at Beacon Hill (of a rural classification) located approximately 5km to the southeast, however the site was closed in 2014. Monitoring has been undertaken within Leeds for 12 months between 2010 and 2011 as part of an EfW application in Newmarket, Leeds. This data, taken from the application[15], is shown in Table 4-5.

Table 4-5
Metals Monitoring Data from Newmarket Leeds

Metal		Annual average (ng/m³)
Arsenic	As	1.1
Cadmium	Cd	0.20
Chromium (total)	Cr	6.3
Copper	Cu	17
Manganese	Mn	100
Nickel	Ni	6.6
Lead	Pb	34
Vanadium	V	1.1
Antimony	Sb	2.3
Chromium (VI)	CrVI	1.3 (estimated as 20% of total Cr)
Mercury	Hg	0.00017

[15] Assessment of Impacts to Air Quality Arising from the Operation of the Proposed Leeds RERF Appendix D1 June 2012

Monitoring is not routinely undertaken for thallium or hexavalent chromium (Cr(VI)) in the UK and therefore no background data are available. The adopted approach of the EA for estimating Cr(VI) is to assume it is a fraction of total Cr, guidance[16] states that a value of 20% should be applied unless otherwise justified.

4.5.4 Hydrogen Halides

Hydrogen Chloride

Hydrogen chloride is monitored as part of the UK Acid Gases & Aerosol Network (AGANET) at Ladybower located approximately 45km southwest of the Site. The annual mean concentration of HCl from the most recent ratified data, i.e. 2014 and 2015 is 0.40µg/m^3 and 0.23µg/m^3.

Hydrogen Fluoride

In 2005 The Expert Panel on Air Quality Standards (EPAQS) published a draft report entitled 'Guidelines for halogen and hydrogen halides in ambient air for protecting human health against acute irritancy effects'. The report noted that only a small number of measurements of ambient concentrations of hydrogen fluoride have been made in the UK. All of these have been made in the vicinity of three industrial plants. Many samples were below the limit of detection. However, measurable values were in the range 0.05 to 3.5µg/m^3 as approximate monthly averages.

4.5.5 Ammonia

Ammonia is monitored at 85 sites as part of the National Ammonia Monitoring Network (NAMN). The closest monitoring station is at Tadcaster (a rural background site approximately 20km north east). The most recent ratified data shows average annual mean concentration between 2016 and 2018 of 2.02µg/m^3.

The APIS modelled 3 year average value (2013-2015) for the 5km grid square containing the site is 1.89µg/m^3.

4.5.6 Dioxins and PCBs

The Toxic Organic Micro-Pollutants (TOMPs) network measures ambient air concentrations for a range of persistent organic pollutants (POPs) across the UK, including polychlorinated biphenyls (PCBs), polychlorinated-p-dioxins (PCDDs - dioxins), polychlorinated dibenzofurans (PCDFs - furans). The closest urban monitoring site is the Manchester Law Courts data from 2016, as follows:

- sum of dioxins and furans (Toxic Equivalent Quotient): 12fgTEQ/m^3
- sum of seven indicator PCB congeners (PCBs 28,52,101,118,138,153,180): 105pg/m^3.

4.6 Applied Background Concentrations

The applied backgrounds are provided in Table 4-6 below. Baseline concentrations for short-term averaging periods have been converted from annual mean in accordance with AERA guidance and LAQM.TG16.

Table 4-6
Applied Background Concentrations

Pollutant	Units	Background Concentration		Data Source
		Short Term [(a)]	Annual	

[16] Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators. Version 4. Environment Agency, June 2016.

Pollutant	Units	Background Concentration		Data Source
NO_2	µg/m³	48	24	LCC Diffusion Tube Monitoring - highest urban background
PM_{10}	µg/m³	15.9	15.9	UK-AIR 2015 background map – highest in study area.
$PM_{2.5}$	µg/m³	22.2	11.1	
CO	µg/m³	1048.0	524.0	
SO_2	µg/m³	2.3	1.1	APIS Background map (2013 -15)
HCl	µg/m³	0.8	0.4	UK AGNET Ladybower 2014
HF	µg/m³	7.0	3.5	EPAQS
Benzene	µg/m³	1.3	0.7	UK-AIR 2015 background map
Ammonia	µg/m³	4.0	2.0	NAMN Tadcaster 2016-2018
Antimony	ηg/m³	4.6	2.3	Monitoring commissioned as part of the Leeds RERF work at the former Wholesale Market site
Cadmium	ηg/m³	0.4	0.2	
Mercury	ηg/m³	0.00034	0.00017	
Arsenic	ηg/m³	2.2	1.1	
Chromium	ηg/m³	12.6	6.3	
Copper	ηg/m³	34.0	17.0	
Lead	ηg/m³	68.0	34.0	
Manganese	ηg/m³	200.0	100.0	
Nickel	ηg/m³	13.2	6.6	
Vanadium	ηg/m³	2.2	1.1	
Chromium VI	ηg/m³	2.52	1.3	EA guidance 20% of total Cr
PCB	pg/m³	210	105	TOMPS (Manchester Law Courts 2016)
Dioxins furans	fgTEQ/m³	24	12	TOMPS (Manchester Law Courts 2016)

4.7 Critical Levels and Loads

APIS is a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. APIS[17] has been used to provide information on:

- identification of whether the habitats present are sensitive;
- critical levels and current baseline levels (Table 4-7); and

[17] At the time of writing the APIS baseline data has reverted to 2013-2015 averages

- critical loads and current loads (Table 4-8 and Table 4-9).

The baseline concentrations (3-year average 2013 - 2015) of NOx, SO_2 and NH_3 are summarised in Table 4-7 below.

Table 4-7
Baseline Concentrations

Site	NO_x (µg/m³)	SO_2 (µg/m³)	NH_3 (µg/m³)
ER1	26.4	1.1	1.9
ER2	31.2	1.1	1.9

4.7.1 Relevant Critical Loads

APIS was used to obtain location specific C_{Lo} of nitrogen and acid deposition and current loads (3-year average 2013 - 2015) as summarised in Table 4-8 and Table 4-9 below. The most sensitive habitat type listed on APIS has been used for the assessment and nitrogen C_{Lo} applied according to APIS guidance[18].

Table 4-8
Relevant N Critical Loads (kgN/ha/yr)

Site	APIS Habitat (most sensitive to N deposition)	C_{Lo} for Assessment (kgN/ha/yr)	Current N Load (kgN/ha/yr)
ER1	Broadleaved deciduous woodland	10	36.26
ER2	Broadleaved deciduous woodland	10	36.26

Table 4-9
Relevant Acid Critical Loads and Baseline Deposition

Site	Habitat (most sensitive to acid deposition)	Critical Level (k_{eq}/ha/yr)			Current Load (k_{eq}/ha/yr)	
		CLmaxS	CLminN	CLmaxN	N	S
ER1	Broadleafed/Coniferous unmanaged woodland	1.501	0.142	1.643	2.59	0.43
ER2	Broadleafed/Coniferous unmanaged woodland	2.500	0.357	2.857	2.59	0.43

[18] 'Indicative values within nutrient nitrogen critical load ranges for use in air pollution impact assessments' (http://www.apis.ac.uk/indicative-critical-load-values)

5.0 EMISSIONS TO ATMOSPHERE

5.1 Emission Scenarios

For the purposes of the dispersion modelling assessment, to represent a precautionary (worst case) approach, it has been assumed that the plant will operate at maximum throughput, 24-hours per day for 365 days per year (i.e. 8,760 hours per year), with emission concentrations at the Permitted ELVs. In reality operational hours are likely to be less than this to allow for maintenance and emissions control would reduce emissions to meet the limits achievable by the use of Best Available Techniques (BAT-AELs) as set out in the Revised Waste Incineration Bref Final Draft, December 2018, which sit some way below the Permitted ELVs. As such the following scenarios have been assessed:

- Normal 'daily average' emission limits;
- Half-hourly emission limits; and
- Plausible abnormal emissions

5.2 Emission Parameters

The following emission parameters and process conditions were used to determine the pollutant emission rates and as input to the dispersion modelling. These are common to all scenarios assessed with variations to a number of parameters investigated in Section 7.0.

Table 5-1
Emission Characteristics

Parameter	Stack 1	Stack 2
Stack Location (NGR x/y)	433470/431232	433472/431235
Stack Internal Diameter (m)	1.9	1.9
Stack Exhaust Height (m AGL)	90m	90m
Volume Flow (Nm^3/s) (273K, 11% O_2, dry)	37.92	37.92
Emission Temperature (°C)	140	140
Oxygen Content (% O_2 dry gas)	7.64	7.64
Moisture content (% H_2O)	19.07	19.07
Actual Flow Rate (Am^3/s) (wet, at stack conditions)	52.88	52.88
Emission velocity (m/s)	18.8	18.8

5.3 'Daily Average' Pollutant Emission Scenario

The pollutants emitted from the EFW stacks and their emission concentration limit values, as stated in the IED are shown in Table 2-1. The emission rates are presented in Table 5-2 and have been calculated from the process conditions detailed above and the emission limits as detailed in Table 2-1. Other pollutant specific issues are discussed in the sections below.

Table 5-2
'Daily Average' Pollutant Emission Rates

Pollutant	Emission Concentration (mg/Nm3)	Daily Average Emission Rate (per stack)	Emission Rate Units
Particulate Matter	10	0.379	g/s
Nitrogen Dioxide	200	7.584	g/s
Carbon Monoxide	50	1.896	g/s
Sulphur Dioxide	50	1.896	g/s
Hydrogen Chloride	10	0.379	g/s
Hydrogen Fluoride	1	0.038	g/s
Organics (TOC)	10	0.379	g/s
Group 1 metals (total)	0.05	1.896	mg/s
Group 2 metal	0.05	1.896	mg/s
Group 3 metals (total)	0.5	18.960	mg/s
Dioxins and furans	0.0000001	3.792	ng/s
Ammonia	10	0.379	g/s
PCB's	0.005	0.190	mg/s

5.3.1 Particle Size

In air quality terms PM is classified in terms of its aerodynamic diameter; with PM_{10} relating to particles with an aerodynamic diameter of less than 10µm. Other smaller relevant fractions of particulate matter such as $PM_{2.5}$ (aerodynamic diameter less than 2.5µm) are a sub-fraction of the PM_{10} fraction i.e. PM_{10} includes $PM_{2.5}$.

For the purposes of this assessment 100% of particulate matter has been assumed to be PM_{10} and 100% to be $PM_{2.5}$. This approach ensures that a worst case scenario has been considered for the smallest particles.

5.3.2 Total Organic Carbon

There are no relevant air quality assessment levels or backgrounds for TOC. Whilst it is unlikely that any benzene would be released from the process due to the high temperature of combustion a cautious approach has been adopted by assuming all the organic carbon would be in the form of benzene in line with AERA guidance.

5.3.3 Ammonia

The plant utilises a selective-catalytic-reduction system (SCR) to abate emission of NO_x. The manufacturer information indicates very low levels of residual ammonia present; however as a precautionary approach an annual average of 10mg/Nm^3 has been applied in the assessment.

5.3.4 PCBs

There is no ELV for PCB's provided in the IED. The previous Waste Incineration BREF Note (May 2017), indicates potential PCB emissions of 0.005mg/Nm^3. This value has been applied in the assessment. The current draft Bref (December 2018) contains information on dioxin-like PCBs that are addressed in the Human Health Risk Assessment.

5.3.5 Metals

As shown in Table 2-1, the IED emission limits for metals are based on total emission rates for 3 different groups. Additionally, in relation to chromium, different EALs apply depending on the oxidation state of chromium. The EPAQS recommended annual mean limit of 0.2ηg/m^3 relates specifically to chromium (VI) (i.e. hexavalent chromium), with the long-term EAL of 5µg/m^3 applying to all other oxidation states of chromium.

The EA's approach to assessment of Group 3 metals[19] is based on emissions monitoring data from the UK and includes two steps. Step 1 is a screening stage and requires each metal to be modelled at 100% of the group limit and Step 2, which has been applied in this detailed assessment, requires the maximum measured value to be applied from the data presented in Table 5-3.

Table 5-3
EA Group 3 Metals Monitoring Data

Parameter	Measured Concentrations (mg/Nm^3)			Maximum as a % of Group 3 total	Modelled emission rate (mg/s)
	Maximum	Mean	Minimum		
Antimony	0.0115	0.0014	0.0001	2.3%	0.44
Arsenic	0.0250	0.0010	0.0002	5.0%	0.95
Chromium (II and III)	0.0920	0.0084	0.0002	18.4%	3.49
Chromium (VI)	1.3×10^{-4}	3.5×10^{-5}	2.3×10^{-6}	0.003%	0.01
Cobalt	0.0056	0.0011	0.0002	1.1%	0.21
Copper	0.0290	0.0075	0.0019	5.80	1.10
Lead	0.0503	0.0109	0.0003	10.1%	1.91
Manganese	0.0600	0.0168	0.0015	12.0%	2.28
Nickel	0.2200	0.0150	0.0025	44.0%	8.34
Vanadium	0.0060	0.0004	0.0001	1.2%	0.23

5.4 Half Hourly Emission Limits Scenario

In addition to the daily average emission limits assessed, the IED also stipulates half-hourly emission limit values with the 97th percentile at levels that mirror the daily average levels (with the exception of HF and CO), but with 100th percentile values that are elevated. As such the model scenarios include an assessment of elevated emissions that could occur for 3% of half hourly averages as detailed in Table 2-1.

[19] Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators. Version 4. Environment Agency, June 2016.

Table 5-4
'Half hourly' Pollutant Emission Rates

Pollutant	Emission Concentration (mg/Nm3)	Daily Average Emission Rate (per stack)	Emission Rate Units
Particulate Matter	30	1.14	g/s
Nitrogen Dioxide	400	15.17	g/s
Carbon Monoxide	150	5.69	g/s
Sulphur Dioxide	200	7.58	g/s
Hydrogen Chloride	60	2.28	g/s
Hydrogen Fluoride	4	0.15	g/s
TOC	20	0.76	g/s

5.5 Abnormal Operating Conditions Scenario

The IED allows for elevated emissions of some pollutants for limited periods of time during 'abnormal operating conditions' from facilities undertaking the incineration of waste. Under such abnormal operating conditions, waste feed to the plant must be stopped and the plant is required to cease the incineration of waste as soon as practicable, within a maximum timeframe of 4 hours. Such abnormal operating conditions are only allowed to occur for 60-hours per year per line:

> *'the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded.*
>
> *The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours.'*

UK data for plant that thermally treat residual municipal solid waste shows that the reported occurrence of abnormal operating conditions (or exceedences of permitted emission limits) is very infrequent (far below the 60-hours allowed for abnormal operating conditions under the IED).

Based on annual reports for similar operational facilities in the UK, the following are considered to be examples of abnormal operating conditions which may lead to 'abnormal emission levels' of pollutants:

- significant variation in waste composition (i.e. very high moisture) promoting poor combustion, leading to CO exceedences;
- reduced efficiency of FGT injection system such as through blockages or failure of pumps leading to elevated acid gas emissions;
- reduced efficiency of particulate filtration system due to bag failure and inadequate isolation, leading to elevated particulate emissions; or
- reduced efficiency of SNCR system as a result of blockages or failure of ammonia injection system, leading to elevated NOx emissions.

The potential impact of plausible abnormal emissions has been investigated using emission concentrations consistent with documented events for mass-burn incineration facilities in the UK and as detailed in available EA decision documents (see Table 5-5 below).

It should be noted that the definition of 'abnormal operating conditions' also encompasses periods where the continuous emission monitoring equipment is not operatively correctly and data relating to the actual emission concentrations are not available. This assessment has only used data where the concentration of continuously monitored pollutants has been quantified. Furthermore no data on flow characteristics (flow rate, temperate etc.) during these abnormal operating conditions is available, so for the purposes of this assessment the design flow characteristics have been applied to the plausible emission levels to derive an emission rate and assess impact.

Table 5-5
Plausible Abnormal Emissions

Pollutant	Permitted Emission (mg/m^3)		Plausible Abnormal Emission (mg/m^3)[a]	% increase above Permitted Emission
	Daily Average	½ hourly max		
Particulate Matter	10	30	150[b]	1400%
Nitrogen Dioxide	200	400	600	200%
Carbon Monoxide	50	150	400	700%
Sulphur Dioxide	50	200	600	1100%
Hydrogen Chloride	10	60	900	8900%
Hydrogen Fluoride	1	4	10	900%
TOC	10	20	100	900%
Group 1 Metal	0.05		0.1	100%
Group 2 Metal	0.05		0.2	300%
Group 3 Metal	0.5		1.5	200%

Table note:
a) Based upon a review of EA decision documents and annual reports for similar facilities.
b) Based upon IED

5.6 RERF Emissions for Cumulative Impact Assessment

The Veolia RERF emission parameters and buildings have been based upon the impact assessment undertaken for the facility[15]. The same approach to pollutant emissions has been adopted as described in Section 5.3.

Table 5-6
RERF Emission Characteristics

Parameter	Stack 1
Stack Location (NGR x/y)	432815/432450
Stack Internal Diameter (m)	1.6
Stack Exhaust Height (m AGL)	75
Volume Flow (Nm^3/s) (273K, 11% O_2, dry)	28.4
Emission Temperature (°C)	140
Oxygen Content (% O_2 dry gas)	9.3

Moisture content (% v/v H_2O)	17.4
Actual Flow Rate (Am^3/s) (wet, at stack conditions)	44.3
Emission velocity (m/s)	22.2

Table 5-7
RERF 'Daily Average' Pollutant Emission Rates

Pollutant	Emission Concentration (mg/Nm^3)	Daily Average Emission Rate (per stack)	Emission Rate Units
Particulate Matter	10	0.284	g/s
Nitrogen Dioxide	200	5.68	g/s
Carbon Monoxide	50	1.42	g/s
Sulphur Dioxide	50	1.42	g/s
Hydrogen Chloride	10	0.284	g/s
Hydrogen Fluoride	1	0.0284	g/s
Organics (TOC)	10	0.284	g/s
Group 1 metals (total)	0.05	1.42	mg/s
Group 2 metal	0.05	1.42	mg/s
Group 3 metals (total)	0.5	14.2	mg/s
Dioxins and furans	0.0000001	2.84	ng/s
Ammonia	8	0.2272	g/s
PCB's	0.005	0.142	mg/s

6.0 PREDICTED AIR QUALITY IMPACTS

6.1 Predicted Long-term Impacts

Predicted long-term impacts are summarised in Table 6-1. The results are the maximum predicted long-term impacts and relate to the highest predicted level of impact at any location on the receptor grid and impacts at all other locations will be lower. Isopleth plots are presented in Appendix A for those PCs that are not insignificant.

The maximum ground level PC is insignificant for the majority of emissions and can be considered insignificant. For those PC's that cannot be considered insignificant the PEC does not exceed standard.

Table 6-1
Predicted Maximum Ground Level Long-term Impacts

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard	PEC (µg/m³)[(a)]	PEC as % Standard
NO_2	40	1.21	3.0%	25.2	63.0%
PM_{10}	40	0.09	0.2%	n/c	n/c
$PM_{2.5}$	25	0.09	0.3%	n/c	n/c
HF (monthly)	16	0.02	0.1%	n/c	n/c
TOC (as Benzene)	5	0.09	1.7%	0.76	15.1%
NH_3	180	0.09	<0.1%	n/c	n/c
Cadmium	0.005	0.0002	4.3%	0.0004	8.3%
Mercury	0.25	0.0004	0.2%	n/c	n/c
Antimony	5	0.0001	<0.1%	n/c	n/c
Arsenic	0.003	0.0002	7.2%	0.0013	43.9%
Chromium (III)	5	0.0008	<0.1%	n/c	n/c
Chromium (VI)	0.0002	1.3E-06	0.6%	n/c	n/c
Lead	0.25	0.0004	0.2%	n/c	n/c
Manganese	0.15	0.0005	0.3%	n/c	n/c
Nickel	0.02	0.0019	9.5%	0.0085	42.5%
Vanadium	5	0.00005	<0.1%	n/c	n/c
PCB	0.2	4E-05	<0.1%	n/c	n/c

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

The NO_2 annual mean process contribution is not insignificant at the point of maximum ground level concentration, although this is not a location of relevant exposure. The impact at receptor locations including the highest impact at an AQMA is presented in Table 6-2. The NO_2 PC is less than 1% of the standard at the assessed human receptor locations and AQMAs.

Table 6-2
Predicted Long-term NO_2 Impacts at Receptor Locations

Receptor	PC (µg/m³)	PC as % Standard
HR1	0.28	0.7%
HR2	0.28	0.7%
HR3	0.37	0.9%
HR4	0.22	0.6%
HR5	0.10	0.2%
HR6	0.10	0.3%
HR7	0.12	0.3%
HR8	0.16	0.4%
HR9	0.09	0.2%
HR10	0.14	0.3%
HR11	0.18	0.4%
Maximum at an AQMA	0.10	0.2%

Table note: PEC not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

The impact at receptors for the other PC's (TOC, As, Cd, and Ni) that are not insignificant at the point of maximum ground level concentration are presented in Table 6-3. At locations where the PC cannot be considered insignificant the PEC does not exceed standard.

Table 6-3
Predicted Long-term Impacts at Receptor Locations

Rec.	TOC PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	Cd PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	As PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	Ni PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL
HR1	0.0201	0.4%	n/c	n/c	0.0001	1.0%	0.0003	5.0%	0.0001	1.7%	0.0012	38.3%	0.0004	2.2%	0.0070	35.2%
HR2	0.0201	0.4%	n/c	n/c	0.0001	1.0%	0.0003	5.0%	0.0001	1.0%	0.0012	38.3%	0.0004	2.2%	0.0070	35.2%
HR3	0.0261	0.5%	n/c	n/c	0.0001	1.3%	0.0003	5.3%	0.0001	1.3%	0.0012	38.8%	0.0006	2.9%	0.0072	35.9%
HR4	0.0159	0.3%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.8%	n/c	n/c	0.0004	1.8%	0.0070	34.8%
HR5	0.0068	0.1%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.3%	n/c	n/c	0.0002	0.8%	n/c	n/c
HR6	0.0075	0.1%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.4%	n/c	n/c	0.0002	0.8%	n/c	n/c
HR7	0.0085	0.2%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.4%	n/c	n/c	0.0002	0.9%	n/c	n/c
HR8	0.0111	0.2%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.6%	n/c	n/c	0.0002	1.2%	0.0068	34.2%
HR9	0.0064	0.1%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.3%	n/c	n/c	0.0001	0.7%	n/c	n/c
HR10	0.0097	0.2%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.5%	n/c	n/c	0.0002	1.1%	0.0068	34.1%
HR11	0.0128	0.3%	n/c	n/c	<0.0001	n/c	n/c	n/c	<0.0001	0.6%	n/c	n/c	0.0003	1.4%	0.0069	34.4%

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

6.2 Predicted Short-term Impacts

Predicted short-term impacts are summarised in Table 6-4. The results presented are the maximum predicted short-term impacts and relate to the highest predicted level of impact at any location on the receptor grid and impacts at all other locations, and at all other times, will be lower. The maximum ground level PCs are insignificant for all emissions.

Table 6-4
Predicted Maximum Ground Level Short-term Impacts

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard
NO_2	200	7.5	3.7%
PM_{10}	50	0.24	0.5%
CO (8-hr)	10000	3.9	<0.1%
CO (1-hr)	30000	14.6	<0.1%
SO_2 (24-hr)	125	2.0	1.6%
SO_2 (1-hr)	350	5	1.5%
SO_2 (15-min)	267	11	4.1%
HCl	750	2.9	0.4%
HF	160	0.29	0.2%
NH_3	2500	2.9	0.1%
Mercury	7.5	0.01	0.2%
Antimony	150	0.003	<0.1%
Chromium (III)	150	0.03	<0.1%
Copper	200	0.01	<0.1%
Manganese	1500	0.02	<0.1%
Vanadium	1	0.002	0.2%
PCB	6	1.5E-03	<0.1%

6.2.1 Impacts from Half Hourly Emission Limits

In addition to the daily average emission limits assessed, the IED also stipulates half-hourly emission limit values with the 97th percentile at levels above the daily average levels. The significance of the half-hourly emission limits has been investigated for NO_2, SO_2, HCl and HF that have Standards set on an hourly average period but not for standards based on 24-hour or longer averaging periods that would not be significantly affected by the half-hourly IED emission limit. Even with the highly conservative (worst case) assumption that allowable elevated emissions coincide with the worst case meteorological conditions for dispersal over the year, the PC's are insignificant with the one exception (SO_2 15-minute averaging period) for which the PEC remains well below the Standard.

Table 6-5
Maximum Impacts using Half-hourly IED Chapter IV Limits

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard	PEC (µg/m³)[(a)]	PEC as % Standard
NO_2	200 (1-hr 99.89%ile)	15.0	7.5%	n/c	n/c
CO	30,000 (1-hr)	43.8	0.1%	n/c	n/c
SO_2	350 (1-hr 99.73%ile)	20.6	5.9%	n/c	n/c
SO_2	266 (15-min 99.9%ile)	44.3	16.6%	46.6	17.4%
HCl	750 (1-hr maximum)	17.5	2.3%	n/c	n/c
HF	160 (1-hr maximum)	1.17	0.7%	n/c	n/c

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 10% or above.

6.3 Impacts from Plausible Abnormal Emissions

Table 6-6 presents the potential short-term impacts from the plausible abnormal emissions scenario. Even with the highly conservative (worst case) assumption that abnormal emissions coincide with the worst case meteorological conditions for dispersal over the year, the PC's are insignificant with the six exceptions for which PECs remain well below the Standard.

Table 6-6
Predicted Maximum Ground Level Short-term Impacts (Abnormal Emissions)

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard	PEC (µg/m³)[(a)]	PEC as % Standard
NO_2	200 (1-hr 99.89%ile)	22.5	11.2%	70	35.2%
PM_{10}	50 (24-hr 90.4%ile)	3.60	7.2%	n/c	n/c
CO	10,000(8-hour)	31.3	0.3%	n/c	n/c
CO	30,000 (1-hr)	116.8	0.4%	n/c	n/c
SO_2	125 (24-hr 99.18%ile)	23.7	19.0%	26	20.8%
SO_2	350 (1-hr 99.73%ile)	62	17.6%	64	18.3%
SO_2	266 (15-min 99.9%ile)	133	49.8%	135	50.6%
HCl	750	262.7	35.0%	263.5	35.1%
HF	160	2.92	1.8%	n/c	n/c
Mercury	7.5	1.46	19.5%	1.46	19.5%
Antimony	150	0.02	0.0%	n/c	n/c
Chromium (III)	150	0.13	0.1%	n/c	n/c
Copper	200	0.04	0.0%	n/c	n/c
Manganese	1500	0.09	0.0%	n/c	n/c
Vanadium	1	0.01	0.9%	n/c	n/c
PCB	6	2.9E-06	0.0%	n/c	n/c

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 10% or above.

In order to assess the effect on long-term ground level concentrations associated with the plant operating at the identified plausible abnormal emission levels; the calculated long-term ground level concentrations have been increased pro-rata according to Table 5-5. This assumes that the plant is operating at the daily average IED emission limits for 8700 hours per year and at the plausible abnormal emission levels for 60-hours per year. Given this low frequency of occurrence, the plausible abnormal emissions are predicted to have little effect on long-term impacts as shown in Table 6-7.

Table 6-7
Predicted Maximum Ground Level Long-term Impacts (Abnormal Emissions)

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard	PEC (µg/m³)[a]	PEC as % Standard
NO_2	40	1.2	3.1%	25.2	63.1%
PM_{10}	40	0.09	0.2%	n/c	n/c
$PM_{2.5}$	25	0.09	0.4%	n/c	n/c
HF (monthly)	16	0.01	0.1%	n/c	n/c
TOC (as Benzene)	5	0.09	1.8%	0.76	15.2%
Cadmium	0.005	0.0002	4.4%	0.0004	8.4%
Mercury	0.25	0.0007	0.3%	n/c	n/c
Antimony	5	0.0001	<0.1%	n/c	n/c
Arsenic	0.003	0.0002	7.4%	0.0013	44.1%
Chromium (III)	5	0.0008	<0.1%	n/c	n/c
Chromium (VI)	0.0002	1.3E-06	0.7%	n/c	n/c
Lead	0.25	0.0004	0.2%	n/c	n/c
Manganese	0.15	0.0005	0.4%	n/c	n/c
Nickel	0.02	0.0020	9.8%	0.0086	42.8%
Vanadium	5	0.0001	<0.1%	n/c	n/c

Table Note:
n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

6.4 Predicted Impacts at Sensitive Ecosystems

6.4.1 Critical Levels

The predicted impacts on C_{Le} at the identified ecological sites are presented in Table 6-8 and Table 6-9. The findings are that the PC's are less than 100% of the C_{Le} at the LNR and LWS and therefore the impact is considered insignificant and will cause *'no significant pollution'*.

Table 6-8
Predicted Impacts on Long-term Critical Levels

Site	PC SO_2 (µg/m³)	PC as % C_{Le}	PC NO_x (µg/m³)	PC as % C_{Le}	PC NH_3 (µg/m³)	PC as % C_{Le}

ER1	0.36	2%	1.43	5%	0.07	2%
ER2	0.05	<1%	0.18	<1%	0.01	<1%

Table 6-9
Predicted Impacts on Short-term Critical Levels

Site	PC NO_x Daily (µg/m³)	PC as % C_{Le}	PC HF Daily (µg/m³)	PC as % C_{Le}	PC HF Weekly (µg/m³)	PC as % C_{Le}
ER1	7.8	10%	0.04	1%	0.02	4%
ER2	3.6	5%	0.02	<1%	0.01	2%

6.4.2 Critical Loads

The predicted impact on C_{Lo}'s at the identified ecological sites for nitrogen and acid deposition are presented in Table 6-10 and Table 6-11 respectively. The findings are that the PC's are less than 100% for the LNR and LWS therefore the impact is considered insignificant and will cause *'no significant pollution'*.

Table 6-10
Predicted Impacts on Nitrogen Critical Loads

Site	PC N (kg/ha/yr)	Applied C_{Lo}	PC as % C_{L0}
ER1	0.85	10	8.5%
ER2	0.11	10	1.1%

Table 6-11
Predicted Impacts on Acid Critical Loads

Site	PC N (kg/ha/yr)	PC S (kg/ha/yr)	Applied C_{Lo} CLmaxN (kg/ha/yr)	PC as % C_{L0} (PC S + N as % CLmaxN)
ER1	0.060	0.121	1.643	11.1%
ER2	0.008	0.016	2.857	0.8%

6.5 Cumulative Impact Assessment with RERF

For those Skelton Grange EfW PCs that are not insignificant, the cumulative impact with the Veolia RERF has been predicted. The predicted long-term impacts are summarised in Table 6-12. The PEC does not exceed the relevant standards.

Table 6-12
Predicted Cumulative Maximum Ground Level Long-term Impacts

Pollutant	Standard (µg/m³)	PC (µg/m³)	PC as % Standard	PEC (µg/m³)[a]	PEC as %

					Standard
NO_2	40	1.48	3.7%	25.5	63.7%
TOC (as Benzene)	5	0.11	2.1%	0.78	15.5%
Cadmium	0.005	0.0003	5.3%	0.0005	9.3%
Arsenic	0.003	0.0003	8.8%	0.0014	45.5%
Nickel	0.02	0.0023	11.6%	0.0089	44.6%

The cumulative impact at receptor locations including the highest impact at an AQMA is presented in Table 6-13. The PEC does not exceed the relevant standards.

Table 6-13
Predicted Cumulative Long-term NO_2 Impacts at Receptor Locations

Receptor	PC (µg/m³)	PC as % Standard	PEC (µg/m³)	PEC as % Standard
HR1	0.7	1.7%	24.7	62%
HR2	0.5	1.1%	24.5	61%
HR3	0.5	1.3%	24.5	61%
HR4	0.3	0.7%	24.3	61%
HR5	0.1	0.3%	n/c	n/c
HR6	0.2	0.4%	n/c	n/c
HR7	0.2	0.5%	n/c	n/c
HR8	0.3	0.8%	n/c	n/c
HR9	0.2	0.5%	n/c	n/c
HR10	1.2	3.0%	25.2	63%
HR11	0.3	0.8%	n/c	n/c
Max at an AQMA	0.2	0.4%	n/c	n/c

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

The Skelton Grange EfW PC's (TOC, As, Cd, and Ni) that are not insignificant at the point of maximum ground level concentration have been combined with the RERF PC's to present a cumulative impact assessment in Table 6-14. The findings are that the PEC does not exceed the standard at any receptor location.

Table 6-14
Predicted Cumulative Long-term Impacts at Receptor Locations

Rec.	TOC PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	Cd PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	As PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL	Ni PC (µg/m³)	% EAL	PEC (µg/m³)	PEC as % EAL
HR1	0.0472	0.9%	n/c	n/c	0.0001	2.4%	0.0003	6.4%	0.0001	3.9%	0.0012	40.6%	0.0010	5.2%	0.0076	38.2%
HR2	0.0327	0.7%	n/c	n/c	0.0001	1.6%	0.0003	5.6%	0.0001	1.6%	0.0012	39.4%	0.0007	3.6%	0.0073	36.6%
HR3	0.0358	0.7%	n/c	n/c	0.0001	1.8%	0.0003	5.8%	0.0001	1.8%	0.0012	39.7%	0.0008	3.9%	0.0074	36.9%
HR4	0.0199	0.4%	n/c	n/c	0.0000	1.0%	0.0002	5.0%	0.0000	1.0%	0.0011	38.3%	0.0004	2.2%	0.0070	35.2%
HR5	0.0088	0.2%	n/c	n/c	0.0000	0.4%	n/c	n/c	0.0000	0.4%	n/c	n/c	0.0002	1.0%	0.0068	34.0%
HR6	0.0118	0.2%	n/c	n/c	0.0000	0.6%	n/c	n/c	0.0000	0.6%	n/c	n/c	0.0003	1.3%	0.0069	34.3%
HR7	0.0143	0.3%	n/c	n/c	0.0000	0.7%	n/c	n/c	0.0000	0.7%	n/c	n/c	0.0003	1.6%	0.0069	34.6%
HR8	0.0220	0.4%	n/c	n/c	0.0001	1.1%	0.0003	5.1%	0.0001	1.1%	0.0012	38.5%	0.0005	2.4%	0.0071	35.4%
HR9	0.0154	0.3%	n/c	n/c	0.0000	0.8%	0.0002	4.8%	0.0000	0.8%	n/c	n/c	0.0003	1.7%	0.0069	34.7%
HR10	0.0867	1.7%	0.757	15.1%	0.0002	4.3%	0.0004	8.3%	0.0002	4.3%	0.0013	43.9%	0.0019	9.5%	0.0085	42.5%
HR11	0.0226	0.5%	n/c	n/c	0.0001	1.1%	0.0003	5.1%	0.0001	1.1%	0.0012	38.5%	0.0005	2.5%	0.0071	35.5%

Table note: n/c = not calculated: following AERA guidance the PEC has only been calculated where the PC is 1% or above.

7.0 MODEL SENSITIVITY ASSESSMENT

The sensitivity of a dispersion model is defined in the UK Atmospheric Dispersion Modelling Committee (ADMLC) guidance[20] as the differential of model output by model input. In accordance with EA guidance the following key input variables were subject to sensitivity analysis:

- meteorological data, such as different weather stations, inter-annual variation and surface characteristics;
- emission parameters;
- the receptor grid resolution; and
- treatment of terrain and buildings.

Therefore, in order to investigate the sensitivity of the dispersion model to relation the input parameters stated above the following scenarios were investigated:

- Sensitivity 0 - Baseline, 2017 meteorological data (meteorological data that gave peak long-term impacts);
- Sensitivity 1 - increased temperature by 30ºC. All other parameters unchanged;
- Sensitivity 2 - decreased temperature by 30ºC. All other parameters unchanged;
- Sensitivity 3 - increased discharge velocity by 10%. Normalised flow (and mass emission) remains as baseline;
- Sensitivity 4 - decreased discharge velocity by 10%. Normalised flow (and mass emission) remains as baseline;
- Sensitivity 5 - Flat terrain;
- Sensitivity 6 - No buildings;
- Sensitivity 7 - higher receptor grid resolution (closer spacing resolution doubled);
- Sensitivity 8 - Met Data Preparation: Increased Roughness (Z_0 = 1); and
- Sensitivity 9 - Met Data Preparation: Decreased Roughness (Z_0 = 0.001).

Inter-annual variation in the meteorological data results in annual mean NO_2 ranges from 1.1µg/m³ to 1.6µg/m³ and 1-hour mean (99.9%ile) from 7.7µg/m³ to 11.7µg/m³.

The results are summarised in Table 7-1 for NO_2 annual and 1-hour (99.79%ile) means. None of the variations in the parameters investigated leads to a breach of the NO_2 standards. The level of variation is broadly applicable to other pollutants, on the basis of which it can be concluded that the level of variation in the parameters investigated would not lead to exceedances of standards.

Table 7-1
Model Sensitivity Assessment

Scenario	Max GLC ST NO_2 (µg/m³)	PC as % of Standard	PEC (µg/m³)	PEC as % of Standard	Max GLC LT NO_2 (µg/m³)	PC % of Standard	PEC (µg/m³)	PEC as % of Standard
0	8.2	4.1%	56	28.1%	1.6	3.9%	25.6	63.9%
1	7.8	3.9%	56	27.9%	1.5	3.6%	25.5	63.6%

[20] Guidelines for the Preparation of Dispersion Modelling Assessment for Compliance with Regulatory Requirements – an update to the 1995 Royal Meteorological Society guidance. UK Atmospheric Dispersion Modelling Committee (ADMLC), Version 1.4, 2004

2	9.0	4.5%	57	28.5%	1.7	4.3%	25.7	64.3%
3	7.8	3.9%	56	27.9%	1.5	3.6%	25.5	63.6%
4	8.9	4.5%	57	28.5%	1.7	4.2%	25.7	64.2%
5	8.3	4.1%	56	28.1%	1.6	3.9%	25.6	63.9%
6	5.6	2.8%	54	26.8%	0.9	2.3%	24.9	62.3%
7	8.5	4.2%	56	28.2%	1.6	3.9%	25.6	63.9%
8	5.9	3.0%	54	27.0%	1.6	4.0%	25.6	64.0%
9	18.2	9.1%	66	33.1%	1.0	2.5%	25.0	62.5%

8.0 Conclusions

The conclusions of the detailed atmospheric dispersion modelling assessment of the EFW combustion emissions are as follows:

- there are no predicted exceedances of short-term or long-term standards at the point of maximum ground level impact or at relevant exposure locations for any of the scenarios assessed;
- the predicted impact on designated sensitive habitats are considered insignificant and will cause *'no significant pollution'* according to EA/Natural England guidance; and
- the model sensitivity assessment indicates none of the variations in the parameters investigated lead to exceedances of the standards or any material change to the overall conclusions of the assessment.

APPENDIX A

Process Contribution Isopleths

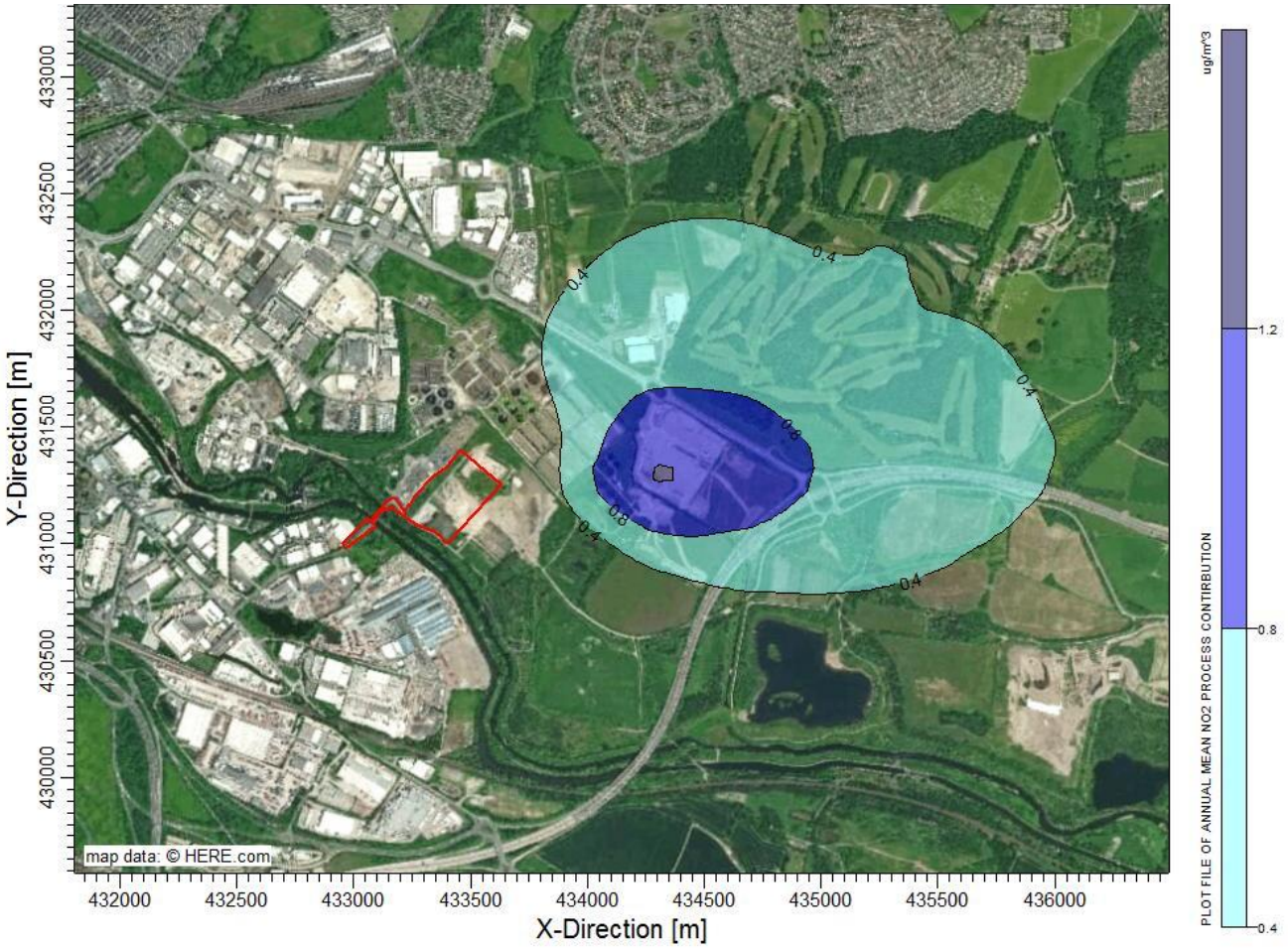

Figure A-1
Plot of NO_2 Annual Mean Process Contribution

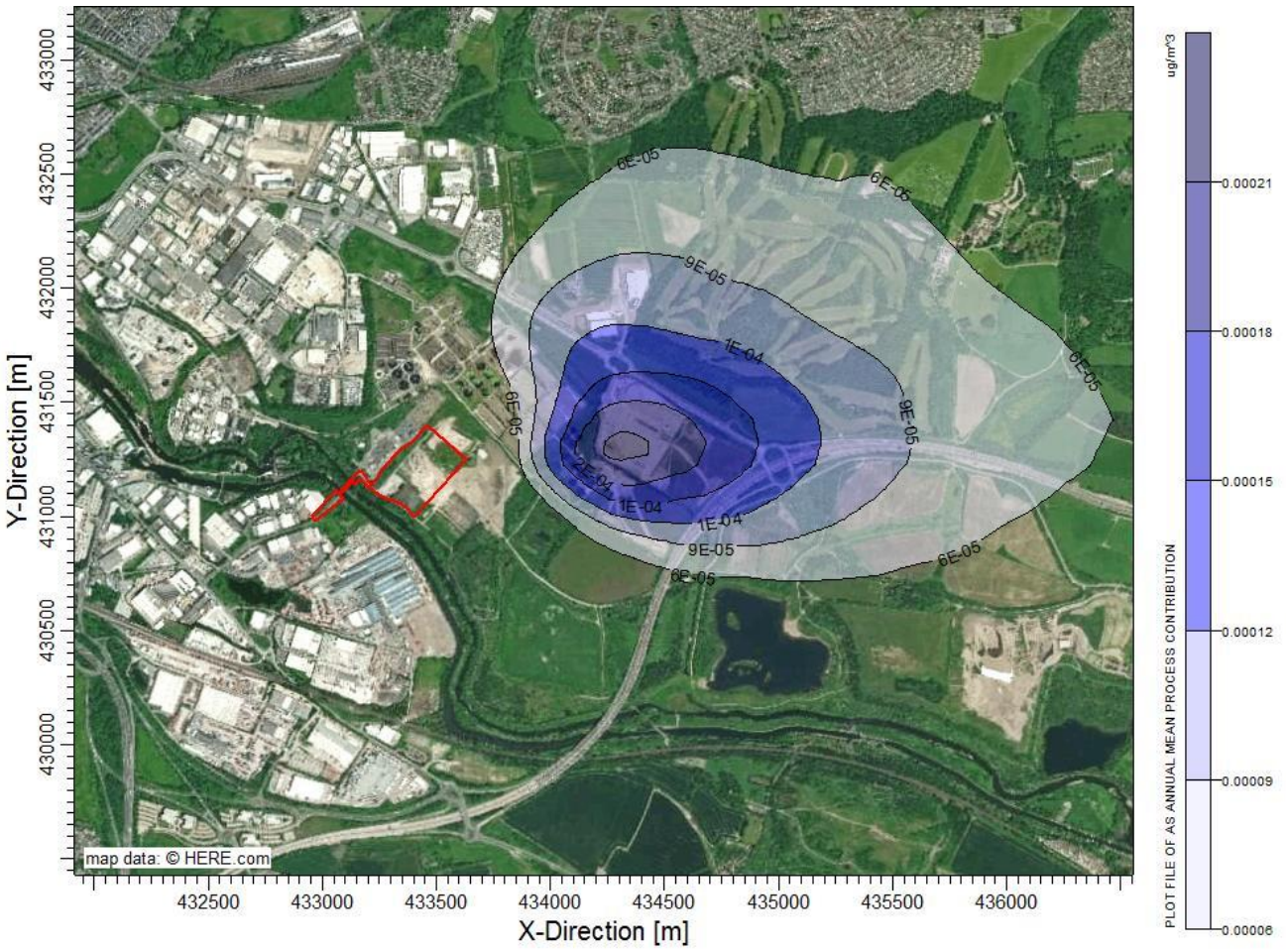

Figure A-2
Plot of Arsenic Annual Mean Process Contribution

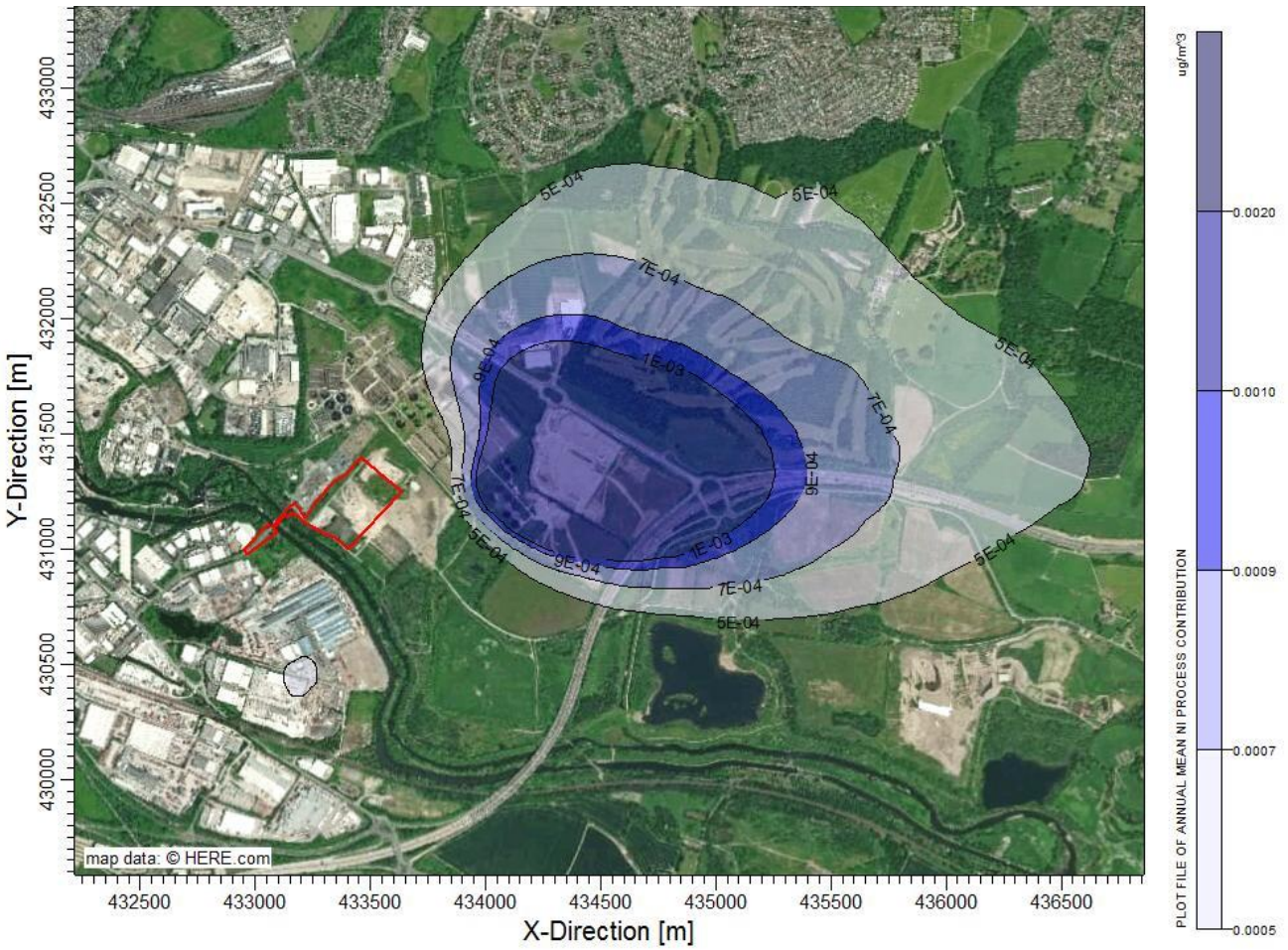

Figure A-3
Plot of Nickel Annual Mean Process Contribution

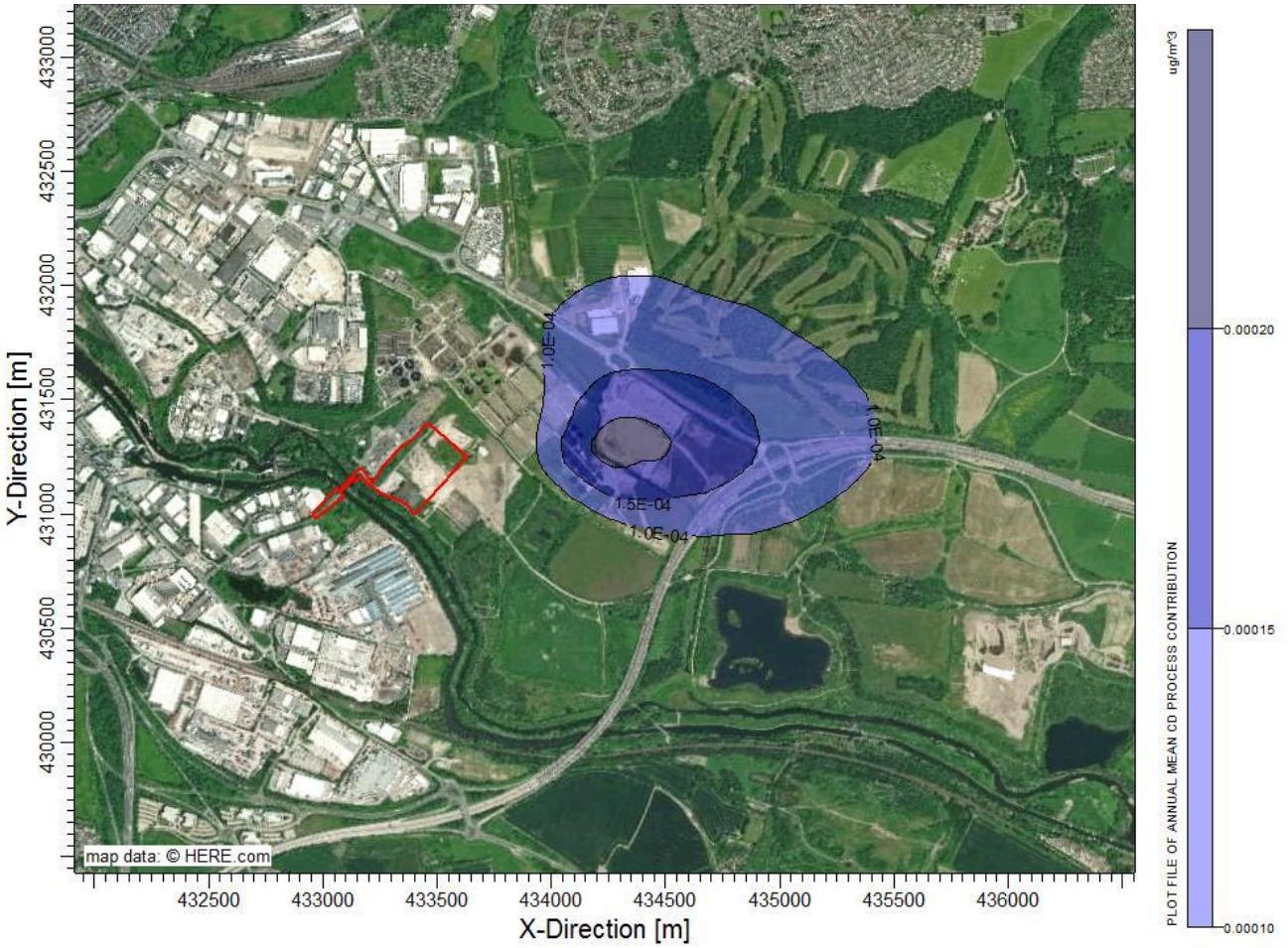

Figure A-4
Plot of Cadmium Annual Mean Process Contribution

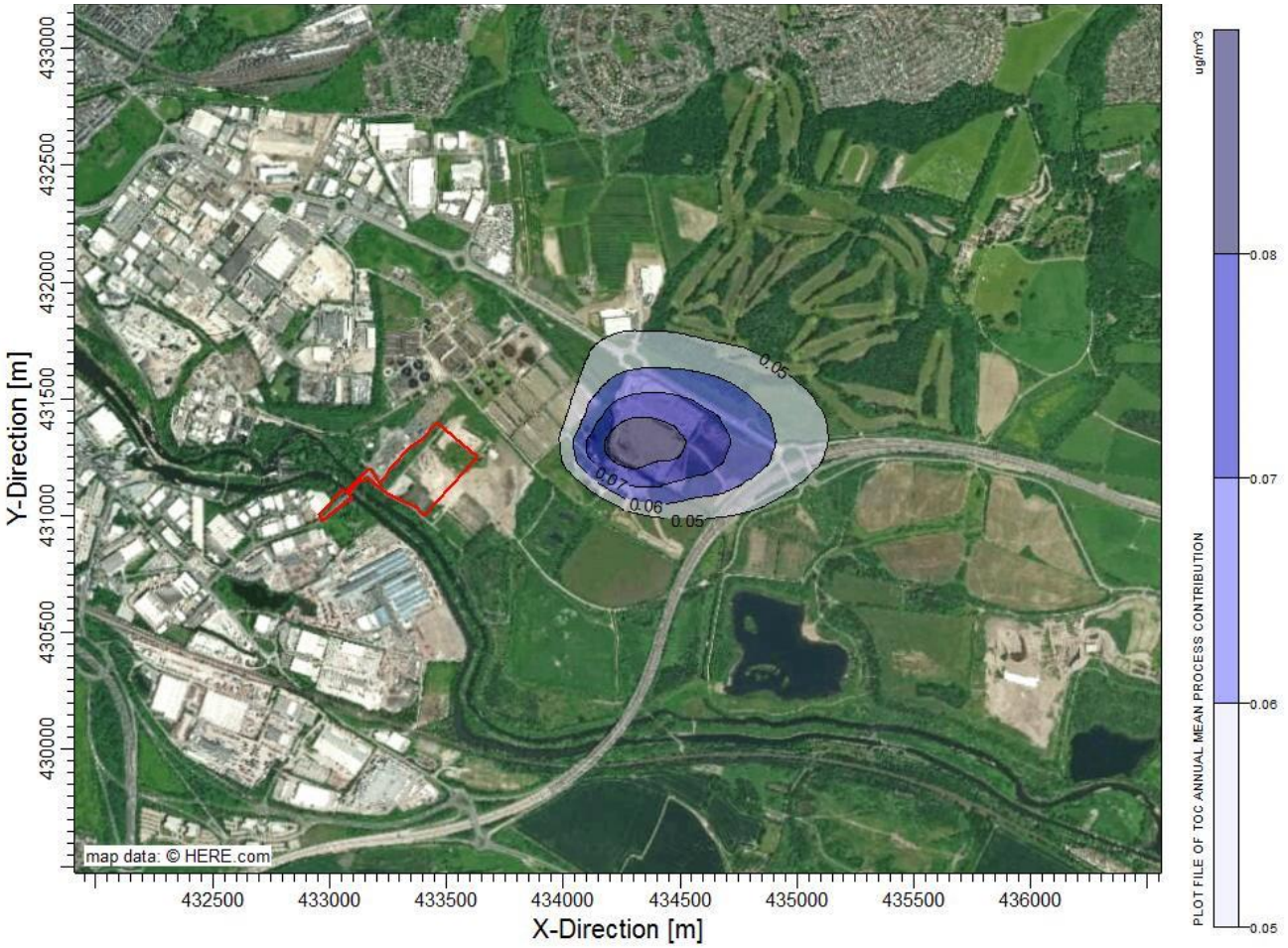

Figure A-5
Plot of TOC Annual Mean Process Contribution

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APPENDIX ERA 3

Odour Management Plan

SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Appendix ERA 3: Odour Management Plan

Prepared for: WTI EfW Holdings Limited

SLR Ref: 416.07232.00002.
Version No: 1
August 2019

BASIS OF REPORT

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CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

DRAWINGS

Drawing 001	Site Location Plan
Drawing 002	Environmental Permit Boundary & Site Layout
Drawing 003	Sources, Pathways and Receptors
Drawing 004	Cultural and Natural Heritage

1.0 Introduction

WTI EfW Holdings Limited has instructed SLR Consulting Limited (SLR) to prepare an Environmental Permit (EP) application for the proposed Skelton Grange Energy from Waste (EfW) Facility in Skelton Grange, near, Leeds under the Environmental Permitting (England and Wales) Regulations 2016 (as amended). The facility will be operated by WTI UK Ltd (WTI).

This document is an Appendix to the Environmental Risk Assessment carried out as part of the EP application. The purpose of this Odour Management Plan (OMP) is to identify potential sources of odour from the proposed facility, the receptors which might be impacted and associated pathways and to demonstrate that the proposed control measures will prevent and minimise significant impacts.

1.1 Proposed Operations

WTI propose to operate a new EfW facility at Skelton Grange. The EfW Facility will process municipal solid waste, commercial, industrial, sewage sludge and non-infectious clinical waste at a capacity of up to 410,000 tonnes per annum.

The technology will be based on conventional thermal incineration comprising moving grate furnace, steam boiler and turbine generator to produce electricity and the potential to recover waste heat.

The operation will process waste 24 hours a day, 365 days a year.

1.2 Report Context

This OMP outlines the methods by which WTI will assess, reduce and prevent potentially odorous emissions from the EfW facility at Skelton Grange during commissioning, normal operations and during future abnormal events.

This OMP will consider sources, releases and impacts, and review these to identify cost-effective opportunities for odour management.

The OMP should be read in conjunction with the following documents submitted with this EP application:

- Non-Technical Summary; and
- Drawings
    - 001 Site Location Plan
    - 002 Environmental Permit Boundary & Site Layout
    - 003 Sources, Pathways and Receptors
    - 004 Cultural and natural Heritage
    - 005 Site Drainage Layout

2.0 Odour Regulation

The following guidance has been reviewed and followed for the development of this OMP:

- EA H4 Odour Management (April 2011) – how to comply with your environmental permit guidance;
- EA Control and Monitor emissions for your environmental permit guidance (February 2016);
- EA S5.06 guidance (May 2013); and
- IAQM (July 2018) Guidance on the assessment of odour for planning.

2.1 Objectives of regulations

The EA H4 Odour Management guidance provides three pollution prevention objectives to be developed within OMP's:

- Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution;
- Prevent unacceptable odour pollution at all times; and
- Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

The OMP is a working document and should:

- Clearly demonstrate the operator's competence and commitment to controlling odour pollution;
- Provide an understanding of how processes could give rise to odour pollution;
- Detail capabilities to manage the risks of odour pollution effectively; and
- Review the effectiveness of the odour control measures once a year, following a complaint or relevant changes to the operation.

The guidance suggests that an OMP should contain the following elements:

- An assessment of the risks of odour problems, from normal and abnormal situations, including worst case scenarios, for example of weather, temperature, or breakdowns, as well as accident scenarios;
- The appropriate controls (both physical and management) needed to manage those risks;
- Suitable monitoring;
- Actions, contingencies and responsibilities when problems arise;
- Regular review of the effectiveness of your odour control measures; and
- Emission limits (where appropriate).

The OMP is also required to include clear statements to demonstrate that the operator understands and accepts its responsibilities. In particular, it should show:

- That WTI, either directly or through its contractors or subcontractors, will ensure that any odour control equipment is designed, operated and maintained such that it operates effectively to control odour at all times;
- That WTI is familiar with the characteristics of the processes and equipment on site and have identified the areas of risk of emissions from odour;
- How WTI will reduce or cease operations if necessary to avoid serious odour pollution;
- How WTI will engage with neighbours to minimise their concerns and complaints; and
- How WTI will respond to complaints.

3.0 Sources, releases and impacts

This section provides an inventory of potential odour sources, release points, pathways and receptors relevant to the EfW Facility.

3.1 Potential Odour Sources

The application of good working practices and process control is of fundamental importance in eliminating and minimising the quantities of odours formed on Site and their subsequent release to atmosphere. This section identifies all potential sources of odour on Site during normal operations.

WTI will operate in accordance with legislation and procedures as detailed in the Best Available Techniques, Operating Techniques report (BAT-OT) included in section 7 of this EP application.

3.1.1 Received waste

The EfW will process municipal solid waste, commercial and industrial waste, sewage sludge and non-infectious clinical waste at a capacity of up to 410,000 tonnes per annum. Table 3-1 below identifies the potential primary chemical odorants that may be present in these types of waste. All waste received on Site will be in vehicles which are covered /sheeted or otherwise contained. A list of wastes is included as appendix B3_1.

Table 3-1
Wastes – Primary Chemical Odorants

Source	Primary Chemical Odorants
Green waste	Terpenes, amines, aromatics, ammonia.
Food	Putrecine, cadaverine, amines, sulphides, ammonia.
Oils	Aromatics, toluene, xylene.
Sewage sludge	Ammonia, sulphides.

3.1.2 Storage of waste

Although the waste bunker can hold up to 5 days of waste, under normal operations the volume of waste in the bunker will be below this. The storage of waste within the waste bunker will be maintained in line with the waste bunker management procedures to ensure older waste is processed first and waste is mixed if necessary to minimise the likelihood of anaerobic conditions developing and potential odours.

3.1.3 Incinerator Bottom Ash (IBA)

The IBA will not be a source of offensive odour as the incineration process will ensure a very high degree of burnout. It will be stored in the IBA bunker before removal offsite on a vehicle which is covered /sheeted or otherwise contained.

3.2 Release points

The release points for the odour sources identified above are described in Table 3-2. The release points consider all unintentional non-emergency releases that may occur. Emergency scenarios are addressed in section 7.

Table 3-2
Release points

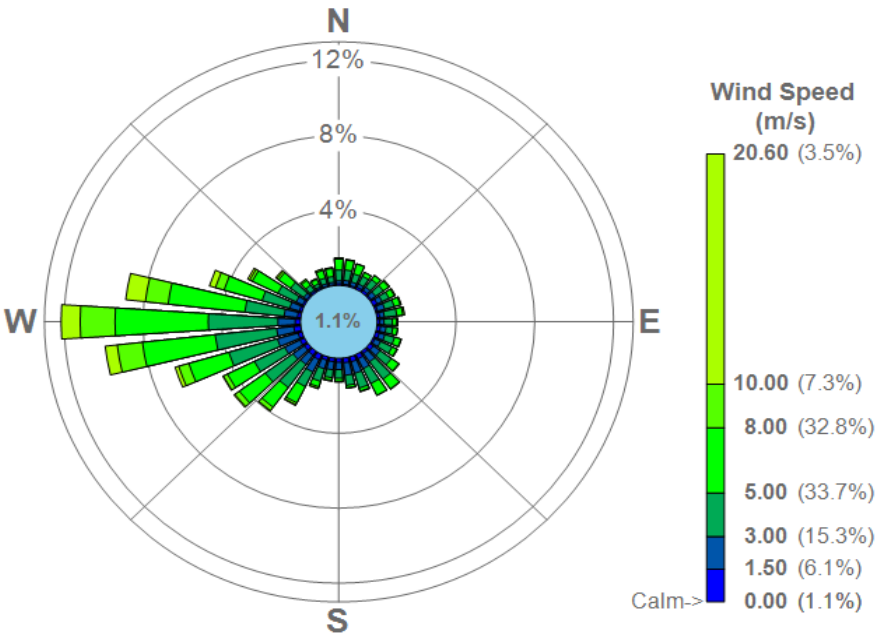
Source / release point	Odour risk	Equipment required to reduce odour pollution
Delivery of waste	High	Covered/sheeted or otherwise contained delivery vehicle
Unloading of waste	High	Fast acting roller shutter doors
Storage of waste	High	Containment with negative pressure
Removing IBA from Site	Low	None, Non-odorous waste.
Surface water drainage	Low	Separate drainage and collection system for areas handling waste, with run-off stored on site in appropriate tank/s before being used in the process.

3.3 Pathways

The pathway by which odours may impact upon receptor locations is a result of atmospheric dispersion. In general, high wind speeds lead to emitted odour being rapidly dispersed and diluted due to the turbulence, and low wind speeds inhibit the dilution of odours.

Figure 1-1 shows the wind patterns (wind speed and direction) in 2017 as identified by the Leeds Bradford meteorological station. The most prominent wind direction is from the west to the east. Winds from all other directions are relatively infrequent.

Figure 3-1
Leeds Bradford Meteorological Station, 2017



3.4 Receptors

The likelihood and frequency of exposure to odour arising from the EfW facility is determined by the magnitude of release, the prevailing meteorological conditions, and the distance and direction of receptors in relation to the Site.

The Site is situated in Skelton Grange, near Leeds within an area predominately occupied by commercial/industrial premises, sewage works, derelict ground and areas of woodland/open ground. The Site's location is illustrated on drawing 001. The surrounding land uses and local receptors within 500m and cultural and natural heritage receptors within 2km are illustrated on drawings 003 and 004.

A summary of the Site's immediate surrounding land uses is identified in Table 3-3 below.

Table 3-3
Surrounding Land Uses

Boundary	Description
North	Mix of commercial/industrial premises and derelict land. Beyond is Knostrop sewage works facility.
East	The majority of the land to the east is derelict ground with woodland/open ground beyond.
South	Adjacent to the south of the Site is woodland/open ground, the River Aire and Aire & Calder Navigation, with predominately commercial/industrial premises beyond.
West	To the west of the Site is commercial/industrial premises, a recreational/educational facility and areas of woodland/open ground.

There are two potentially sensitive receptors within 500m of the Site's boundary, the two recreational facilities located to the southwest of the Site.

4.0 Odour Control Measures

Odour management at Skelton Grange EfW Facility will be based on the following principles:

- The facility will be designed to be enclosed with the waste bunker and treatment occurring within the confines of the building;
- The building will be designed and constructed to minimise fugitive emissions; and
- Operation of the EfW Facility will be carried out to prevent and mitigate nuisance from odours.

This section presents the principles of controlling odour generation and release at the facility and the specific control and management measures to be employed at the facility. This includes measures to control the generation and release of odorous chemicals from the above sources, abatement and dispersion of releases, and plans for mitigation of community impacts.

4.1 Managing inventory

All waste accepted on Site will be subjected to strict waste acceptance procedures to ensure all waste conforms to the agreed Waste Acceptance Criteria (WAC). Waste deliveries will be subject to routine inspections to identify potentially odorous materials. Waste deemed potentially odorous will be prioritised for processing.

The holding time of waste material stored prior to processing is a significant factor in a Site's potential odour generation. The waste bunker can hold a maximum of 5 days of waste deliveries; however, the waste bunker will be kept lower than the maximum capacity during normal operations and managed in accordance with the waste bunker management procedures.

Combustion air for the furnace is extracted from the tipping hall and all flue gas emissions are ultimately released through the main stack. In this way negative pressure is maintained within the building and odours are completely oxidised.

The waste bunker management procedures will ensure odours are minimised and all waste documentation will be recorded and securely stored.

4.2 Controlling evaporation

In order to reduce odorous chemicals their rate of evaporation must be reduced. This can be achieved by:

- **Lowering the temperature –** All waste delivered and stored onsite is within a closed building, therefore reducing the exposure to direct sunlight and keeping the temperature down;
- **Reduce airflow over the surface –** All waste delivered and stored onsite is within a closed building, therefore reducing the exposure to atmospheric conditions. The waste bunker is also installed with an extraction system;
- **Reduce the surface area –** All waste will be delivered to the waste bunker where waste will be contained to avoid increasing surface areas; and
- **Avoid disruptive activities –** Once the waste has been delivered to the waste bunker it will be mixed before being processed.

4.3 Containment and abatement

It is essential that the integrity of the fabric of the main processing building is maintained continuously, other than during periods of essential maintenance. The effective operation of rapid reaction roller doors will be therefore checked routinely.

Routine inspections will be carried out across the facility to ensure complete containment and identify any fugitive emissions.

The by-products from reactions within the process will be captured in fabric filters as air pollution control residues (APCR). The treated flue gases then leave the facility through the stacks.

4.4 Dispersion

Meteorological conditions will be monitored regularly to assess potential increases in odours at the Site.

The Site will be designed to ensure the height of the stacks is sufficient to enable any odour emissions to disperse before reaching the ground.

Two potentially sensitive receptors are located within 500m of the Site's boundary, which are identified on drawing 003. The two receptors are however not situated within the predominant wind direction.

4.5 Reducing impacts

The following measures will be adopted to ensure a 'good neighbour' approach with the local community:

- Engagement with the local communities and methods of engagement with the wider public will consider use of newsletters, website announcements and open days on a case by case basis;

- Site telephone numbers will be made available;
- Responding to odour complaints promptly and keeping complainants informed of the investigation and outcomes; and
- Meetings to be held with local communities if required.

Periodic odour inspections will be carried out, particularly in favourable odorous conditions and all details will be recorded.

5.0 Monitoring

Monitoring of process controls, odour containment and abatement performance, odorous releases and dispersion pathways as described in the sections below are undertaken.

The Site Manager (or deputy) will have responsibility for ensuring that nuisances and hazards arising from the facility due to odour are minimised. Throughout construction, commissioning and ongoing operations site management will consider potential aspects that could generate odorous site emissions.

5.1 Effectiveness of Odour Containment and Abatement Measures

5.1.1 Sources of Odour Emission

The effectiveness of odour control at the Site is reliant on emissions from major odour sources being effectively contained within the building and being extracted with combustion air used in the furnace.

If fugitive emissions from the Site are identified as being responsible for unacceptable offsite odour impacts, a review of the design will be undertaken to identify if adequate containment/extraction is being provided.

5.1.2 Containment System Monitoring

The effectiveness of the containment system relies on keeping the fast-acting doors closed whenever they are not in use. This is monitored in the following ways:

- Doors will be manually operated to ensure they are only open when a vehicle is entering or leaving the tipping hall; and
- The doors will be inspected on a routine basis by site personnel and the findings documented.

5.2 Monitoring Odorous Releases

Odour monitoring can be carried out in the following ways:

- Sniff testing;
- Meteorological monitoring;
- Complaints monitoring;
- Odour diaries;
- Surrogate chemicals or process parameters;
- Emissions monitoring from a point of discharge; and
- Grab samples of source emissions that are subsequently tested within a lab.

The below sections detail the various odour monitoring measures in place for the Site.

5.2.1 External Procedure – Sniff testing

External checks will take place twice daily as a minimum under normal operating conditions. When there may be shortened working hours (e.g. during scheduled shut downs) the checks will take place on a pro-rata basis according to the number of operational hours.

Nominated site personnel will complete the checks using sensory field odour assessments (Sniff Testing) based on the EA Sniff Test protocol within the EA H4 guidance.

Sniff testing is completed in the following circumstances:

- Survey along the Site's boundary during normal operation, this will confirm the effective performance of odour control measures in place;
- Survey along the Site's boundary during periods of adverse meteorological conditions, abnormal operations or breakdowns to evaluate the effectiveness of the control measures in place and the likelihood of potential odour complaints; and
- If complaints are received, the locations of complaint and potential sensitive receptors.

The Sniff testing assessments are based on the EA Sniff Test protocol within the EP H4 Guidance.

5.2.2 Meteorological monitoring

Meteorological conditions will be monitored regularly to assess potential increases in odours at the Site. The following parameters will be recorded as a minimum;

- Wind speed;
- Wind direction;
- Temperature; and
- Precipitation rates.

5.2.3 Monitoring Impacts – complaints

Monitoring odour impacts will be achieved by monitoring and recording complaints. Complaints may be reported directly to the Site or via the EA 24-hr line.

Complaints records will include:

- Date;
- Time;
- Nature of complaint;
- Locality of the complaint (postcode, grid reference, street);
- Description of the odour observed (intensity, character, frequency, duration);
- Name of complainant;
- Potential source of the odour;
- A summary of investigations undertaken;
- Actions taken; and
- An Outcome.

In the event of frequent complaints (nature and/or volume of complaints) offsite olfactory monitoring will be undertaken until the cause is identified and resolved.

5.2.4 Record Keeping

Daily records will be maintained and will include the following details:

- Results of inspections and any olfactory monitoring carried out by site personnel;
- Weather conditions, including wind speed and direction;
- Operational problems, including date, time, duration and cause of problem;
- Complaints received; and
- Details of corrective action taken, and any subsequent changes to operational procedures.

6.0 Contingencies

In accordance with guidance on odour management plans, contingency plans have been defined to react to situations where monitoring indicated that a potential odour source is not completely under control, meteorological conditions are unfavourable or that adverse impact has occurred. This includes accidents or incidents which would result in the loss of control of odorous substances and have the potential to cause an unacceptable short-term impact on the local community but are not considered an emergency situation. These situations have been identified as follows:

6.1 Receipt of particularly odorous wastes;

If the Site accepts particularly odorous waste, the waste will take priority for processing and:

- Be isolated and promptly processed;
- Tipped into the bunker as soon as possible; or
- Buried and mixed with less odorous wastes to minimise dispersion of odour.

If the origin of the odorous waste is able to be identified further acceptance of consignments of the particular waste category from the particular waste producer will be investigated to identify a solution.

6.2 Damage to the reception building;

If damage to the tipping hall is identified, a temporary fix will be put in place until permanent repairs are made. If necessary, any waste streams deemed particularly odorous will not be accepted into the waste bunker until permanent repairs are made.

If unacceptable offsite odour exposure is identified during temporary repairs, the Site will review and improve temporary measures and prioritise permanent repairs.

6.3 Odour abatement proving ineffective;

All equipment will be subject to a pre-planned preventative maintenance schedule. In the event the odour abatement system is proven to be ineffective either through the maintenance inspections or monitoring results, operations will cease until the system is fully functional. Monitoring will be implemented throughout this period to ensure odours don't build up and are contained within the boundaries of the Site.

6.4 Requirement to undertake temporary odorous activities;

If it is necessary to undertaken particularly odorous activities the Site manager will plan these operations with favourable meteorological conditions (consideration to prevailing wind direction), inform any interested parties (local community) and ensure odour monitoring is in place (onsite and offsite if deemed necessary). These activities would be of temporary nature for example, replacement of roller shutter doors if damaged or beyond repair.

6.5 Abnormal meteorological conditions;

Abnormal and extreme meteorological conditions that promote the generation of odour and inhibit its effective dispersion, specifically high temperature and stable conditions, may results in increased risk of impact at receptor locations.

Contingency measures to minimise the risk of unacceptable odour exposure at receptor locations during these conditions, will include but not be limited to consideration of:

- Undertaking additional odour monitoring; and
- Minimising the frequency and duration of the reception building door opening.

6.6 Detection of odour at the Site boundary or beyond; and

Monitoring will be carried out as detailed in section 5.2 to identify the source of the odour. Contingency actions will be implemented as necessary which will include, but not be limited to, those detailed in section 6.5.

6.7 Receipt of an odour complaint that is attributed to the Site.

If an odour complaint is received, actions detailed in section 5.2.3 will be followed and a review of the waste operations and environmental control systems at the Site prior to and at the time of complaint will be completed, this will include:

- Determine if waste was being received at the time of the complaint;
- Examine weighbridge records to determine if any abnormal loads were received;
- Determine if any abnormal operating conditions were being undertaken;
- Determine if any accidents or incidents requiring contingency actions were being undertaken; and
- Determine if any emergency situations existed at the time of the complaint.

If the Plant Manager considers that a source and pathway may be present between the Site and the complainant, the Plant Manager, or appointed representative, will visit the complainant as soon as possible in order to subjectively determine odour presence/absence and, if present, odour characteristics and intensity.

7.0 Emergency plans

This section details the emergency actions that would be undertaken in the case of an incident or accident which would result in the loss of control of odorous substances and could have an unacceptable short-term impact on the environment and human health.

An emergency plan for the Site will be devised in accordance with the Site's Environmental Management System (EMS) which will be accredited to ISO 14001 Standard within 12 months of the Site becoming operational. Standard Operating Procedures (SOP's) will be devised to cover the events detailed below.

7.1 Fire

In the event of a fire site personnel will follow procedures outlined in the Fire Prevention Plan (FPP). With regard to the management of odour impact from a fire, the key principles are prompt responses that contain the fire, attempt to extinguish the fire, if it is safe to do so, and minimise damage to containment and mitigation infrastructure.

7.2 Damage to Waste Bunker building

Site personnel will follow the company's SOP in the event of a failure to containment of the waste. With regard to mitigating the odour impact the most important measures to be implemented will be to re-establish containment, using temporary or permanent methods.

7.3 Staff absence

The Site operates a shift pattern for all site personnel, this ensures a sufficient number of personnel are trained and competent meaning the facility will always have personnel on stand-by. Prolonged or short-term staff shortages will therefore not affect the ability of the Site to operate effectively. If prolonged, widespread absence occurs, appropriate measures will be undertaken until operations can resume effectively.

7.4 Flooding

The Site lies within flood zone 1 and therefore has a low probability of flooding.

7.5 Power failure

In the event of a power failure, operations will not be affected since the facility is not dependent on power import.

7.6 Failure of equipment

A planned preventative maintenance schedule for all site equipment will be implemented, ensuring all equipment is maintained to manufacturers standards.

8.0 Document updates and reviews/management

The Site will operate in accordance with the Site's EMS, which will be accredited to ISO 14001 Standard within 12 months of the Site becoming operational.

WTI has a well-defined and formally documented management structure for managing the impacts of odour from the Site. It is the responsibility of each manager, with the support of the environmental professionals, to identify environmental risks that are relevant to the Site and determine the significance of the potential impacts.

Once the environmental risks have been identified it is the managers responsibility to highlight the significant aspects to all staff and contractors. The manager is also responsible for monitoring and improving environmental performance where possible.

8.1 Training and competency of staff

Training and competency of staff is controlled by WTI Management System. This covers training, awareness and competence. The company identifies training requirements of its employees and provides suitable resources to ensure they have the required knowledge, skills and expertise to complete their role.

Roles and responsibilities, Management System requirements for each staff member and accompanying legislation is identified and delivered through induction training, awareness training for all and specific training when required.

All contractors and persons performing tasks on behalf of the company will be made aware of the Management System requirements and will be competent in the roles undertaken.

Staff competency and the need for further training is assessed as part of the Management System and EMS on an annual basis.

8.2 Complaints Management

Members of the public will be able to contact WTI with any odour complaints in relation to the EfW facility by the following means:

- Email; and
- Phone.

Details of the above will be provided by WTI prior to commencement of operations at the Site and will be displayed at the site entrance and other appropriate locations and in any relevant information materials.

8.3 Complaints Registration

Once a complaint has been received and all details collected, the complaint must be processed. The process includes the following:

- Complaint registration;
- Roles and responsibilities for complaints management; and
- Collecting relevant details.

A record of all complaints will be maintained. Following the receipt of a complaint the complaint will be fed into the registration system and complaint data will be recorded in a systematic way, enabling comparison with standard odour descriptors, with weather conditions and Site operations. The complaints register will be reviewed on a monthly basis. The minimum information required for each complaint is detailed in section 5.2.3.

8.4 OMP update and review

This OMP is a controlled document and will form part of the EMS, along with a comprehensive record of the results of the monitoring and inspections.

The specification for the periodic review and update of the OMP will be set out within the EMS. In line with the recommendation of the H4 Odour Guidance, a review will take place on an annual basis as a minimum.

However, the OMP is intended to be a live document which serves as a reference during daily operations, and as such would be updated on a more frequent basis should the following occur:

- Significant changes are made to the plant or operational practices;
- There is a change to the management structure, designation of responsibility or training provision;
- The regulator requests the OMP is updated; or
- Complaints are received, which on subsequent investigation result in the identification of further control measures or remedial action, in addition to those set out within this OMP.

9.0 Conclusion

This OMP has been undertaken in accordance with EA guidance. The assessment is provided as part of the EP application for the EfW facility and Skelton Grange for WTI.

This OMP concludes that with the odour control measures, monitoring, contingency and emergency plans and locations of receptors in relation to the Site odour pollution is not likely to be significant and no further assessment is required.

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APPENDIX ERA 4

Noise Assessment (Including model files)

Model files provided separately

SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Appendix ERA 4: Noise Impact Assessment

Prepared for: WTI EFW Holdings Limited

Client Ref: 416.07232.00002

SLR Ref: 416.07232.00002
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BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with WTI EFW Holdings Limited (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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DOCUMENT REFERENCES

TABLES

1.0 Introduction

1.1 Background

WTI EfW Holdings Limited has retained SLR Consulting to prepare the Environmental Permit (EP) application as required by the Environmental Permitting Regulations 2016 (as amended) for the Skelton Grange Energy from Waste Facility (EfW) ('the Facility') located at Skelton Grange Road, Leeds, West Yorkshire ('the Site'). The facility will be operated by WTI UK Ltd (WTI).

This report presents the Noise Impact Assessment undertaken in accordance with Environment Agency guidance. SLR previously conducted a similar assessment as part of the original planning application in 2009.

1.2 Scope of Report

The purpose of this report is to assess the risk of adverse impact from noise 'pollution' generated by the facility on noise-sensitive receptors in the surrounding area. This is with respect to the noise generated by the facility once it has been constructed and is operational.

Where (or if) considered necessary, mitigation measures have been suggested to reduce the risk of adverse impact.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, a glossary of terminology is provided in **Appendix 01**.

1.3 Requirements, Guidelines and Standards

In producing this report, SLR has followed the guidelines within the EA publication *'Environmental permitting: H3 Horizontal Guidance for Noise Part 2 – Noise Assessment and Control'* document. SLR has also considered government planning policies including the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the Planning Practice Guidance on Noise (PPG-N), which outline the purpose and long-term vision of planning policy with respect to noise.

More specifically, the assessment of the impact on local built environment receptors from noise generated by the proposed extension during its operational phase has been undertaken with reference to BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*', which assesses the potential adverse impact of noise pollution from a sound source (or sources) of a commercial or industrial nature (i.e. fixed mechanical plant, mobile machinery and other operational noise associated with the development).

The assessment of operational noise and its impact on local natural environment receptors (i.e. the Transpennine trail) has been undertaken with reference to the '*Guidelines for Environmental Noise Impact Assessment*' produced by the Institute of Environment Management & Assessment (IEMA), which considers the impact of an increase/change in average ambient sound levels.

2.0 Development Description

2.1 Site Setting and Sensitive Receptors

The Site is located in Skelton at National Grid Reference (NGR) SE 334 312. The Site is approximately 4.5km southeast of Leeds city centre in an industrial area. The Site lies on a flat area at approximately 25m AOD close to the River Aire. Within approximately 2km the land is relatively flat to the northwest and southeast along the river plain.

The Site is in the southwest part of the former power station site, which itself is bounded by the Knostrop Sewage Treatment Works to the north and an extensive National Grid 275KV sub-station to the west. The River Aire and Aire Calder Navigation form the southern boundary of the site, and the Stourton Industrial Estate extends between the river and the M1/M621 motorways to the south and southwest of the site. The Cross Green Industrial Estate lies to the northwest of the site. There are further developments on an industrial/commercial nature on the northwest side of Pontefract Lane.

The closest residential areas in the surrounding environment are Hunslet (approximately 1.3km to the west), and Halton (approximately 1.4km north east). There had previously been a farm on the north side of Pontefract Lane when SLR assessed the site in 2009, but this has since converted to industrial use.

The Skelton Grange Environment Centre lies approximately 120m to the northwest of the Site, which is considered to be the closest built environment receptor. Further west lies the Thwaite Mills Watermill, approximately 450m away, and Hunslet Mill approximately 1.9km away. The industrial estates and other commercial receptors identified above are not considered to be a particularly noise-sensitive set of receptors.

The Transpennine Trail lies approximately 80m to the southwest of the closest site boundary and is considered to be the closest natural environment receptor, as an area that is regularly used by people and therefore is noise sensitive.

2.1.1 Noise-Sensitive Receptors

In assessing noise pollution from a site, the 'worst case' noise-sensitive receptors (NSRs) must be considered. This is typically the nearest noise-sensitive building(s), or other nearby receptors which may be considered more sensitive or more exposed to noise than closer receptors, due to differences in the landscape or the presence of other buildings (which provide acoustic 'screening').

For the purposes of this assessment, receptors considered are:

- **NSR1** – Skelton Grange Environment Centre;
- **NSR2** – the Transpennine Trail;
- **NSR3** – Thwaite Mills Watermill;
- **NSR4** – residential properties along Halton Moor road; and
- **NSR5** – Yarn Street / Hunslet Mill.

These NSRs are shown in **Drawing NIA01** in **Appendix 03** in relation to the Site and the monitoring positions used in the Baseline Sound Survey.

2.2 Proposed Facility

The Facility, an Energy from Waste facility, will process up to 410,000 tonnes of waste per annum, operating 24/7. A relevant selection of drawings and Site layout plans are presented in **Appendix 02** of this report.

2.2.1 Process and Plant

The technology will be based on conventional thermal incineration comprising moving grate furnace, steam boiler, and turbine generator to produce electricity and the potential to recover waste heat.

The EfW will consist of a two-line combined heat and power (CHP) enabled plant for the recovery of energy from waste by combustion and steam generation. Waste will be received and accepted in the waste reception hall via delivery vehicles discharging into the waste bunker for temporary storage. The waste will be mixed in the bunker and then fed into the feed hoppers.

The boiler will comprise two combustion and steam generating units, producing electricity in the turbine-generator and/or to provide heat/steam for export.

Key components of the technology will include, but shall not be limited to:

- Two-line furnace/boiler units incorporating moving grate technology and steam boiler with an energy recovery system;
- Flue gas treatment (FGT) system comprising selective non-catalyst reduction (SNCR), lime reactor and bag house filters;
- Steam turbine/generator set with the capability for CHP operation;
- Condensate system, including air cooled condensers (ACC);
- Residue handling and storage facilities;
- Electrical equipment associated with the facility and its connection to the national grid;
- Continuous emissions monitoring system (CEMS); and
- Auxiliary equipment.

2.2.2 Vehicular Traffic

It is anticipated that there would be approximately 63 two-way HGV movements per day to import waste, and 17 two-way HGV movements per day to export. These would occur 24 hours per day, with no particular peak period. It is anticipated that 90% of the vehicles delivering fuel/waste to the site will be 20-tonne vehicles.

There are 53 staff car parking spaces at the proposed Facility.

3.0 Requirements, Guidelines, and Standards

3.1 Planning Conditions

The development gained planning consent from Leeds City Council in September 2013 (Ref: 11/03705/FU) with a number of planning conditions.

With regards to operational noise, condition 50 of the consent stipulates the following:

"The combined rating level of plant noise from the operational Energy Recovery Facility when measured and/or calculated shall not exceed the following values at the nearest façade of the specified noise sensitive premises:

Noise Sensitive Premises (Receptor)	*Rating Level 0700 - 2300 (dB(A)) free-field*	*Rating Level 2300 - 0700 (dB(A)) free-field*
Yarn Street / Hunslet Mill	*41*	*27*
Thwaite Mill	*44*	*N/A*
Skelton Grange EEC	*45*	*N/A*
Skelton Moor Farm	*46*	*37*
Cartmell Drive / Halton Moor Road	*36*	*34*

To minimise potential for noise nuisance in the interests of the living and working conditions of occupiers of nearby property in accordance with policies GP5 of the Leeds Unitary Development Plan Review (2006) and WASTE 9 of the Natural Resources and Waste Local Plan (2013)."

The receptors correlate to the NSRs in Section 2.1.1 and **Drawing NIA01** as follows:

- Yarn Street / Hunslet Mill **(NSR5).**
- Thwaite Mill **(NSR3).**
- Skelton Grange EEC **(NSR1).**
- Skelton Moor Farm (no longer exists).
- Cartmell Drive / Halton Moor Road **(NSR4).**

3.2 Horizontal Guidance Note for Noise Assessment and Control

The purpose of the *Horizontal Guidance Note for Noise Assessment and Control* is to provide supplementary information, relevant to all sectors, to assist in preventing and minimising emissions of noise as described in the Sector Guidance Notes (or the General Sector Guidance Note).

The guidance is in two parts:

Part 1 – Regulation and Permitting – outlines the main considerations relating to the setting of Permit conditions and subsequent regulation of noise. Part 1 is aimed primarily at the information needs of regulators.

Part 2 – Noise Assessment and Control – describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. Outline methods of noise control are provided such as:

- use of inherently quieter processes;
- selection of inherently quiet plant or "low-noise options";

- site layout to maximise natural screening, screening by buildings and separation distances;
- the orientation of directional noise sources away from sensitive receptors; and
- noise barriers or bunding.

3.3 BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor locations within the context of the existing sound environment.

3.3.1 Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- **Background Sound Level, $L_{A90,T}$:** A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- **Rating Level, $L_{Ar,Tr}$:** Specific sound level plus any adjustment for the characteristic features of the sound.
- **Reference Time Interval, T_r:** Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).
- **Specific Sound Level, $L_s = L_{Aeq,Tr}$:** Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
- **Specific Sound Source:** Sound source being assessed.

3.3.2 Specific Sound Source

BS 4142:2014 defines sound of an industrial and/or commercial nature as:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading/unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from fork-lift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads and railway systems; recreational activities; music and entertainment; shooting grounds; construction and demolition; domestic animals; people; public address systems for speech; and 'other sources falling within the scopes of other standards or guidance'.

3.3.3 Specific Sound Level

The specific sound level L_s is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r, of 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).

Note that the specific sound level L_s at the pre-construction stage of assessment is typically calculated through the summation of predicted sound levels from a source or source(s), based upon either sound power data supplied by the manufacturer; measurements of the unit(s) in-situ operation; or from typical noise levels from

similar sources from guideline documents (including British Standards). This also accounts for the operational times of the specific sound source, i.e. the % of a defined (day or night) time period that it is operational for.

3.3.4 Rating Level

The rating level $L_{Ar,Tr}$ is the specific sound level L_s plus any 'penalties' which account for the characteristic features of the sound.

BS 4142:2014 provides the following with respect to the application of penalties to account for *"the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention".*

- ***Tonality*** *– "For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;*
- ***Impulsivity –*** *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;*
- ***Intermittency*** *– When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and*
- ***Other Sound Characteristics*** *– Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

Note that SLR consider the word 'perceptible' to be important, and variable depending on the context of a site. For example at a site with a relatively high background sound level of 50 dB(A), an 'impulsive' sound source with a specific sound level of 30 dB(A) at a NSR is unlikely to be perceptible and should probably not be penalised. However the same source at a site with a lower background level of 30 dB(A) would be perceptible, and therefore a penalty of 3 or 6 dB could be applied to the rating level, with possibly a 9 dB penalty being applied if the specific sound level were to rise from 30 to 40 dB(A). Therefore the context is important in applying rating level penalties.

3.3.5 Background Sound Level

BS 4142:2014 states that *"in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."*

BS 4142:2014 further states that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value".*

Hence BS 4142:2014 does not provide a 'black and white' method of obtaining the assessment level for background sound $L_{A90,T}$.

Note that it is standard practice that the $L_{A90,T}$ is determinable from the results of a baseline sound survey conducted at positions representative of sound levels at the nearest or worst affected noise-sensitive receptors.

3.3.6 Assessment of Adverse Impact

The assessment of adverse impact contained in BS 4142:2014 is undertaken by comparing the rating level $L_{Ar,Tr}$, to the measured representative background sound level $L_{A90,T}$ outside the sensitive receptor location.

The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{Ar,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context.

The impact can be quantified, where BS 4142:2014 states that one should *"obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:*

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

BS 4142:2014 also notes that, *"adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact".*

3.4 IEMA Guidelines for Environmental Noise Impact Assessment

3.4.1 Scope

The Institute of Environmental Management and Assessment (IEMA) *'Guidelines for Environmental Noise Impact Assessment'*, Version 1.2 published in November 2014 addresses the key principles of a noise impact assessment and are applicable to *"all development proposals where noise effects are likely to occur"* and *"are relevant to all types of projects, regardless of size".*

The guidelines provide specific support on how noise impact assessments fit within the Environmental Impact Assessment (EIA) process but can also apply to developments which do not require an EIA. They cover:

- how to scope a noise assessment;
- issues to be considered when defining the baseline noise environment;
- prediction of changes in noise levels as a result of implementing development proposals; and
- definition and evaluation of the significance of the effect of changes in noise levels.

3.4.2 Assessment of Adverse Impact

The IEMA guidelines provide a method of assessing the significance of a change in the equivalent continuous A-weighted sound pressure level $L_{Aeq,T}$, usually interpreted as the average ambient sound level across a time period (of 07:00 – 23:00 for daytime and 23:00 – 07:00 for night-time).

Table 3-1 (recreated from Table 7-14 of the IEMA guidelines) gives an example of how the impact arising from a change in sound levels could be evaluated.

Table 3-1
The significance of adverse impact from an increase change in ambient sound levels (Table 7-14 of the IEMA guidelines)

Long-term Impact Classification	Short-term Impact Classification	Sound level change dB $L_{Aeq,T}$ (positive or negative) T = either 16 hr day or 8 hr night
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥ 1 dB and < 3 dB
Minor	Moderate	≥ 3 dB and < 5 dB
Moderate	Major	≥ 5 dB and < 10 dB
Major		≥ 10 dB

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental sound that is perceptible to the human ear. A 10 dB(A) change in sound represents a doubling or halving of the sound level. The difference between the minimum perceptible change and the doubling or halving of the sound level is split to provide greater definition to the assessment of changes in sound level.

4.0 Baseline Sound Survey

SLR has attended the Site and surrounding area on several occasions to conduct a Baseline Sound Survey at the closest nearby NSRs. Most recently this included surveying conducted between Friday 31st May and Tuesday 4th June 2019, to determine a representative background sound level in accordance with BS 4142:2014, and to determine the average ambient sound level in accordance with IEMA *'Guidelines for Environmental Noise Impact Assessment'*. Surveying was also conducted in September 2009 as part of the original planning application. Though it is recognised that the results of this older survey should not be relied upon, they have been included for comparison with the more recent survey.

4.1 Methodology

4.1.1 Monitoring Locations

Two monitoring positions were employed with sound level meters installed at the following locations:

- **P1** – in the grounds of the Skelton Grange Environment Centre, to represent expected environmental noise conditions at NSR1; and
- **P2** – by the river along the Transpennine Trail, to represent expected environmental noise conditions at NSR2.

These positions are reflected in **Drawing NIA01** in relation to the Site, with photographs from the survey in Figure 03-1, in **Appendix 03**.

At both positions, the microphone was placed at 1.5m above the ground in 'free-field' conditions, i.e. at least 3.5m from the closest vertical reflecting surface.

For reference, the surveying locations from the 2009 survey are designated as M1, M2, M3, M4, M5 and M6 in **Drawing NIA01.**

4.1.2 Monitoring Periods

The sound level meters were installed to measure over the following periods:

- **P1** – between 13:00 on Friday 31st May to 12:30 on Tuesday 4th June 2019; and
- **P2** – between 13:35 and 14:35 on Friday 31st May 2019.

The monitoring equipment at position P1 was left unattended for the majority of the survey with the exception for a short period around the installation and collection of the sound level meter. The meter was set to log noise levels over continuous 15-minute periods.

The monitoring equipment at position P2 was attended by the surveyor at all times and set to log noise levels over continuous 5-minute periods.

4.1.3 Noise Level Parameters

The following noise indices were recorded (amongst others):

- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the 'representative background sound level' as defined by BS 4142:2014;
- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the 'average' noise level and is therefore used to determine the 'average ambient sound level' in accordance with IEMA guidelines;

- $L_{A10,T}$: The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level'; and
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T.

4.1.4 Equipment

The monitoring equipment used for the Baseline Sound Survey is detailed in Table 4-1. The sound level meters were calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meters have been calibrated to a traceable standard by UKAS-accredited laboratories within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard by UKAS-accredited laboratories within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

Table 4-1
Monitoring Equipment

Survey Location	Equipment	Serial Number
P1	Rion NL-52 Sound Level Meter	976174
	Rion NL-74 Acoustic Calibrator	34478298
P2	Cirrus CR:171B Type 1 Sound Level Meter	G0300561
	Cirrus CR:515 Acoustic Calibrator	87922

4.1.5 Weather Conditions

During the survey, weather conditions were mostly dry and sunny with wind speeds of less than 5 ms^{-1} (with the exception of higher wind speeds on Sunday evening) and temperatures of up to 20°C. These weather conditions are suitable for the measurement of environmental noise in accordance with BS 4142:2014 and BS 7445-1:2003 '*Description and Measurement of Environmental Noise'*.

4.2 Soundscape and Context

During the installation and collection of the survey, a note of all noise sources audible to the engineer was made, including the regularity and subjective magnitude of each. The following notes were made:

- **P1** – noise predominantly from the neighbouring substation and distant road traffic from the M1.
- **P2** – noise predominantly from distant road traffic along the M1, birdsong, the substation and from the Stourton Industrial Estate.

4.3 Results

4.3.1 Position P1

A summary of the measured noise levels from monitoring location P1 is provided in the tables below, broken down on a day-by-day and night-by-night basis to observe the variance in noise levels between weekdays and weekends (Table 4-2); and to summarise noise levels across all daytime (Table 4-3) and night-time (Table 4-4) periods.

A graphic representation of the entire monitoring period is given in Figure 03-2 in **Appendix 03,** where the fluctuation in noise levels over time can be observed.

Table 4-2
Summary of measured noise levels at monitoring location P1 on a day-by-day and night-by-night basis, dB

Time period	Logarithmic average $L_{Aeq,T}$	Mean $L_{A90,15min}$	Mean $L_{A10,15min}$	Highest $L_{AFmax,15min}$
Daytime (07:00 – 23:00) T = 16-hours				
Friday 31st May; 13:00 - 23:00	53	50	54	72
Saturday 1st June; 07:00 - 23:00	53	47	53	97
Sunday 2nd June; 07:00 - 23:00	52	50	54	74
Monday 3rd June; 07:00 - 23:00	55	50	55	81
Tuesday 4th June; 07:00 - 12:30	53	49	55	79
Night-time (23:00 – 07:00) T = 8-hours				
Friday 31st May / Saturday 1st June; 23:00 - 07:00	52	49	52	81
Saturday 1st June / Sunday 2nd June; 23:00 - 07:00	52	49	52	84
Sunday 2nd June / Monday 3rd June; 23:00 - 07:00	53	49	53	80
Monday 3rd June / Tuesday 4th June; 23:00 - 07:00	53	49	53	86

Table 4-3
Summary of measured daytime noise levels at P1 (only including periods between 07:00 and 23:00), dB

Parameter	Maximum	Minimum	Logarithmic average	Mean average	Modal average	Median average
$L_{Aeq,15min}$	67	47	53	52	52	52
$L_{AFmax,15min}$	97	50	74	66	66	66
$L_{A10,15min}$	68	47	55	54	54	54
$L_{A90,15min}$	54	43	50	49	50	50

Table 4-4
Summary of measured night-time noise levels at P1 (only including periods between 23:00 and 07:00), dB

Parameter	Maximum	Minimum	Logarithmic average	Mean average	Modal average	Median average
$L_{Aeq,15min}$	62	47	53	51	49	50
$L_{AFmax,15min}$	86	49	71	63	64	63
$L_{A10,15min}$	61	48	54	52	50	52
$L_{A90,15min}$	53	47	49	49	48	49

4.3.2 Position P2

Table 4-5 provides a summary of the noise levels measured over the course of the survey at position P2, whilst a graphic representation is given in Figure 03-3 in **Appendix 03,** where the fluctuation in noise levels over time can be observed

Table 4-5
Summary of measured daytime noise levels at P2 (from 13:35 to 14:35 on Friday 31st May 2019), dB

Parameter	Maximum	Minimum	Logarithmic average	Mean average	Modal average	Median average
$L_{Aeq,5min}$	56	53	55	54	54	54
$L_{AFmax,5min}$	72	58	66	65	66	66
$L_{A10,5min}$	58	54	56	56	57	56
$L_{A90,5min}$	53	51	52	52	52	52

4.3.3 2009 Survey

For reference purposes against the results of the most recent survey, a summary of the measured noise levels from the 2009 survey, conducted as part of the original planning assessment, are given below in Table 4-6 and Table 4-7.

Whilst it is recognised that these results are outdated, it is seen that the results at positions P1/M1 and P2/M2 are relatively similar despite the 10-year gap. There is also not seen to be any significant change to the area which would result in noise levels decreasing from 2009 to 2019.

Table 4-6
Summary of measured midweek noise levels from the baseline sound survey conducted in 2009, dB

Location	Period	Logarithmic average $L_{Aeq,T}$	Mean L_{A90}	Mean L_{A10}	Highest L_{Amax}
M1 (close to P1) Skelton Grange EEC	Daytime	54.8	50.3	54.1	76.2
M2 (close to P2) The Transpennine Trail	Daytime	51.8	48.0	52.9	74.5

Location	Period	Logarithmic average $L_{Aeq,T}$	Mean L_{A90}	Mean L_{A10}	Highest L_{Amax}
M3 Thwaites Mill Museum	Daytime	53.2	49.4	54.5	85.0
M4 Cartmell Drive/ Halton Moor Road	Night-time	52.6	39.3	49.8	71.2
	Daytime	46.8	40.9	48.1	71.2
M5 Yarn Street/Hunslet Mill	Night-time	34.9	32.3	36.1	59.8
	Daytime	53.1	46.1	52.8	80.4
M6 Skelton Moor Farm (no longer exists)	Night-time	45.4	42.4	46.9	59.8
	Daytime	54.2	51.3	56.2	67.9

Table 4-7
Summary of measured Sunday noise levels from the baseline sound survey conducted in 2009, dB

Location	Period	Logarithmic average $L_{Aeq,T}$	Mean L_{A90}	Mean L_{A10}	Highest L_{Amax}
M1 (close to P1) Skelton Grange EEC	Daytime	48.9	41.4	47.3	71.2
M2 (close to P2) The Transpennine Trail	Daytime	50.9	42.5	51.9	74.5
M3 Thwaites Mill Museum	Daytime	46.3	44.4	47.0	67.4
M4 Cartmell Drive/ Halton Moor Road	Night-time	48.4	35.4	45.0	73.7
	Daytime	51.7	40.1	50.6	87.1
M5 Yarn Street/Hunslet Mill	Night-time	48.9	41.7	48.7	74.4
	Daytime	51.7	45.1	54.7	69.1
M6 Skelton Moor Farm (no longer exists)	Night-time	41.7	37.6	42.3	61.8
	Daytime	46.2	41.3	48.6	65.7

5.0 Operational Noise Impact – Plant

5.1 Methodology

The assessment of the noise impact on nearby NSRs in relation to the likely levels of operational noise produced by plant at the proposed Facility has been undertaken with reference to:

- BS 4142:2014 for 'built environment' receptors, that is, NSRs 1, 3, 4 and 5; and
- IEMA guidelines for 'natural environment' receptors, that is, NSR2 (the Transpennine Trail).

5.1.1 Assessment Process

The following summarises the main steps of action in the assessment method:

- the background sound level $L_{A90,Tr}$ in accordance with BS 4142:2014 (or the average ambient noise level $L_{Aeq,T}$ in accordance with IEMA) is determined at each NSR for the operational period of the Facility, based upon the results of the Baseline Sound Survey;
- the scope of sound sources associated with the Facility is determined; including the sound power levels, locations and operating times of sources;
- the specific sound level L_s at each NSR is predicted by noise map calculations which account for the Site layout including proposed buildings, the presence of buildings external to the Site in the vicinity of the NSRs and the characteristics of the noise sources referenced above;
- for 'built environment' receptors (NSRs 1, 3, 4 and 5):
  - the rating level $L_{Ar,Tr}$ is determined by the application of any 'penalties' which adjust for characteristic features of the sound which may be perceptible and potentially cause annoyance at the NSRs;
  - the rating level $L_{Ar,Tr}$ is compared to the background sound level $L_{A90,Tr}$, with the difference between the two levels indicating the likelihood of adverse impact at the NSRs in accordance with BS 4142:2014;
- for 'natural environment' receptors (NSR2):
  - the predicted $L_{Aeq,T}$ is added to the existing $L_{Aeq,T}$ to indicate the 'new' $L_{Aeq,T}$; and finally
  - the 'new' and existing $L_{Aeq,T}$ values are assessed in accordance with IEMA guidelines by referencing against Table 3-1, with the difference between the two levels indicating the likelihood of adverse impact at the NSR.

5.1.2 Noise Map Modelling

The noise predictions for the operational assessment within this report have been undertaken using the proprietary software CadnaA® by DataKustik, which predicts the propagation of noise levels through noise mapping and implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise map model has assumed:

- downwind propagation, i.e. a wind direction that assists the propagation of sound from source to receptor;
- a ground absorption factor of 0 on any roads, car parks, buildings, and any tarmacked/concreted areas;
- a ground absorption factor of 1 on grassy areas;

- a ground absorption factor of 0.5 on areas with a mix of the aforementioned ground conditions;
- a maximum reflection factor of three;
- that noise sources do not have strong radiation patterns and therefore radiate equally in all directions;
- the use of single A-weighted sound power levels (in the absence of frequency sound power level data); and
- receptor heights of 4m to represent the height of a first-floor window for buildings, and a height of 1.5m to represent external areas.

5.2 Existing Sound Levels

5.2.1 Background Sound Levels (BS 4142:2014)

In accordance with BS 4142:2014, the predicted rating level should be assessed against a 'representative' background sound level. This is commonly determined through the results of a baseline sound survey, as has been done in this case. The derived levels in Table 5-1 below are based upon the mean L_{A90} values from the surveys, including the 2009 survey for NSRs which were not surveyed more recently, as it is seen to be unlikely that noise levels would have decreased over the intervening period. The predicted specific noise levels (as seen in later sections) at many of the NSRs are also very low in comparison to the background sound levels.

Table 5-1
Derived representative background sound level for NSRs 1, 3, 4 and 5

Noise-Sensitive Receptor(s)	Time Period	Background Sound Level $L_{A90,Tr}$
NSR1	Daytime (07:00 to 23:00) **T_r = 60-minutes**	43
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	N/A
NSR3	Daytime (07:00 to 23:00) **T_r = 60-minutes**	44
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	N/A
NSR4	Daytime (07:00 to 23:00) **T_r = 60-minutes**	40
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	35
NSR5	Daytime (07:00 to 23:00) **T_r = 60-minutes**	45
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	32
Notes: Note that NSRs 1 and 3 are not residential receptors and therefore the night-time period has not been assessed in these locations.		

5.2.2 Existing Ambient Noise Levels (IEMA)

For the purpose of assessment, it is considered appropriate to use the logarithmic average value of the $L_{Aeq,T}$ determined from the surveys, to represent the existing ambient noise level ($L_{Aeq,16hr}$). Values from the 2009 survey have been used as a worst case, as these are slightly lower than the 2019 survey.

Table 5-2
Existing ambient noise level ($L_{Aeq,T}$) at NSR2 for the daytime periods

Noise-Sensitive Receptor	Time Period	Existing Ambient Noise Level $L_{Aeq,T}$
NSR2	Daytime (07:00 to 23:00) **T = 16-hours**	51

5.3 Sound Sources

5.3.1 Internal Plant

SLR has based the assessment upon the list of internal plant supplied by the operator in Table 5-3 below. The % on-time is assumed to be the same throughout the day and night period as the Facility will be operational for 24 hours a day.

Table 5-3
Noise sources – internal plant

Area	Plant/Activity	No. of Units	L_{WA} dB	Estimated On-Time %	Equivalent Continuous per unit L_{WA} dB
Tipping Hall	HGV unloading	1	93	50	90
Waste Bunker	Crane	1	78	100	78
	Hopper Loading	1	88	20	81
Boiler Hall	Ash Transport	1	78	100	78
	Combustion Fan	1	93	100	93
	Rappers	1	95	10	85
	De-aerator	1	88	100	88
	Conveyor Drive Units	2	93	100	93
Flue Gas Hall	ID Fans	1	100	100	100
	Residue Conveyors	1	78	100	78
Turbine Hall	Turbine	1	108	100	108
	Gearbox	1	108	100	108
	Generator	1	108	100	108
	Feed water Pumps	1	98	100	98

Area	Plant/Activity	No. of Units	L_{WA} dB	Estimated On-Time %	Equivalent Continuous per unit L_{WA} dB
	Condensate Pumps	1	93	100	93
	Vacuum Ejectors	1	103	100	103

The internal reverberant sound pressure level incident upon the inside of the building façade has then been calculated based upon the proposed plant and the volume, surface area and estimated reverberation time of each respective process hall.

The sound reduction indices of the facades have been based upon the descriptions of the external wall and roof constructions in the planning application documents. Based upon the predicted internal noise levels and the sound reduction provided by each element of the façade, the façade noise sources are presented in Table 5-4.

Table 5-4
Noise sources – internal noise breakout through the facade

Sound Source		Reverberant Sound Level incident on Interior of Façade L_{Aeq} (dB)	Sound Reduction Index (dB R_w)
Ref	Description		
S1	Fuel Reception Hall - Wall	56	31 [1]
S2	Fuel Reception Hall - Roof	56	25 [3]
S3	Waste Bunker - Wall	49	31 [1]
S4	Waste Bunker - Roof	49	25 [3]
S5	Boiler Hall - Wall	65	22 [2]
S6	Boiler Hall - Roof	65	25 [3]
S7	Flue Gas Hall - Wall	66	31 [1]
S8	Flue Gas Hall - Roof	66	25 [3]
S9	Turbine Hall - Wall	85	31 [1]
S10	Turbine Hall - Roof	85	25 [3]

Notes:

[1] Based upon Europanel cladding - https://www.eurobond.co.uk/media/25677/europanel_brochure_lr.pdf

[2] Based upon Danpalon 16mm cladding - www.everliteconcept.com/en/dl/doc_download/1064-danpalon-brochure.html

[3] Based upon a Kingspan KS1000 Rw Roof - https://az750602.vo.msecnd.net/netxstoreviews/assetOriginal/12578_Kingspan_PIR_Trapezoidal_Roof_KS1000RW_Datasheet%20_EN_UK.pdf

5.3.2 External Plant

There is an external compound for four large air-cooled condensers (ACCs), with sits adjacent to the ERF building. Although the ACCs are visually contained, the enclosure is not roofed and the area under the units is open, to ensure optimum air circulation.

There are also two chimney stacks emerging from the boiler hall.

The noise emissions data for these sources are listed in the table below.

Table 5-5
Noise sources – external plant

Area	Plant	No. of Units	L_{WA} dB	Estimated On-Time %	Equivalent Continuous per unit L_{WA} dB
ACC Compound	Air Cooled Condensers	4	92	100	92
Above the Boiler Hall	Chimney Flue	2	90	100	90

5.4 Predicted Sound Levels and Assessment – BS 4142:2014

Table 5-6 and Table 5-7 lists the predicted specific sound level and rating levels at the 'built environment' receptors (NSRs 1, 3, 4 and 5) during the daytime and night-time periods respectively.

Note that NSRs 1 and 3 are not residential receptors and therefore the night-time period has not been assessed in these locations.

A rating level penalty has been applied at NSR1 to account for general characteristics that may be different or distinctive against the existing noise environment. No rating level penalties have been applied at the other NSRs due to the low specific noise level, which may not be noticeable against residual noise.

As the rating levels are all below the background sound level, there is likely to be a 'negligible' risk of adverse impact.

The rating levels also comply with the limits within condition 50 of the planning consent (see Section 3.1).

Table 5-6
Predicted specific sound levels and rating levels at NSRs 1, 3, 4 and 5 during the daytime (07:00 – 23:00), dB

Noise-Sensitive Receptor	Predicted Specific Sound Level $L_{Aeq,60min}$	Rating Level Penalties	Rating Level $L_{Ar,60min}$	Representative Background Sound Level $L_{A90,Tr}$	Difference
NSR1	37	3	40	43	-3
NSR3	29	0	29	44	-15
NSR4	19	0	19	40	-21
NSR5	21	0	21	45	-24

Table 5-7
Predicted specific sound levels and rating levels at NSRs 4 and 5 during the night-time (23:00 – 07:00)

Noise-Sensitive Receptor	Predicted Specific Sound Level $L_{Aeq,15min}$	Rating Level Penalties	Rating Level $L_{Ar,15min}$	Representative Background Sound Level $L_{A90,Tr}$	Difference
NSR4	19	0	19	35	-16
NSR5	21	0	21	31	-10

5.5 Predicted Sound Levels and Assessment – IEMA

Table 5-8 summarises the predicted average noise levels ($L_{Aeq,60min}$) at NSR2 (the Transpennine Trail), generated by the plant at the proposed Facility.

The risk of adverse impact from noise levels generated by operations at the proposed Facility can be assessed by logarithmically adding the predicted noise levels to the existing measured L_{Aeq} noise levels and assessing using the criteria outlined in Table 3-1.

The predicted noise emissions do not suggest that the existing ambient noise levels will be significantly increased, therefore there is only a 'negligible' risk of adverse impact.

Table 5-8
Assessment of predicted noise levels (dB $L_{Aeq,60min}$) generated by plant at the proposed Facility

Noise-Sensitive Receptor	Period	Ambient Noise Level $L_{Aeq,T}$				Long-term Risk of Adverse Impact
		Existing	Predicted from the Facility	Predicted 'New'	Change	
NSR2	Daytime (07:00 to 23:00) **T = 60-minutes**	51.0	41.9	51.5	+0.5	Negligible

6.0 Operational Noise Impact – Vehicles

6.1 Methodology

The assessment of the noise impact on nearby NSRs in relation to the likely levels of operational noise produced by Heavy Goods Vehicles (HGVs) and staff cars at the proposed Facility has been undertaken with reference to IEMA guidelines for 'natural environment' receptors, that is, NSR2 (the Transpennine Trail).

6.1.1 Assessment Process

The following summarises the main steps of action in the assessment method:

- the existing equivalent continuous A-weighted sound pressure level $L_{Aeq,T}$ (usually interpreted as the average ambient noise level), is determined based upon the results of the Baseline Sound Survey, at all NSRs for the daytime and night-time periods;
- the scope of the HGVs with the proposed Facility is determined; including the sound power levels, locations and frequency of the vehicle movements;
- the $L_{Aeq,T}$ from the HGVs at each NSR is predicted, by noise map calculations which account for the Site layout including proposed buildings, the presence of buildings external to the Site in the vicinity of NSRs and the characteristics the noise sources;
- the predicted $L_{Aeq,T}$ is added to the existing $L_{Aeq,T}$ to indicate the 'new' $L_{Aeq,T}$; and
- the 'new' and existing $L_{Aeq,T}$ values are assessed in accordance with IEMA guidelines by referencing against Table 3-1, with the difference between the two levels indicating the likelihood of adverse impact at each NSR.

6.1.2 Noise Map Modelling

The noise mapping for this part of the assessment follows the same method described in Section 5.1.2. The predicted noise level produced by on-site heavy goods vehicle movements has been calculated using the methodology contained in BS 5228-1:2009+A1:2014.

6.2 Existing Ambient Noise Levels

For the purpose of assessment, it is considered appropriate to use the logarithmic average value of the $L_{Aeq,T}$ determined from the surveys, to represent the existing ambient noise level ($L_{Aeq,16hr}$). Values from the 2009 survey have been used as a worst case, as these are slightly lower than the 2019 survey.

Table 6-1
Existing ambient noise level ($L_{Aeq,T}$) at NSR2 for the daytime periods

Noise-Sensitive Receptor	Time Period	Existing Ambient Noise Level $L_{Aeq,T}$
NSR1	Daytime (07:00 to 23:00) **T = 16-hours**	49
NSR2	Daytime (07:00 to 23:00) **T = 16-hours**	51
NSR3	Daytime (07:00 to 23:00) **T = 16-hours**	46

Noise-Sensitive Receptor	Time Period	Existing Ambient Noise Level $L_{Aeq,T}$
NSR4	Daytime (07:00 to 23:00) **T = 16-hours**	47
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	47
NSR5	Daytime (07:00 to 23:00) **T = 16-hours**	35
	Night-time (23:00 to 07:00) **T_r = 15-minutes**	52

6.3 Sound Sources

As described in Section 2.2.2, it is anticipated that there would be approximately 63 two-way HGV movements per day to import waste, and 17 two-way HGV movements per day to export. These would occur 24 hours per day, with no particular peak period.

Therefore, there would be up to 80 two-way HGV movements per 24 hours, which if spread evenly per hour, would result in 3 – 4 two-way movements per hour.

As a worst-case, SLR has modelled based upon 14 two-way HGV movements in the worst-case hour.

There are 53 staff car parking spaces at the proposed Facility. SLR have assumed up to 50 car movements per hour within the modelling.

Table 6-2 provides details of the vehicle sound sources used in the assessment. Noise levels have been determined from measurements that SLR have conducted on past projects of cars and HGVs.

The vehicles have been modelled as moving point sources which travel in and out of the site via the access road through the industrial estate to the southwest.

Table 6-2
Noise sources – external vehicles

Sound Source		Sound Power Level L_{WA} (dB)	Movements over a worst case 60-minute period
Ref	Description		
V1	HGVs (import)	98.0	14 movements
V2	HGVs (export)	98.0	14 movements
V3	Staff Cars	84.0	50 movements

6.4 Predicted Sound Levels and Assessment

Table 6-3 presents the predicted average noise levels ($L_{Aeq,60min}$) during a worst-case 60-minute period, at each of the NSRs during the daytime and night-time periods.

The risk of adverse impact from noise levels generated by operations at the Proposed Development can be assessed logarithmically adding the predicted noise to the existing measured L_{Aeq} noise levels and assessing using the criteria outlined in Table 3-1.

The predicted noise emissions do not suggest that the existing ambient noise levels will be significantly increased, therefore there is only a 'negligible' risk of adverse impact.

Table 6-3
Predicted noise levels and risk of adverse impact at each NSR from vehicles associated with the proposed Facility

Noise-Sensitive Receptor	Period	Ambient Noise Level L_{Aeq}				Long-term Risk of Adverse Impact
		Existing	Predicted from Proposed Development	Predicted 'New'	Change	
NSR1	Daytime (07:00 to 23:00)	49.0	43.0	50.0	+1.0	Negligible
NSR2	Daytime (07:00 to 23:00)	51.0	46.4	52.3	+1.3	Negligible
NSR3	Daytime (07:00 to 23:00)	46.0	39.5	46.9	+0.9	Negligible
NSR4	Daytime (07:00 to 23:00)	47.0	19.8	47.0	0	None
	Night-time (23:00 to 07:00)	47.0	19.8	47.0	0	None
NSR5	Daytime (07:00 to 23:00)	35.0	28.8	35.9	+0.9	Negligible
	Night-time (23:00 to 07:00)	52.0	28.8	52.0	0	None

7.0 Summary and Conclusions

WTI EFW Holdings Limited (WTI) has retained SLR Consulting to prepare the Environmental Permit (EP) application as required by the Environmental Permitting Regulations 2016 (as amended) for the Skelton Grange Energy from Waste Facility (EfW) ('the Facility') located at Skelton Grange Road, Leeds, West Yorkshire ('the Site').

This report presents the Noise Impact Assessment undertaken in accordance with Environment Agency guidance. SLR previously conducted a similar assessment as part of the original planning application in 2009.

The purpose of this report is to assess the risk of adverse impact from noise 'pollution' generated by the facility on noise-sensitive receptors in the surrounding area. This is with respect to the noise generated by the facility once it has been constructed and is operational.

The assessments have been conducted in accordance with BS 4142:2014, the IEMA '*Guidelines for Environmental Noise Impact Assessment'* and the EA *'Environmental permitting: H3 Horizontal Guidance for Noise Part 2 – Noise Assessment and Control'* document.

An assessment of noise generated by plant at the Facility has indicated that there is only a 'negligible' risk of adverse impact. For most receptors, the predicted specific noise level is very low and is unlikely to be noticeable against the residual noise environment. The assessment also demonstrates compliance with the conditions imposed within the planning consent.

Furthermore, with respect to noise from HGVs and staff cars travelling in and out of the site and onto surrounding roads, there is again only a 'negligible' risk of adverse impact.

Therefore, noise should not pose a material constraint to gaining the Environmental Permit for the proposed Facility.

APPENDIX 01

Acoustics Concepts and Terminology

01.1 Glossary of Acoustic Terminology

Table 01-1
Glossary of Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2x10-5 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency Octave bands (and Third Octave bands)	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63 Hz to 4000 Hz (4 kHz). This is roughly equal to the range of frequencies on a piano. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7 octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz. 'Third' octave bands split this further into smaller frequency bands. This is typically only referenced in assessment of tonality of a noise source by identifying peaks (tones) in the frequency spectrum, i.e. when applying a rating penalty for tonality within a BS 4142:2014 assessment.
L_{Aeq}	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{A10} & L_{A90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{A10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{A90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{A10} index to describe traffic noise. The 'A' in the notation indicates a single weighted figure using the 'A' weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L_{AFmax}	L_{AFmax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{AFmax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{Aeq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using a 'fast' response.
Sound pressure level (SPL)	Represents a noise level that can be measured directly, the result of pressure variations in the air achieved by the sound waves, on a dB scale.

01.2 Subjective Noise Levels

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

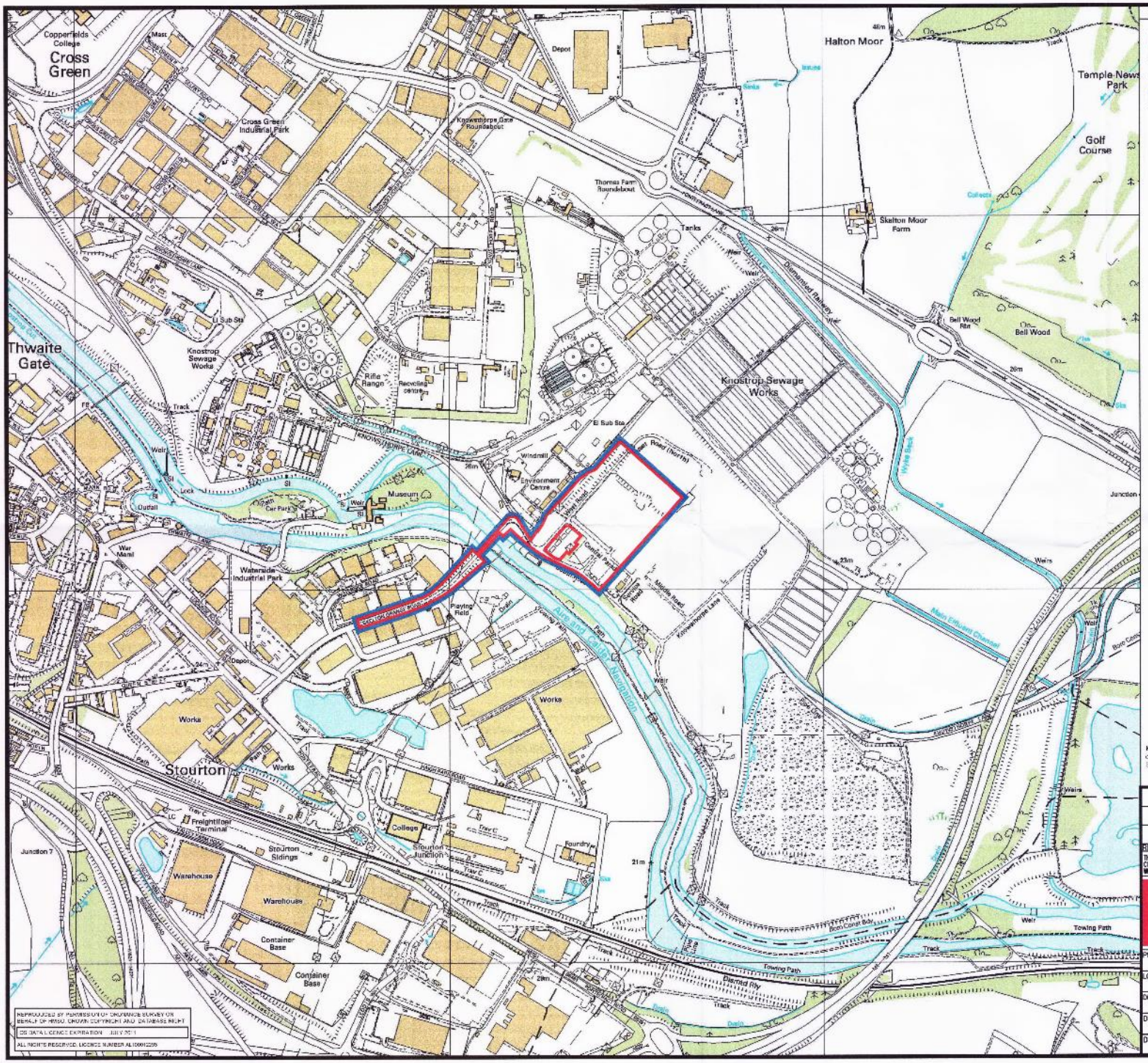
Table 01-2
Subjective examples of different noise levels

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1 m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of Pain

APPENDIX 02

Proposed Facility Plans

11/03705



LEGEND

PLANNING APPLICATION BOUNDARY

LAND UNDER CONTROL OF APPLICANT

N

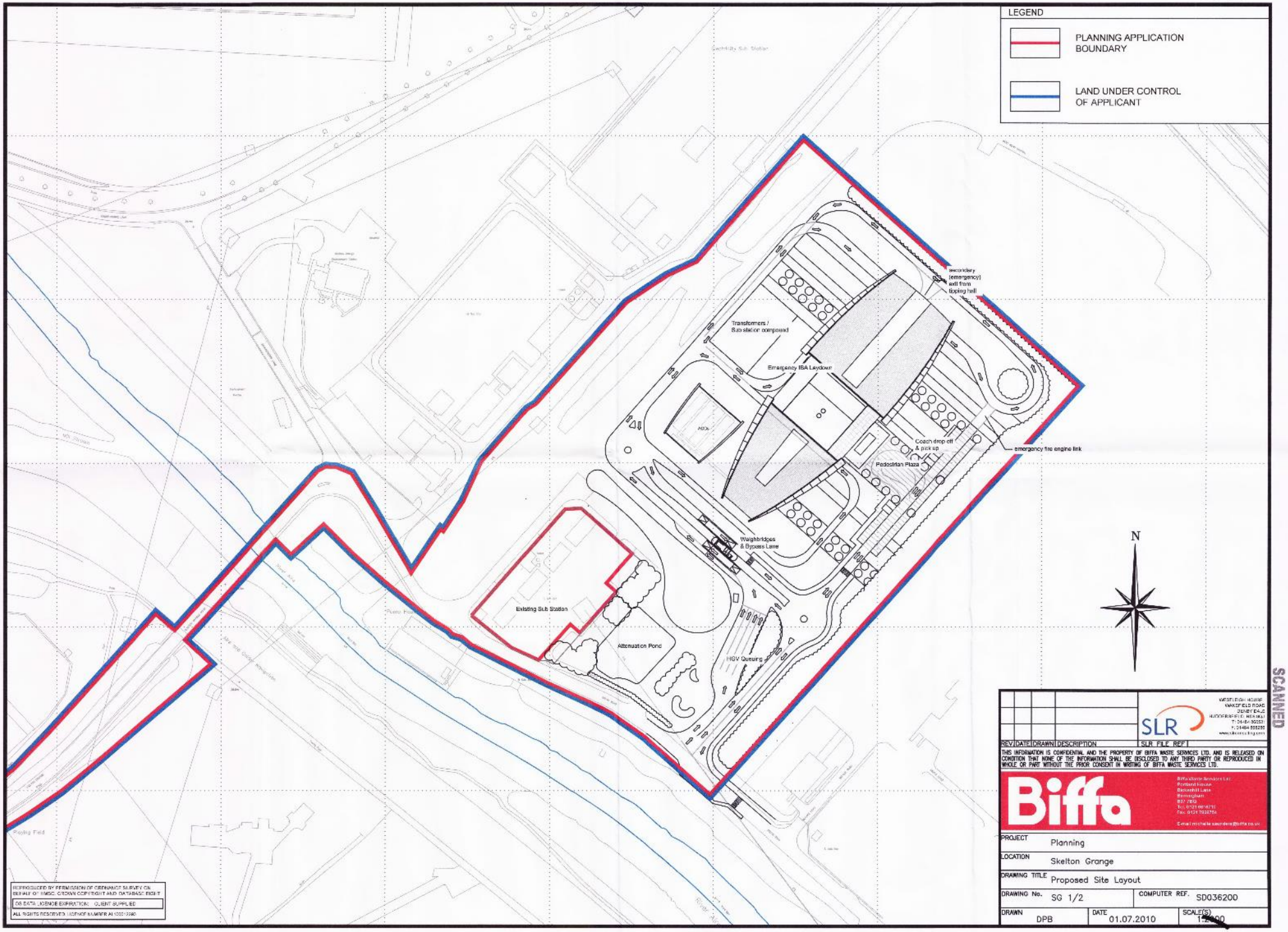
REV	DATE	DRAWN	DESCRIPTION	SLR FILE REF

SLR

Biffa

PROJECT	Planning
LOCATION	Skelton Grange
DRAWING TITLE	Site Location
DRAWING No.	SG 1/1
COMPUTER REF.	SD036100
DRAWN	BS
DATE	01.07.2010
SCALE(S)	1:10,000

11/03705



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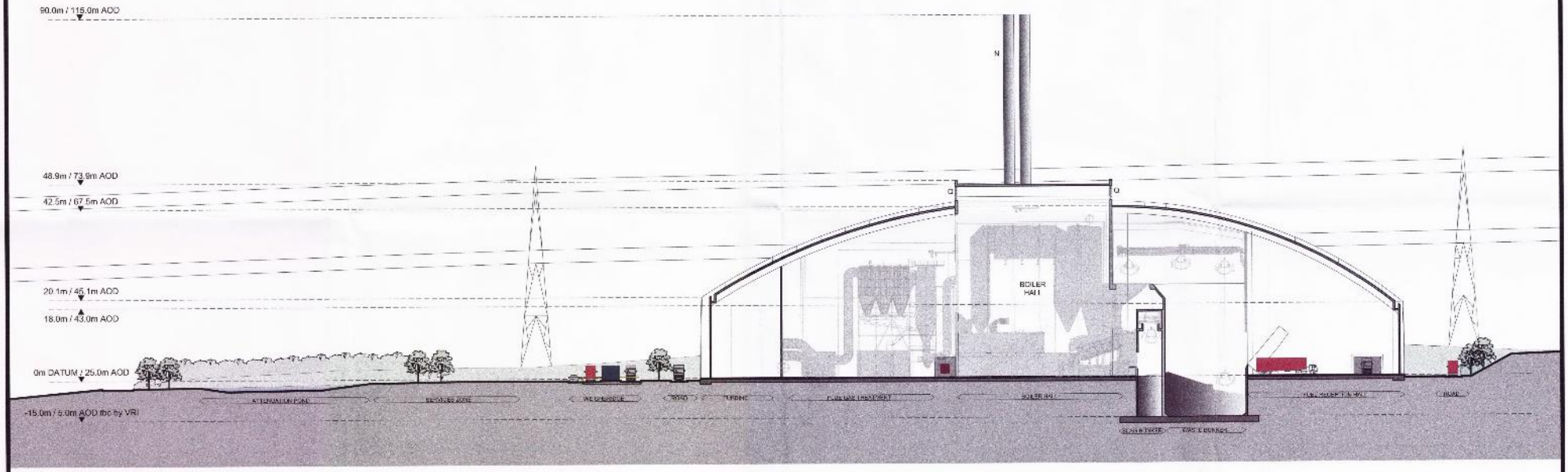

MATERIALS KEY

ROOF ROOF
A EXTERNAL SHEET: Kalzip profiled aluminium standing seam roof sheet
FINISH: Mill finish aluminium, "Silver anodised" finish

OFFICES ROOF
B Concrete tiles on purlins on plant area
FINISH: Weathering type tbc

WALL CLADDING TO PLINTHS
C MATERIAL: Horizontal insulated cladding as Eurodeck
FINISH: Coloured Plannia
COLOUR: Akaroa

WALL CLADDING TO FET ABOVE PLINTH
D MATERIAL: Horizontal insulated cladding as Eurodeck
FINISH: Coloured Plannia
COLOUR: Akaroa

TRANSLUCENT ROOF LIGHTS
E MATERIAL: Composite 16mm polycarbonate wall cladding system, fixed vertically with internal fixing
FINISH: Soft light COLOUR: tbc

LOUVRES
F MATERIAL: Sheet metal louvres integrated with adjacent cladding systems
FINISH: Polyester powder coated.
COLOUR: To match adjacent cladding

OFFICE WALL CLADDING
G MATERIAL: Curtain wall glazing system
FINISH: T.B.C.
COLOUR: T.B.C.

BRISE SOLEIL TO OFFICES
H MATERIAL: Lightweight aluminium walk on system including access walkway and horizontal brise-soleil with fair faced.
FINISH: Polyester powder coated. COLOUR: T.B.C.

TRANSLUCENT WALL CLADDING TO BOILER HALL
J MATERIAL: Composite 16mm polycarbonate wall cladding
FINISH: Soft grip
COLOUR: Slate Grey

VEHICLE DOOR SURROUNDS
K MATERIAL: Sheet (channel sections)
FINISH: Polyester powder coated.
COLOUR: T.B.C.

EXPOSED STEEL STRUCTURE, EXTERNAL GANTRIES AND WALKWAYS
L MATERIAL: Exposed steel to be hot dip galvanised
FINISH: Painted in accordance with specification

DOORS TO ENV
M MATERIAL: Steel fascia as and wall door or roller shutter door
FINISH: Polyester powder coated.
COLOUR: To match Plant Cladding

CHIMNEY STACKS
N MATERIAL: Steel
FINISH: Polyester powder coated.
COLOUR: Goose wing grey

CURVED SCREEN TO ACCS
P MATERIAL: Perforated Kalzip aluminium type (Kal35R/Wall) in horizontal bands
FINISH: Polyester powder coated
COLOUR: To match glass line cladding

HIGH LEVEL LOUVRES
Q MATERIAL: Sheet metal louvres integrated with adjacent cladding systems
FINISH: Polyester powder coated.
COLOUR: To match adjacent roof cladding

0m 10m 20m 30m 40m 50m
Scale

SCANNED

REV	DR	CHD	DRAWN	DESCRIPTION	SLR FILE REF
					0034.00350.26

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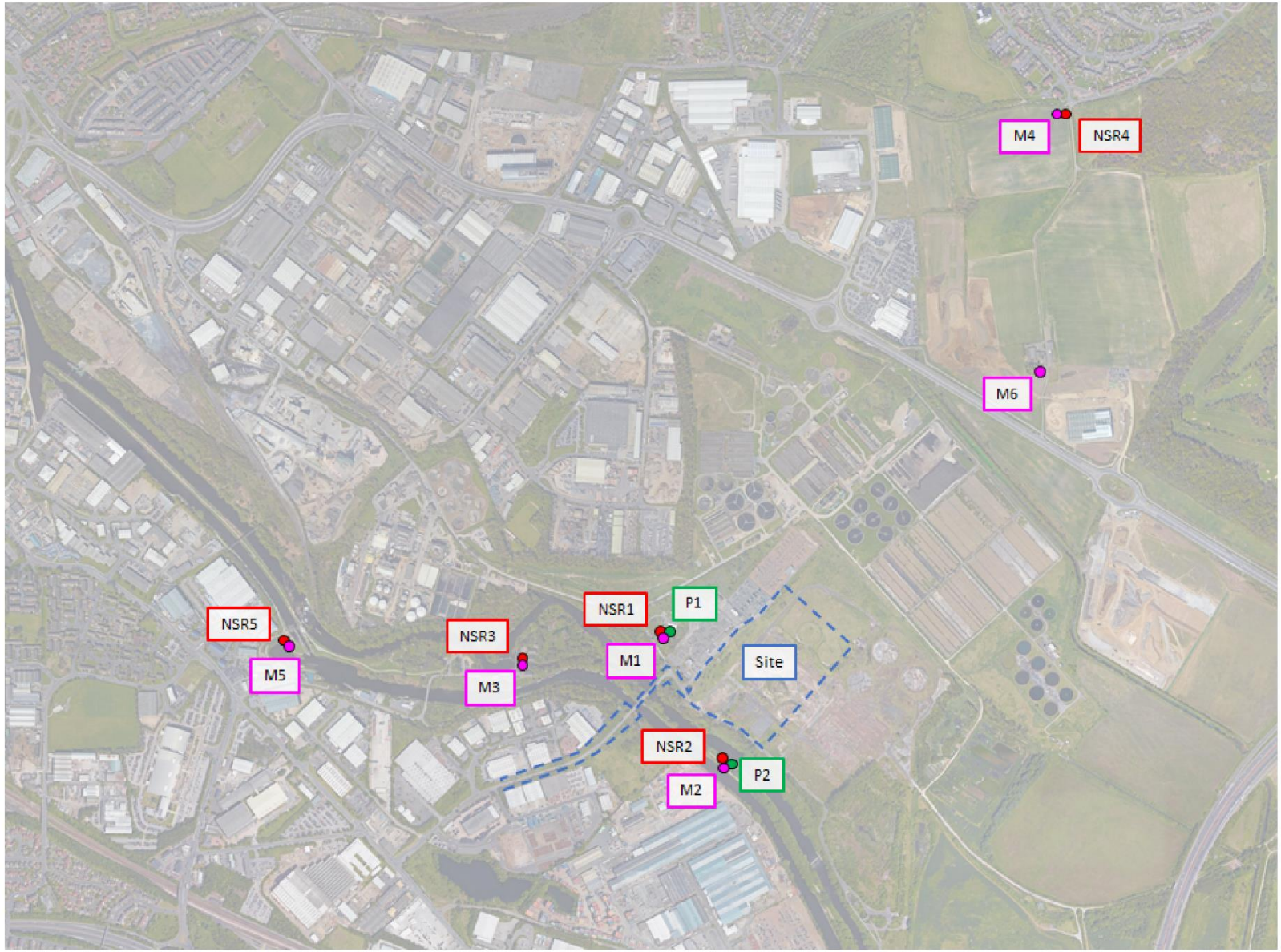
PROJECT	Planning
LOCATION	Skelton Grange
DRAWING TITLE	Longitudinal Section
DRAWING No.	SG 3/8
COMPUTER REF.	SD037000
DRAWN	ZH
DATE	01.07.10
SCALE(S)	1:1000

APPENDIX 03

Baseline Sound Survey Details



LEGEND

- Baseline sound survey monitoring positions (2019)
- Noise-sensitive receptors (NSRs)
- Baseline sound survey monitoring positions (2009)
- Site boundaries

N

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Site
SKELTON GRANGE

Project
SKELTON GRANGE EFW FACILITY

Drawing Title
NOISE-SENSITIVE RECEPTORS AND BASELINE SOUND SURVEY LOCATIONS

Scale
N/A

Date
JUNE 2019

Drawing Number
NIA01

Revision
0

Comments

Figure 03-1
Photographs of the monitoring positions for the Baseline Sound Survey

Figure 03-2
Graph of measured noise levels from the Baseline Sound Survey at monitoring position P1

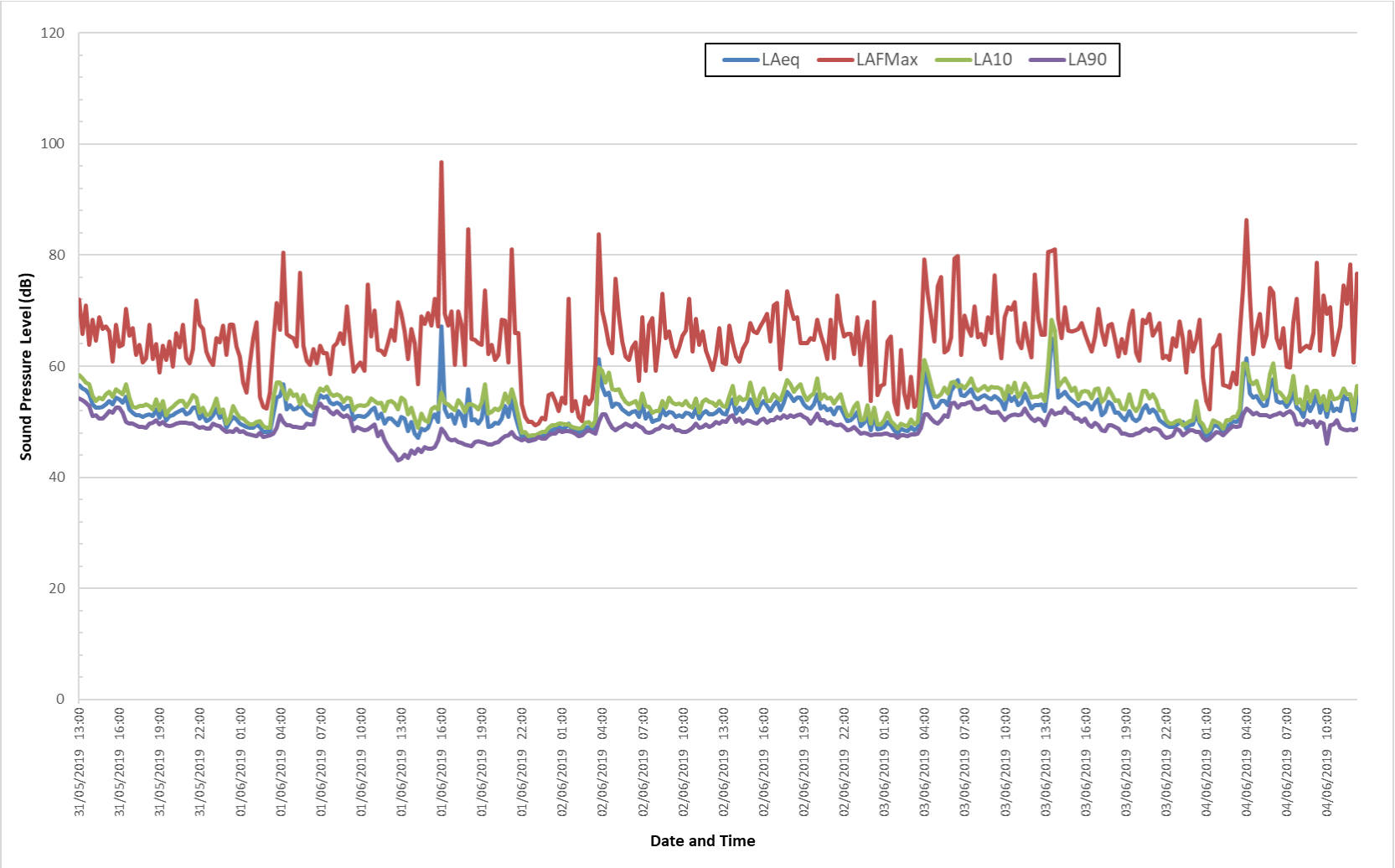
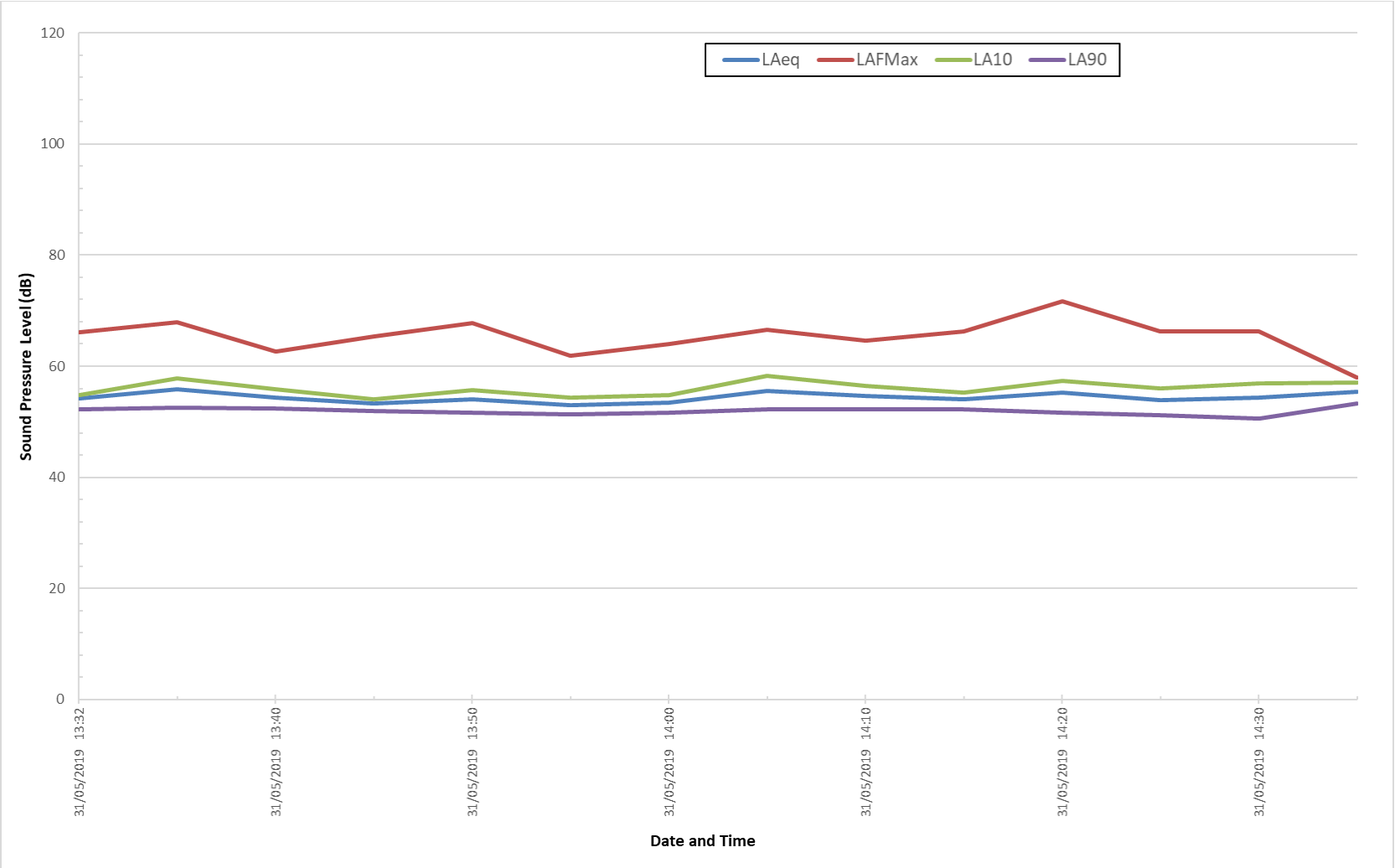


Figure 03-3
Graph of measured noise levels from the Baseline Sound Survey at monitoring position P2



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APPENDIX ERA 5

Solid Residue Management Plan

SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Appendix ERA 5

Solid Residue Management Plan

Prepared for: WTI EfW Holdings Limited

SLR Ref: 416.07232.00002
Version No: 1
August 2019

BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with WTI EfW Holdings Limited (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

CONTENTS

DOCUMENT REFERENCES

TABLES

1.0 Introduction

WTI EfW Holdings Limited has instructed SLR Consulting Limited (SLR) to prepare an Environmental Permit (EP) application for the proposed Skelton Grange Energy from Waste (EfW) Facility at Skelton Grange, near Leeds under the Environmental Permitting (England and Wales) Regulations 2016 (as amended). The facility will be operated by WTI UK Limited (WTI).

The proposed facility will process municipal solid waste, commercial and industrial waste, sewage sludge and non-infectious clinical waste at a capacity of up to 410,0000 tonnes per annum. The technology will be based on conventional thermal incineration comprising moving grate furnace, steam boiler and turbine generator to produce electricity and the potential to recover waste heat. Flue gases will be treated to minimise polluting emissions and solid residues will be transferred off-site for treatment and recovery.

This document provides an Appendix to the Environmental Risk Assessment carried out for the proposed EfW facility. The purpose of this solid residue management plan is to identify and quantify all the waste streams produced on site and to assess:

- the nature of the waste produced; and
- the disposal or recovery options available.

in order to demonstrate that the proposed facility meets Best Available Techniques for the minimisation and management of waste.

2.0 Residue Management Options

2.1 Solid Residue Arisings

The process will generate two main solid waste residues, namely Incinerator Bottom Ash (IBA) and Air Pollution Control Residue (APCR).

An estimation of tonnages of these waste streams is provided in table 2-1 and detailed information on the origins and key issues associated with each is provided in sections 2.2 and 2.3.

Table 2-1
Waste Arising

Waste Source	Approximate Tonnes per Year
IBA	102,500
APCR	24,600

At the time of producing this management plan, it is envisaged that the products and residues arising will be managed in, but not necessarily be limited to, the following ways as described below:

- IBA will be conveyed from the ash quench to the IBA storage bunker pending transfer off site for further treatment and recovery at a suitably permitted facility. No treatment will take place on site;
- APCR will be conveyed to silos for storage pending removal off-site for further treatment or disposal at a suitably permitted facility.

2.2 Incinerator Bottom Ash (IBA)

IBA is generally regarded as a non-hazardous waste and can be treated to produce a material suitable for replacement of primary aggregates, such as sand, gravel or road stone, in construction projects. Treatment usually consists of removing ferrous, non-ferrous metal and oversize components followed by re-grading and weathering.

The IBA remaining after the combustion of the waste will be discharged from the end of the combustion grate directly into an ash quench bath and then stored in the IBA bunker adjacent to the feed bunker.

The IBA will be mixed with fly ash collected from all five boiler passes. Assessment of the level of contaminants within the ash will be made at regular intervals to review whether this approach continues to be suitable. This will be kept separate from APCR. It is expected that between 20 and 25% of the waste input will remain as IBA.

IBA will then be exported off site to a suitable re-processing facility to produce material which can be recovered as IBA Aggregate (IBAA).

WTI will explore options for recovery of IBA with ash recycling facilities.

2.3 Fly Ash and APCR

The APCR consists of the residues following the use of lime and carbon reagents to capture pollutants as part of the flue gas treatment measures. These residues have properties which mean they are classed as hazardous waste. In accordance with the requirements of the Industrial Emissions Directive (IED), Best Available Techniques (BAT) and the BREF Note on Waste Incineration, the intermediate storage and transport of the dry residues in the form of dust will take place in such a way so as to prevent as far as practicable emissions to the environment. Intermediate storage will therefore take place within the Skelton Grange facility and will be within enclosed silos. All vehicles leaving the facility, transporting, dry residues will be enclosed or covered.

The APCR from flue gas treatment will be conveyed to silos for storage pending transfer off-site in enclosed tankers for further treatment and disposal at hazardous waste landfill. APCR shall be handled as a hazardous material when being transported for treatment or landfill.

Commercially viable recycling options for APCR in the UK are currently limited. However, WTI will review disposal on a regular basis and will investigate the possibility of treatment and recovery options as an alternative to disposal to landfill. .

2.4 Residue Testing

IBA and APCR will be collected separately within the process. As required by IED, BAT and the Waste Incineration BREF, WTI will undertake appropriate sampling and testing of the residues to establish the physical and chemical composition of the residues prior to determining suitable routes for recycling or disposal. Testing of residues will be undertaken to ensure compliance with WAC at receiving landfills. A sampling and testing methodology will be agreed by WTI with the Environment Agency prior to commencement of operations at the facility.

3.0 Minimisation of Residues

In order to comply with the requirements of the IED, BAT and the BREF, residues resulting from the operation of the facility will be minimised in their amount and harmfulness. In accordance with the IED, WTI propose to identify markets for use of the residues as permitted by current UK legislation.

3.1 Techniques for minimising the harmfulness and quantity of residues

Control of incoming wastes and process design will be key to minimising the quantity and harmfulness nature of waste residues. The facility will only handle non-hazardous waste from known sources. Wastes will be inspected when received to identify and remove non-permitted components as required. Wastes will then be deposited into the waste bunker and mixed prior to being placed into feed hoppers by overhead crane. Should any non-conforming material be detected, this will be removed from the bunker by the crane.

The process design will also be optimised to ensure an even spread of incoming waste material across the combustion grate and maximum burn-out of the waste. The forward-acting moving grate system is specifically designed for these purposes therefore maximising the opportunity for the combustion of waste and minimising the volume of unburnt material being discharged as IBA.

IBA will be quenched and stored pending transfer off-site for treatment or disposal at a suitably permitted facility. The IBA produced by the facility will be of a quantity suitable for recovery as a secondary IBA aggregate (IBAA) following off-site treatment.

Fly ash collected from the five boiler passes (also known as boiler ash) will also be capable of recovery. The fly ash will be mixed with IBA and kept separate from APCR. The mixed ash will be transfer by means of conveyor to the IBA storage bunker prior to transfer off-site for further processing.

APCR from the flue gas treatment stage will be collected separately and will be conveyed to silo storage pending transfer off-site for further treatment/landfill. The amount of APCR produced depends on the dosing rate of the reagents used for flue gas treatment. Dosing rates will be optimised to ensure that the required emissions reduction performance is achieved without excessive reagent use.

In conclusion WTI has identified the key residues arising from the EfW facility and indicative quantities generated. The Best Available Techniques and Operating Techniques (BATOT) submitted as section 7 of this permit application provides a detailed assessment of the techniques proposed to be implemented at the facility.

Waste disposal routes will be regularly audited once the facility is operational in line with the site's Environmental Management System (EMS). A resource efficiency and waste minimisation programme will also be established to ensure that reagent use is minimised and that new opportunities for reusing and recycling process by-products are identified and acted upon at the earliest opportunity.

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APPENDIX ERA 6

Global Warming Potential Assessment

SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Appendix ERA 6: Global Warming Potential Assessment

Prepared for: WTI EFW Holdings Ltd.

SLR Ref: 416.07232.00002
Version No: 1
August 2019

BASIS OF REPORT

CONTENTS

1.0 INTRODUCTION

WTI EFW Holdings Ltd has instructed SLR Consulting Limited (SLR) to prepare an Environmental Permit (EP) application for the proposed Skelton Grange Energy from Waste facility (EfW) to be located at Skelton Grange near Leeds. The facility will be operated by WTI UK Ltd (WTI).

The proposed facility will process municipal solid waste, commercial and industrial waste, sewage sludge and non-infectious clinical waste at a capacity of up to 410,0000 tonnes per annum. The technology will be based on conventional thermal incineration comprising moving grate furnace, steam boiler and turbine generator to produce electricity and the potential to recover waste heat. Flue gases will be treated to minimise polluting emissions and solid residues will be transferred off-site for treatment and recovery.

A detailed description of the process is provided in the Best Available Techniques and Operating Techniques Document in Section 7 of this application.

The Environment Agency (EA) requires that new environmental permit applications must include a risk assessment to assess the potential environmental impacts of emissions from the proposed activities. The requirements are described in EA guidance 'Risk assessments for your environmental permit' last updated 10 January 2019. For those sites which result in direct and / or indirect emissions to air that impact global warming, an assessment of impact of air emissions on global warming must be undertaken in accordance with the EA's 'Assess the impact of air emissions on global warming' guidance published 1 February 2016.

The Skelton Grange EfW has the potential to contribute to global warming as a result of direct and indirect emissions to air. As such, the purpose of this report is to provide an assessment of the Global Warming Potential associated with the direct and indirect emissions from the facility to support the EP application.

1.1 Scope of the assessment

The Environment Agency's guidance suggests the following steps are used to calculate the impact on global warming.

1. Identify your greenhouse gas emissions.

2. Work out the impact these emissions have on global warming.

3. Work out the impact of your 'process option' on global warming.

4. Add up the impacts from steps 2 and 3 for each of your current or proposed process options to give the total impact on global warming.

The objective of this assessment is to enable:

- techniques to be chosen that have the least impact on global warming; and
- to establish the best available techniques to control emissions with global warming potential.

The global warming potential assessment has been carried out in accordance with the EA's guidance and the H1 software tool.

2.0 Identify Greenhouse Gas Emissions & Impacts

2.1 Sources

Table 1 summarises the sources of greenhouse gas emissions from the installation.

Direct emissions of greenhouse gases are produced by the combustion processes, primarily in the form of carbon dioxide (CO_2). In addition, emissions of nitrous oxide (N_2O) are also released from the combustion process and

as a by-product from the oxides of nitrogen (NO_x) abatement process. Indirect emissions of greenhouse gases are also produced by the energy imported to supply ancillary equipment for start-up and periods when the facility is not generating electricity. This will primarily be in the form of CO_2 from combustion of fossil fuels to generate electricity.

Table 1 Summary of Greenhouse Gas Emission Sources

Emission Type	Source of greenhouse gas	Key influence on emissions
Direct	Combustion of waste. Primarily as CO_2.	Waste
Direct	Combustion gases from ancillary fuels to support combustion (start-up & shutdown, low temperature, etc.) or provide back-up for emergency generators, fire pumps, sprinkler systems. Primarily as CO_2.	Diesel
Indirect	Imported energy (to supply ancillary aspects of the process such as fans, motors etc) with off-site release of combustion gases. Primarily as CO_2.	Electricity source
Direct	By-product of NO_x abatement techniques. Primarily N_2O emissions.	Combustion temperature and reagent dosing rate.

2.1.1 Carbon Dioxide Sources

CO_2 will be released as a product of the combustion of waste in the EfW plant.

The amount of carbon dioxide released will depend on the carbon content of the fuel and the efficiency of combustion. As the purpose of waste to energy processes is to generate useable energy, high conversion rates of carbon in fuel to CO_2 are expected.

Each line will incorporate two auxiliary, diesel-fired support burners to enable temperature to be maintained at all times to comply with Industrial Emissions Directive (IED) requirements. For example, during start-up, shut down and abnormal operations such as feed chute blockage, the auxiliary, diesel-fire support burners will be used to maintain furnace temperatures within IED limits.

2.1.2 Nitrous Oxide sources

Thermal waste treatment is a low contributor of emissions of N_2O in terms of anthropogenic emissions and is not usually reported as a part of NO_x estimation. However, it has a relatively high global warming potential and can form a small but significant component of overall global warming potential. The Final Draft Best Available Techniques (BAT) Reference (BREF) document for Waste Incineration (December 2018)[1] describes that N_2O can arise from:

- use of lower thermal treatment (combustion) temperatures - typically below 850°C; and
- the use of Selective Non-Catalytic Reduction (SNCR) for NO_x reduction.

[1] Section 2.5.9.1.

Thermal Treatment

N_2O can be emitted if there is insufficient oxygen and combustion takes place below 850°C. For municipal waste treatment, N_2O emissions of 1 - 12 mg/Nm³ (for individual measurements) and averages of 1 - 2 mg/Nm³ are seen[2].

Selective Non-Catalytic Reduction (SNCR)

SNCR is commonly used for the abatement of NO_x. In the SNCR process, ammonia (NH_3) or urea ($CO(NH_2)_2$) is injected into the furnace to reduce NO_x emissions. SNCR also produces the formation of N_2O, as a side-reaction dependent upon reagent dose rates and temperature. Values of 20 - 60 mg/m³ have been measured, especially where low NO_x values are sought (N_2O increases when higher dose rates are used to secure lower NO_x emission targets)[3]. The use of urea instead of ammonia can lead to higher N_2O emissions, as much as 2 - 2.5 times higher. At the time of producing this assessment, it has not been decided whether urea or ammonia will be used as the reagent. Therefore, for the purposes of this assessment, a value of 20 mg/m³ has been assumed reflecting a value between that generated from the use of ammonia and use of urea for SNCR.

2.2 Process Options

The objective of this assessment is to demonstrate that BAT will be applied to control emissions with global warming potential. The EA's guidance requires that other process options are considered as part of this assessment. The key emissions of greenhouse gases from waste-to-energy processes are CO_2 and N_2O. Consideration has been given to other process options which may be available as alternatives to those proposed in this application, to identify any which could affect releases of greenhouse gases. This is summarised below.

2.2.1 Carbon Dioxide

The ultimate objective of any type of 'waste to energy' thermal treatment process is to convert the carbon content of waste into energy by combustion, whether that is by full conversion to heat and power on site, or partly off-site by the production of intermediate waste fuels for combustion elsewhere. If conversion technologies are chosen which achieve high burnout of carbon to maximise energy release, then the ultimate emissions of carbon dioxide would be similar per tonne of waste regardless of technology and whether the releases occur on-site or by intermediate fuels combusted off-site.

This principle is confirmed in Item 51 of the EA's guidance 'How to comply with your environmental permit: additional guidance for: The Incineration of Waste (EPR 5.01, March 2009)' (EPR 5.01) states the following in relation to emissions of carbon dioxide:

'The global warming potential (GWP) of the installation will be derived mainly from the CO2 releases arising from the waste combustion. As it is the purpose of an incinerator to convert wastes into (primarily) water and CO2 attention should not focus upon these releases but upon the following: CO2 equivalent releases resulting from N2O releases. These can contribute in the order of 10% of the GWP, and may be minimised by appropriate selection and optimisation of SNCR reagent injection;'

For this reason, it is not considered necessary to consider releases from different conversion technologies as alternative process options for this assessment.

Item 50 of EPR 5.01 states the following:

'All measures that reduce fuel energy use also reduce the CO2 emissions. The selection, when possible, of raw materials with low organic matter content and fuels with low ratio of carbon content to calorific value reduces

[2] Section 3.2.1 of the December 2018 Final Draft BREF document on Waste Incineration.
[3] Section 3.2.1 of the December 2018 Final Draft BREF document on Waste Incineration.

CO2 emissions. In this sector this is only relevant to the support fuels used. In general natural gas will be the preferred option. If not available low sulphur gas oil provides an alternative.'

The Skelton Grange EfW proposes the use of diesel as an auxiliary fuel for start-up and shut down purposes. As natural gas could potentially be used as an alternative process option, this aspect will be considered as part of this assessment.

Item 52 of EPR 5.01 states the following:

'Improving installation energy efficiency (including recovery) will prevent CO2 release by other installations. This may be demonstrated by providing energy balance (Sankey) diagrams and quoting the net energy production per tonne of waste produced.'

The Skelton Grange EfW will be designed to achieve a high level of energy conversion. The BATOT document submitted in Section 7 of this application describes how the relevant energy efficiency techniques in S5.01 and 2018 BREF document on Waste Incineration have been taken into account. This includes (a) components selected to maximise in-process energy efficiency (b) process control systems to ensure than equipment operates as and when required, and (c) in-process measures to optimise plant efficiency.

As this aspect is covered in the BATOT document it is not considered further in this assessment.

Section 2.5.9 of the December 2018 Final Draft BREF document on Waste Incineration states:

'There are essentially two ways of reducing greenhouse gas emissions:

- *Increase the efficiency of energy recovery and supply…;*
- *Control CO_2 emissions using flue gas treatment.*

Production of sodium carbonate by reacting CO_2 in the flue gases with NaOH [sodium hydroxide] is possible.'

As identified above as measures proposed to achieve a high level of energy conversion are discussed with the BATOT document, this aspect is not considered further in this assessment.

Production of sodium carbonate by reacting CO_2 in the flue gases with NaOH has been ruled out from further assessment on the basis of it not being a well-established technique, issues associated with the use of significant volumes of NaOH and the release of CO_2 in NaOH production.

2.2.2 Nitrous Oxide

Item 51 of EPR 5.01 states that attention should focus on the following:

'CO2 equivalent releases resulting from N2O releases. These can contribute in the order of 10% of the GWP, and may be minimised by appropriate selection and optimisation of SNCR reagent injection;'

A SNCR system is proposed for the control of NO_x emissions from the installation. An assessment of BAT for NO_x abatement is presented in Appendix 3 to the BATOT in Section 7 of this application and concludes that this technique represents BAT for the installation. The impact of nitrous oxide emissions on global warming are covered in that NO_x BAT assessment and therefore are not included in this report.

2.3 Impact of Emission Sources on Global Warming

Calculation of the global warming potential of direct and indirect emissions from the process is estimated using the H1 software tool and presented in Table 2 and Table 3 below.

In calculating the Global Warming Potential of emissions, H1 indicates that a carbon dioxide emission factor of zero should be used for renewable energy sources such as waste to conform with convention to treat such emissions as carbon-neutral. Therefore, the carbon dioxide emissions from combustion of waste are not included in the assessment.

Input values for electricity and auxiliary fuel use have been obtained from WTI.

Average outputs are used for electrical power generation and heat and assume replacement of public supply for electricity and diesel for heat.

Calculation of the global warming potential of N_2O emissions from the process has been estimated assuming an emissions concentration of 20mg/m^3 and using the flow rates derived from the air quality modelling.

The following tables reproduce the estimation given by the H1 software tool.

For the purposes of this assessment the following values are used:

- Table 2 - (Electricity Export only Mode) is based on generating 38MW_e as electricity with no heat export.
- Table 3 - (CHP Mode) is based on generating 31MW_e of electricity and exporting 35MW_{th} as heat.

Table 2 Global Warming Potential of Emissions from the Skelton Grange EfW (electricity only mode)

Source	Release	Tonnes per annum	GWP tonnes CO_2 equivalent per annum
CO_2 from Imported electricity	indirect	795	795
CO_2 from Gas oil (diesel) combustion	direct	1,905	1,905
Nitrous oxide from combustion & SNCR	direct	47.8	14,828
Exported electrical energy	indirect	-122,442	-122,442
Total global warming potential			-106,503

Table 3 Global Warming Potential of Emissions from the Skelton Grange EfW (CHP mode)

Source	Release	Tonnes per annum	GWP tonnes CO_2 equivalent per annum
CO_2 from Imported electricity	indirect	795	795
CO_2 from Gas oil (diesel) combustion	direct	1,905	1,905
Nitrous oxide from combustion & SNCR	direct	47.8	14,828
Exported electrical energy	indirect	-101,184	-101,184
Exported heat energy	indirect	-70,000	-70,000
Total global warming potential			-153,655

2.4 Comparison of process options

A comparison of alternative options for NO_x control, including assessment of Global Warming Potential, is provided elsewhere in Appendix 3 to the BATOT in Section 7 of this application and is therefore not repeated here.

As noted in section 2.2.1 of this report, the Skelton Grange EfW proposes to use diesel as an auxiliary fuel for start-up and shut down purposes. As other fuels could potentially be used, this aspect will be considered further as an alternative process option.

Natural gas could be a potential alternative to the use of diesel as auxiliary fuel in the cyclone furnace. CO_2 emission factors are provided for these fuels in Table B2 of Annex H of H1:

- Diesel 0.25 tonnes/MWh
- Natural gas 0.19 tonnes/MWh

The emissions of carbon dioxide released if natural gas were used would be 1,448 tonnes per annum rather than 1,905 tonnes per annum using diesel, resulting in a saving of 457 tonnes. However, this represents only a 0.3-0.4% saving in the positive global warming potential of the Site and is therefore not considered significant. The facility will employ diesel fuelled vehicles and a diesel fuelled emergency generator. As a result of these different onsite uses, optimizing the plant for one fuel (diesel) represents greater efficiency than employing gas fuelled auxiliary burners.

3.0 Conclusions

Global Warming Potential emissions as carbon dioxide equivalents have been estimated for the proposed Skelton Grange EfW in accordance with the EA guidance 'Assess the impact of air emissions on global warming'. The assessment was made using the H1 software tool.

This GWP assessment has only considered alternative process options for the combustion of auxiliary fuel, as:

- Alternative options for NO_X abatement are covered in Appendix 3 to the BATOT in Section 7 of this application; and
- The generation of CO_2 from the burning of waste for energy recovery is assumed to be carbon-neutral.

The potential global warming potential reduction that could be achieved through use of alternative start-up auxiliary fuel is insignificant, at only 0.3-0.4% of the positive contributions predicted to global warming potential.

H1 does not provide criteria for the determination of global warming potential significance. The total global warming potential per annum is estimated at –106,503 tonnes per annum carbon equivalent in electricity only mode or -153,655 tonnes per annum carbon equivalent in CHP mode.

For comparison, government figures[4] indicate that the UK was responsible for releasing around 364 million tpa CO_{2e} in 2018. In 2018, emissions per unit of electricity supplied from fossil fuels is estimated to have been around 0.43 t CO_{2e} per MWh. In comparison, emissions per unit of electricity supplied from the Skelton Grange EfW are predicted to be around -0.35 t CO_{2e} per MWh in electricity only mode.

The assessment indicates that the global warming potential of the proposed EfW is significantly positive when set in this context.

[4] Department for Business, Energy and Industrial Strategy – 2018 UK Greenhouse Gas Emissions, Provisional Figures (March 2019)

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