ADDITION OF TWO BIOMASS BOILERS AT JJC HIRE LIMITED - PERMIT VARIATION APPLICATION SUPPORTING DOCUMENT

JJC Hire Limited

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1 Introduction

1.1 Overview

1.1.1 This document contains supporting information which accompanies the Environmental Permit (EP) variation application being submitted for the addition of two biomass boilers at JJC Hire Limited, Sandscale Park Industrial Estate, Barrow-in-Furness. This application has been completed on behalf of JJC Hire Limited by Oaktree Environmental Ltd.

1.2 Proposed Activities

1.2.1 An EP is already in place for the operation of a single biomass boiler at the site, regulated as a bespoke installation under the Environmental Permitting (England and Wales) Regulations 2016 ("the regulations"). This application includes the addition of two new biomass boilers. The proposed activities are summarised in the table below, together with Schedule 1 References and activity description.

Table 1.1 – Proposed Activities

Site Name	Schedule 1 References	Description of the Activity
JJC Hire Ltd. Sandscale Park, Park Road, Barrow-in-Furness, Cumbria, LA14 4QT	Section 5.1 Part B(a)(v)	The incineration in a small waste incineration plant with an aggregate capacity of 50kg or more of wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coatings

1.3 Details of Site Operator

1.3.1 This EP variation has been applied for by JJC Hire Limited.

1.4 Permit Boundary

1.4.1 An extension to the permit boundary is required to accommodate the additional biomass boilers. The proposed permit boundary is shown on drawing no. 2272-004-02 within Appendix I of this document.

2 Planning Status

2.1 An application for planning permission for the additional two biomass boilers has been submitted to Cumbria County Council. However, it should be noted that planning permission is not required to be in place in order for an EP to be issued.

3 Operating Techniques

3.1 There will be no change to the operating techniques and monitoring procedures in place under the existing EP, which will continue to be implemented during the operation of the additional two biomass boilers.

3.2 The existing boiler is an Heizomat RHK-AK 1000 boiler. The two additional boilers are Heizomat RHK-AK 900 boilers, each having a thermal output of 900KW.

3.3 Reference should be made to Drawing No 2272-004-03 for details of the layout, following the inclusion of the two additional boilers. These each be served by elevated flues, positioned as shown on the layout plan.

3.4 There will be no changes to mitigation and control measures in place under the existing EP.

4 Potential Impacts on the Environment

4.1 An assessment of potential environmental impacts (air) has been undertaken by undertaking an emissions modelling assessment using AERMOD. Reference should be made to Appendix II for a copy of the report. This has demonstrated that proposed stack heights will be of suitable height to achieve adequate dilution and dispersion of residual emissions, resulting in no significant adverse impacts at surrounding ground level locations, including relevant human and ecological receptors.

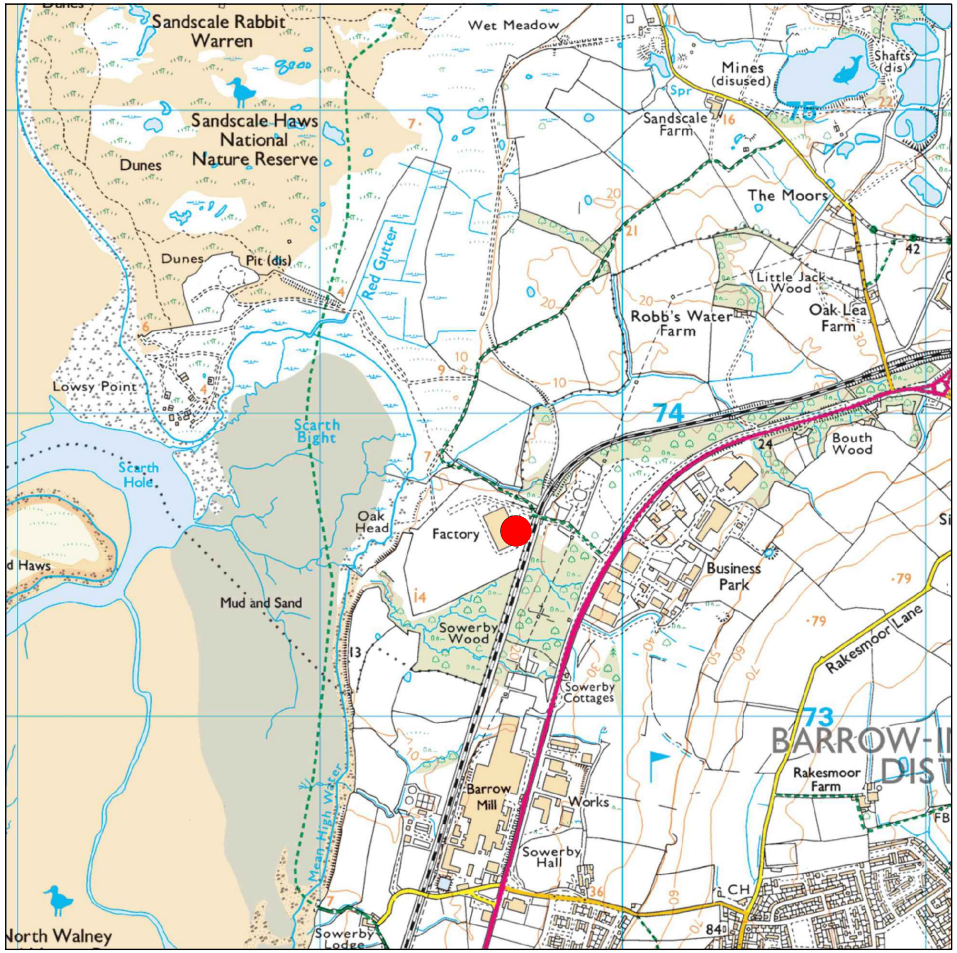
5 Environmental Management System

5.1 An EMS will be implemented during the day to day operation of the biomass boiler to ensure compliance with the EP. Reference should be made to Appendix III for a copy of the EMS. The EMS outlines the following:

- General site management procedures;
- Training procedures;
- Emissions control procedures;
- Emissions monitoring procedures; and,
- Record keeping procedures.

Appendix I

Site Location Map, Permit Boundary Plan and Site Layout Plan



Scale Bar (1:25,000)

0 km 1 km 2 km

NOTES
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Site location

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants

DRAWING TITLE
SITE LOCATION MAP

CLIENT
JJC Hire Ltd

PROJECT/SITE
Sandscale Park, Barrow-in-Furness

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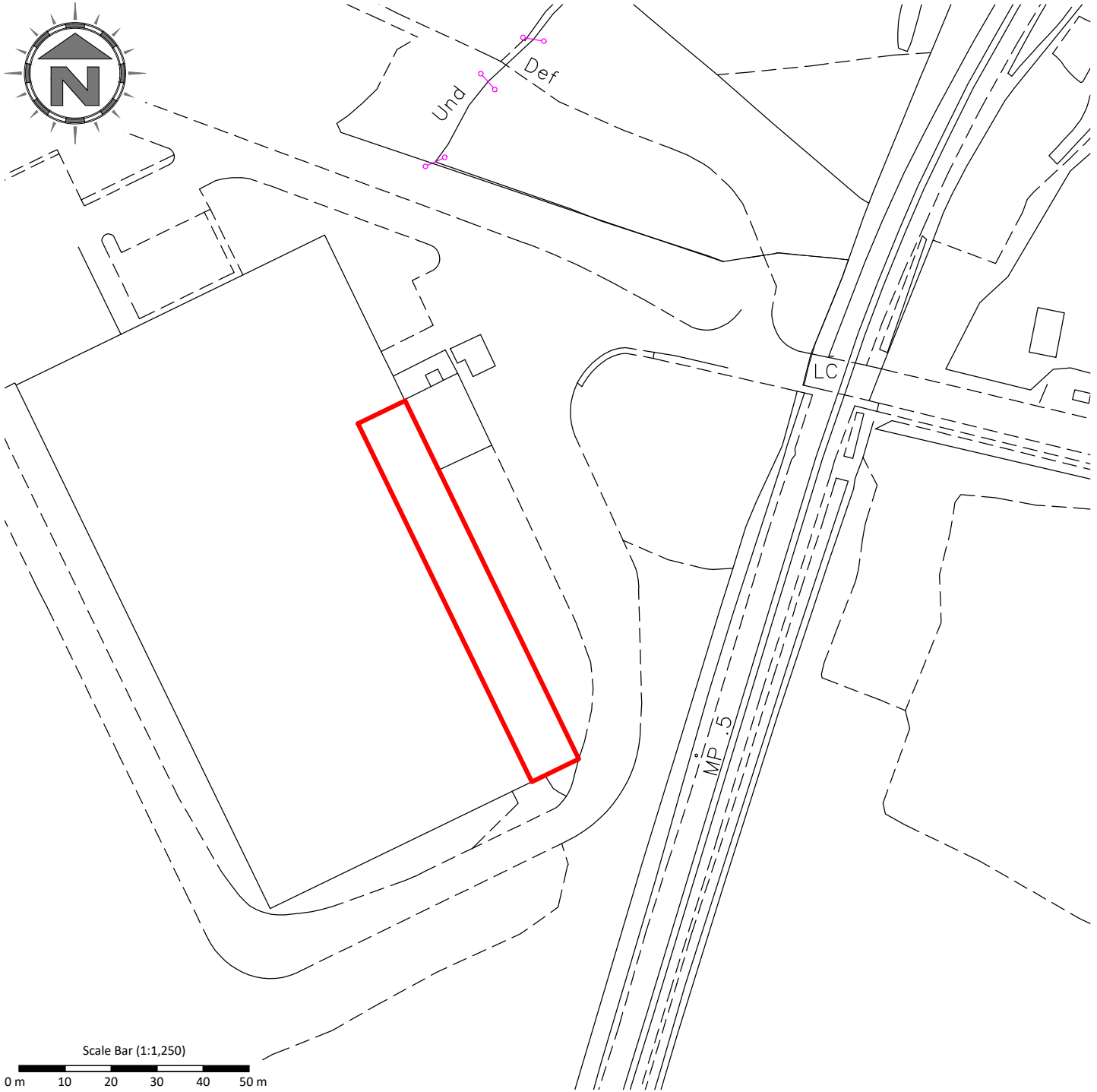

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Permit boundary

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Waste, Planning and Environmental Consultants

DRAWING TITLE

PERMIT BOUNDARY PLAN

CLIENT

JJC Hire Ltd

PROJECT/SITE

Sandscale Park, Barrow-in-Furness

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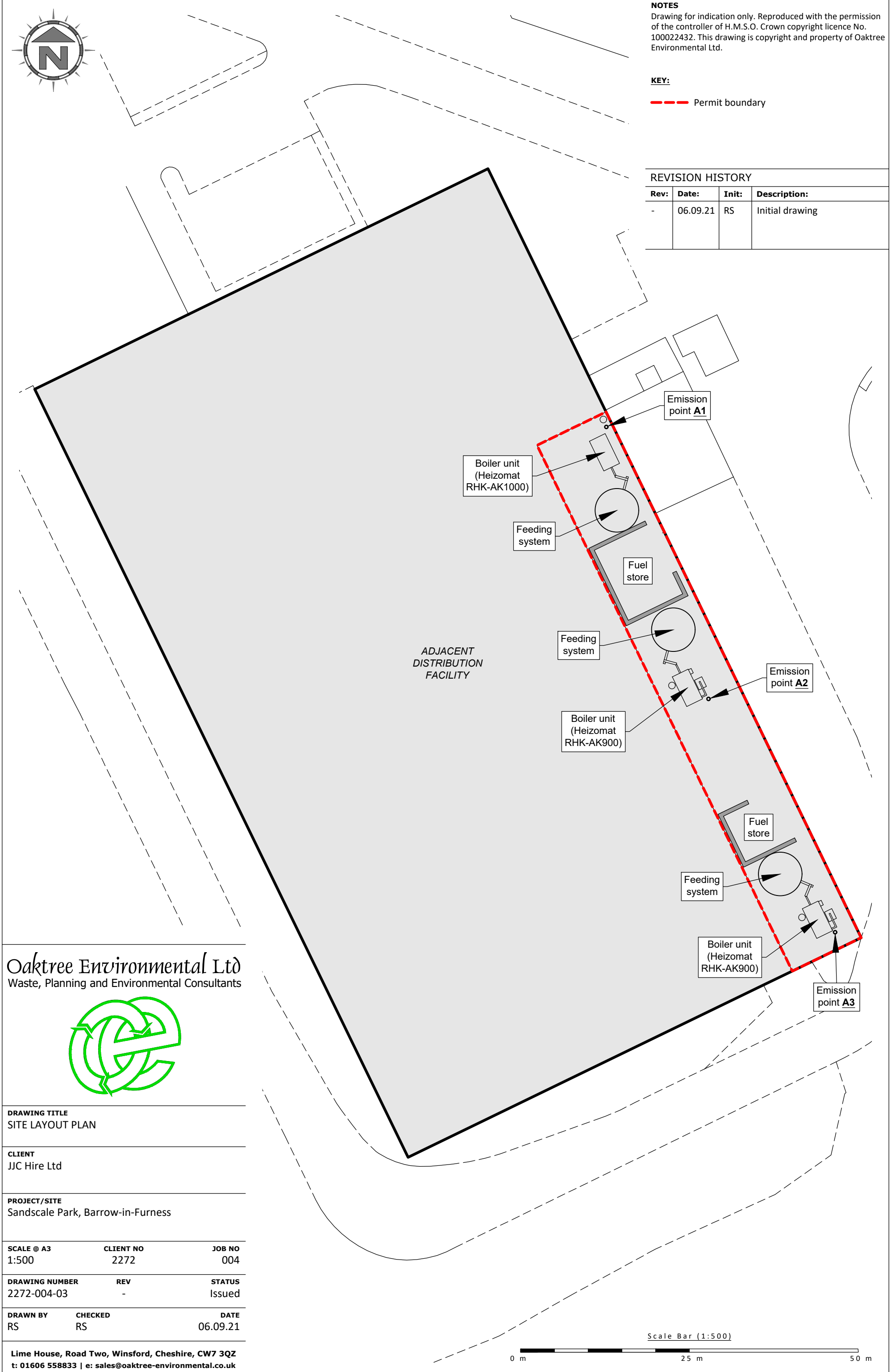

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants

DRAWING TITLE
SITE LAYOUT PLAN

CLIENT
JJC Hire Ltd

PROJECT/SITE
Sandscale Park, Barrow-in-Furness

SCALE @ A3	CLIENT NO	JOB NO
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Appendix II

Emissions Modelling Assessment

EMISSIONS MODELLING ASSESSMENT, BIOMASS BOILERS, SANDSCALE PARK, BARROW-IN-FURNESS

JJC Hire Limited

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1 Introduction

1.1 Background and Context of Assessment

1.1.1 An emissions modelling assessment has been undertaken in support of a Part B Permit Variation Application and planning application being submitted for the operation of three biomass boilers at JJC Hire Limited, Sandscale Park, Barrow-In-Furness. The assessment has been undertaken to predict the potential air quality impacts at sensitive receptor locations as a result of residual emissions associated with the proposed process.

1.2 Site Location

1.2.1 The site is located approximately 4km to the North of Barrow-In-Furness. Reference should be made to Appendix I for a map of the proposed site location.

1.3 Proposed Activities and Environmental Context

1.3.1 The proposals are for the operation of three biomass boilers. The boilers will be fuelled by Grade A waste wood, which is essentially clean, uncontaminated waste wood. Given the operations proposed, the process will be regulated under Part 2, Chapter 5, Section 5.1 Part B(a)(v) of the Environmental Permitting (England and Wales) Regulations 2016 ("the regulations"), which is defined as follows:

"(a) The incineration in a small waste incineration plant with an aggregate capacity of 50 kilogrammes or more per hour of the following waste –

(v) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coatings"

1.3.2 A Part B permit is already in place for the operation of a single biomass boiler. The proposals are to operate an additional two biomass boilers at the site.

1.3.3 The operation of the boiler will have the potential to create airborne emissions and subsequent impacts upon the surrounding environment. Potential air quality impacts have been quantified within this report through prediction of resulting ground level pollutant concentrations which have been compared to the relevant Air Quality Limit Values (AQLVs), Environmental Assessment Levels (EALs), critical levels and loads.

2 Air Quality Standards

2.1 Air Quality Limit Values

2.1.1 Table 2.1 contains the AQLVs which are relevant to this assessment. These have been obtained from the government permitting risk assessment website[1].

Table 2.1 - Air Quality Limit Values

Pollutant	Measured As	Purpose	AQLVs
Nitrogen Dioxide (NO_2)	1-Hour Mean	Protection of human health	200µg.m^{-3} (not to be exceeded more than 18 times per calendar year)
	Annual mean	Protection of human health	40µg.m^{-3}
Particulate matter less than 10µm in aerodynamic diameter (PM_{10})	24-hour mean	Protection of human health	50µg.m^{-3} (not to be exceeded more than 35 times per calendar year)
	Annual mean	Protection of human health	40µg.m^{-3}
Particulate matter less than 2.5µm in aerodynamic diameter ($PM_{2.5}$)	Annual mean	Protection of human health	20µg.m^{-3}
Benzene	Annual Mean	Protection of human health	5µg.m^{-3}
Carbon Monoxide	Daily 8-Hour Running Mean	Protection of human health	10,000µg.m^{-3}

2.2 Environmental Assessment Levels

2.2.1 A list of short and long-term EALs relevant to this assessment are presented in the table below. These have been obtained from the permitting risk assessment guidance on the government website[1].

Table 2.2 - Environmental Assessment Levels

Substance	EALs	
	Short Term Hourly Limit ($\mu g.m^{-3}$)	Annual Mean Limit ($\mu g.m^{-3}$)
Benzene	195	5
CO	30,000	-

2.3 Critical Levels for Protection of Vegetation and Ecosystems

2.3.1 The table below outlines critical levels for the protection of vegetation at nature conservation sites, obtained from permitting risk assessment guidance on the government website.

Table 2.3 – Critical Levels for the Protection of Vegetation

Substance	Concentration ($\mu g.m^{-3}$)	Measured As
Nitrogen Oxides (NO_x)	30	Annual mean
	75	Daily mean

[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

2.4 Critical Loads for Protection of Vegetation and Ecosystems

2.4.1 The table below outlines critical loads relevant to sites considered within this assessment. These have been obtained from the APIS website. It should be noted that this information is only available for Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPAs), Special Areas of Conservation (SAC) and ramsar sites. For local nature sites, a worst case critical load for annual nitrogen deposition of 3kg $N.ha^{-1}.Year^{-1}$ has been assumed.

Table 2.4 – Critical Loads for Nitrogen Deposition

Site	Worst Case Critical Load for Nitrogen Deposition (Kg $N.ha^{-1}.Year^{-1}$)
Duddon Estuary Ramsar/SSSI	8-10
Morecambe Bay SAC	8-10
All local nature sites, including Local Nature Reserves (LNRs), National Nature Reserves (NNR), Local Wildlife Sites (LWS) and ancient woodland areas	3

3 Baseline Position

3.1 Air Quality Across Barrow-In-Furness

3.1.1 Barrow-in-Furness Borough Council (BFBC) are required to undertake a review and assessment of air quality within their area of jurisdiction under Section 82 part IV of the Environment Act (1995). Local Authorities (LAs) are obligated to prepare an Annual Status Report (ASR) each year. For areas where Air Quality Objectives (AQOs)/AQLVs are not expected to be achieved, the LA will undertake further assessment. Subsequently, if AQOs/AQLVs are not predicted to be met, the LA must declare an Air Quality Management Area (AQMA).

3.1.2 The 2020 Air Quality Annual Status Report for BFBC[2] confirmed that no exceedences of the annual mean AQLV for NO_2 have occurred at monitoring sites during the most recent available year of data (2019) and that measured background levels of NO_2 have shown a steady decrease since monitoring began in the early 1990s. No routine monitoring of PM_{10}, $PM_{2.5}$, CO or benzene is undertaken across the borough.

3.1.3 No AQMAs are declared across the borough at present.

3.2 Air Quality Monitoring Data

3.2.1 Continuous Monitoring

3.2.1.1 The Automatic Urban and Rural Network (AURN) is the largest monitoring network within the UK and is the main network used for compliance monitoring against Ambient Air Quality Directives within the UK. The closest AURN monitoring station to the proposed site is Blackpool Marton, which is an urban background monitoring location situated approximately 35km to the South-South-East of the proposed site. With consideration to

[2] 2017 Air Quality Annual Status Report (ASR), NLC, 2017

the proximity to the proposed site, and the nature of this monitoring location, it was not considered that this site would provide a suitably representative source of background data for use in this assessment and therefore was not considered further for this purpose.

3.2.1.2 BFBC do not maintain any continuous monitoring locations.

3.2.2 Nitrogen Dioxide Diffusion Tube Monitoring

3.2.2.1 BFBC maintain a series of NO_2 diffusion tubes across their area of jurisdiction. Four sites are maintained, including three roadside locations and one urban background location. Given the nature of the monitoring locations and the proximity to the site, it was not considered that they would provide a suitably representative source of background data for the site and receptors considered within this assessment and therefore were not considered further for this purpose.

3.2.3 Non-Automatic Hydrocarbon Network

3.2.3.1 The Non-Automatic Hydrocarbon Network includes sites which measure ambient benzene concentrations at various locations around the UK. The closest monitoring locations to the proposed site are Bury Whitefield Roadside, which is an urban traffic monitoring location, situated approximately 90km to the South-East of the site and Carlisle Roadside, which is an urban monitoring location situated approximately 85km to the North-North-East of the site. Given the nature of these monitoring locations and proximity to the site, it was not considered that they would provide a suitable source of background data for use in this assessment, and were not therefore considered further for this purpose.

3.3 Background Pollutant Mapping

3.3.1 The DEFRA website contains background pollutant mapping data for NO_x, NO_2, $PM_{2.5}$, PM_{10}, CO and benzene on a 1km by 1km grid square basis across the UK. This data is routinely used for assessing background pollutant concentrations where no suitably representative air pollution monitoring data exists. NO_x, NO_2, PM_{10} and $PM_{2.5}$ data is available for each grid square for the years 2018 to 2030. Background mapping of CO and benzene is only available

for 2001. Future year predictions of CO and benzene have been calculated using the appropriate year adjustment factors contained on the DEFRA website. Table 3.1 contains background pollutant concentrations for the grid square containing the site.

Table 3.1 - Background Pollutant Mapping Data for Grid Square 319500, 473500

Pollutant	2021 Annual Mean Pollutant Concentrations (µg.m^{-3}) within Grid Square Containing Site
NO_x	7.71
NO_2	6.08
PM_{10}	8.51
$PM_{2.5}$	5.41
CO	78.94
Benzene	0.11

3.4 Summary of Background Data Used in Assessment

3.4.1 The table below summarises the background data used within this assessment. In lieu of suitable local monitoring data, DEFRA mapped background concentrations have been used as background concentrations within the assessment for all pollutants.

Table 3.2 - Summary of Background Data Used in Assessment

Pollutant	Annual Mean Background Concentration (µg.m^{-3})	24-Hour Mean Background Concentration (µg.m^{-3})[(a)]	8-Hour Mean Background Concentration (µg.m^{-3})[(b)]	1-Hour Mean Background Concentration (µg.m^{-3})[(c)]	Source of Annual Mean Background Data
NO_x	7.71	9.10	N/A	15.42	DEFRA mapped background concentration
NO_2	6.08	N/A	N/A	12.16	DEFRA mapped background concentration
PM_{10}	8.51	10.04	N/A	17.02	DEFRA mapped background concentration

Pollutant	Annual Mean Background Concentration ($\mu g.m^{-3}$)	24-Hour Mean Background Concentration ($\mu g.m^{-3}$)[a]	8-Hour Mean Background Concentration ($\mu g.m^{-3}$)[b]	1-Hour Mean Background Concentration ($\mu g.m^{-3}$)[c]	Source of Annual Mean Background Data
$PM_{2.5}$	5.41	N/A	N/A	10.82	DEFRA mapped background concentration
Benzene	0.11	N/A	N/A	0.22	DEFRA mapped background concentration
CO	N/A	N/A	110.52	157.88	DEFRA mapped background concentration

N.B (a) 24-hour mean concentration calculated by multiplying 1-hour mean background concentration by a factor of 0.59 in accordance with relevant guidance
(b) 8-hour mean concentration calculated by multiplying 1-hour mean background concentration by a factor of 0.7 in accordance with relevant guidance
(c) 1-hour mean concentration assumed to be twice the annual mean background concentration in accordance with relevant guidance

3.5 Discrete Sensitive Receptors

3.5.1 Discrete Cartesian receptors were identified for inclusion within the model. Sensitive receptors included in the model are outlined in the table below. These receptors are considered to provide representative points of closest exposure in various directions from the plant. Reference should be made to Appendix II for a graphical representation of receptor locations. The identified NGR for each receptor represents the nearest point(s) to the proposed site boundary in order to ensure a 'worst case' scenario. These were used as inputs to the model. Receptor R19 represents European designated ecological receptors/SSSI which span over a large area. As such, discrete receptor points were placed at minimum 5m intervals along the ecological receptor boundary closest to the site. This ensured the point of maximum input was captured to ensure a robust assessment.

3.5.2 The boilers will be regulated under a Part B Environmental Permit. As such, air emissions are regulated and controlled under the permitting process and in accordance with the National Planning Policy Framework (NPPF) and National Planning Policy for Waste (NPPW), such control should not be duplicated under the planning regime. Local nature sites do not require consideration as part of the Part B permit application process. However, during the planning application process, queries were raised over the potential contribution to

nitrogen deposition at Sandscale Haws NNR. Therefore, this assessment has included assessment of potential impacts, including nitrogen deposition at relevant local nature sites, including all LWS, NNR, LNRs and ancient woodland areas within 2km of the site. These are identified within the table below.

Table 3.3 – Sensitive Receptors

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R1	Robb's Water Farm	320401.7	474326.7
R2	Oak Lea Farm	320792.2	474374.6
R3	Residential Property off Park Road	320935.7	474003.4
R4	Residential Property off Rakesmore Lane	321165.6	473560.7
R5	Rakesmore Farm	320803.9	472709.6
R6	Residential Property off Glenridding	320814.5	472559.3
R7	Residential Property off Seatoller Place	320498.5	472467.8
R8	Sowerby Hall	319863.8	472432.3
R9	Sowerby Lodge	319172.8	472347.5
R10	Sowerby Wood LWS	319703	473577
		319690	473537
		319681	473504
		319658	473493
		319603	473466
		319533	473432
R11	Ancient woodland	319730	473662
R12	Sandscale Haws NNR	319480	473999
		319436	473923
		319358	473801
R13	North Walney NNR	319291	473790
		319271	473752
		319249	473699
		319237	473605

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R14	Park Road Woods LWS	319996	473910
R15	Ancient woodland	320435	473720
R16	Ancient replanted woodland	320887	474112
R17	Ancient woodland	321569	473527
R18	Ancient replanted woodland	321590	473377
R19	Duddon Estuary Ramsar/Site SSSI/ Morecambe Bay SAC	Various, as described above	

4 Modelling Methodology

4.1 Model Description

4.1.1 The potential air quality impacts associated with residual emissions arising from the process have been quantified using AERMOD, which is a steady state, next generation, dispersion model. AERMOD was developed jointly by the American Meteorological Society (AMS) and the United States (US) Environmental Protection Agency (EPA) Regulatory Model Improvement Committee. AERMOD is a development from the Industrial Source Complex (ISC) 3 dispersion model and incorporates improved dispersion algorithms and pre-processors to integrate the impact of meteorology and topography within the modelling output, and is approved for use in the UK. The version of AERMOD that has been used for this current assessment is Lakes Environmental ISC-AERMOD View Version 9.9.5. The model has been run using version 19191 of the AERMOD executable file. In order to improve model run times, Lakes Environmental have produced an equivalent source code to 19191, known as AERMOD parallel which enables the model to be run over multiple processors. The model was run using Lakes Environmental AERMOD MPI 19191.

4.2 Model Inputs

4.2.1 Emission Source Process Parameters

4.2.1.1 Reference should be made to Appendix I for a graphical representation of the stack locations in relation to the surrounding environment. The tables below contain expected stack process parameters for the proposed biomass plant. Parameters for stack diameter, volumetric flow rate, temperature, oxygen content and pressure of exhaust gases were confirmed by the technology provider. The site will include three biomass boilers. This includes a Heizomat RHK-AK 1000 boiler and two Heizomat RHK-AK 900 boilers. The parameters for the RHK-AK 1000 boiler were provided by the previous technology provider

during the preparation of the previous permit application. The parameters for the Heizomat RHK-AK 900 boilers were provided by the current technology provider.[3]

Table 4.1 - Expected Emission Source Process Parameters for Heizomat RHK-AK 1000 Boiler

Process Parameter	Value
Exhaust Flue (A1) NGR (X,Y)	319625.90, 473653.04
Stack internal diameter (m)	0.5
Stack height (m)	9.2
Expected stack efflux velocity ($m.s^{-1}$)	5.093
Expected actual stack volumetric flowrate ($Am^3.s^{-1}$)	1
Stack volumetric flowrate at reference conditions ($Nm^3.s^{-1}$)	0.603
Expected stack efflux temperature (K)	453
Expected oxygen content of exhaust gas (v/v, %)	11

Table 4.2 - Expected Emission Source Process Parameters for Heizomat RHK-AK 900 Boiler

Process Parameter	Value
Exhaust Flue (A2 and A3) NGR (X,Y)	319641.04, 473612.72 319659.80, 473578.13
Stack internal diameter (m)	0.5
Stack height (m)	9
Expected stack efflux velocity ($m.s^{-1}$)	4.475
Expected actual stack volumetric flowrate ($Am^3.s^{-1}$)	0.8787
Stack volumetric flowrate at reference conditions ($Nm^3.s^{-1}$)	0.489
Expected stack efflux temperature (K)	393
Expected oxygen content of exhaust gas (v/v, %)	13

4.2.2 Pollutant Emissions

4.2.2.1 There will be a number of potential pollutant emissions as a result of operation of the proposed biomass boilers. The plant will need to comply with Emission Limit Values (ELVs)

[3] Email communications from Kirsty kennedy, CK Energy, Dated 20 May 2021.

contained within Process Guidance Note 1/12(13)[4] for waste wood combustion, outlined in the table below.

Table 4.3 – ELVs and Associated Emission Rates

Pollutant	ELV (mg.Nm^{-3}) (Expressed at 273.1K, 101.3KPa, 11% oxygen, no correction for moisture)
CO	250
Total Particulate Matter	60
NO_x	400
Organic Compounds	20

4.2.2.2 The boilers also have a Renewable Heat Incentive (RHI) certificate. Reference should be made to Appendix IV for a copy of RHI certificates for the boilers, provided by the technology provider, based on the use of different types of wood fuel. In order to qualify for RHI, the boilers are required to meet maximum emissions levels of 30g.GJ^{-1} for particulate matter and 150g.GJ^{-1} for NO_x. The table below contains the worst case emission rates for the boiler, based on statutory emission limits and RHI limits. Data is also presented based on test data for NO_x and particulate matter contained within the RHI certificates for the boilers. RHI limits are only in place for particulate matter and NO_x. For NO_x and particulate matter, modelling was initially based on RHI limits. This is considered to provide a realistic worst case scenario. Consideration has also been given to monitored emission levels for NO_x, contained with the RHI certificates to provide a more realistic assessment of potential impacts. There are two RHI certificates for the boilers within Appendix IV. Assessment was based on the higher monitored emission levels for NO_x. For CO and organic compounds, modelling has been based on statutory emissions limits within the permit to provide a worst case scenario.

[4] Process Guidance Note 1/12(13) – Statutory Guidance for Combustion of Waste Wood, DEFRA, July 2013.

Table 4.4 – Pollutant Emissions Rates

Pollutant	Maximum Pollutant Emission Rates Based on Statutory Emission Limits ($g.s^{-1}$)		Maximum Pollutant Emission Rates Based on RHI Emission Limits ($g.s^{-1}$)		Maximum Monitored Pollutant Emission Rates Based on RHI Test Data ($g.s^{-1}$)	
	RHK-AK 1000	RHK-AK 900	RHK-AK 1000	RHK-AK 900	RHK-AK 1000	RHK-AK 900
CO	0.151	0.122	N/A	N/A	N/A	N/A
Total Particulate Matter	0.036	0.03	0.033	0.03	0.0151	0.0136
NO_x	0.241	0.195	0.165	0.149	0.0595	0.0536
Organic Compounds	0.0121	0.0098	N/A	N/A	N/A	N/A

4.2.3 Building Downwash

4.2.3.1 The building which houses the biomass boilers was digitised within the model based on site layout and elevation information. In accordance with government guidance, significant structures within a distance of 5L of the emission sources were included, where L is defined as the lesser of the maximum projected building width and height. The table below contains information on buildings/structures included within the model. Reference should be made to Appendix I for a plan showing building/structure locations and orientation. 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 and structures were input into the BPIP processor.

Table 4.5 - Building Inputs

Structure	Length and Width (m)	Max Height (m)
Building Housing Biomass Boiler	74.7 x 126.6	8.41

4.2.4 Meteorological Data

4.2.4.1 Meteorological data used in this assessment was from Barrow/Walney Island. Barrow/Walney Island meteorological station is located approximately 3km to the South-West of the proposed site. Given the proximity, topology and nature of the observing station location, it is considered that it provides suitable data for use in this assessment. Reference should be made to Appendix III for wind roses showing wind speed and direction frequency at Barrow/Walney Island between 2013 and 2017.

4.2.4.2 Five years of sequential meteorological data observed between 2013 and 2017 were used within the assessment. The AERMET processor within AERMOD was used to process the data to be site specific. US EPA guidance on processing met data for use within AERMOD states that land use up to 1km upwind from a site should be considered when determining surface roughness characteristics, whilst for Bowen ratio and albedo, land use types within a 10km by 10km area centred over the site should be considered[5]. AERMOD guidance states that albedo and Bowen ratio should be calculated as the arithmetic and geometric mean respectively of land use types over the 10km by 10km grid, not weighted by direction or distance. The Land Use Creator and AERSURFACE tool within AERMET was used to calculate the appropriate land-use characteristics, which are contained in the following table.

Table 4.6 - Parameters for Surface Roughness, Albedo and Bowen Ratio

Parameter	Directional Sector	Value
Surface Roughness	0-30°	0.088
	30-60°	0.088
	60-90°	0.087
	90-120	0.08
	120-150°	0.033
	150-180°	0.072
	180-210°	0.135

[5] AERMOD Implementation Guide, US EPA, August 2015.

Parameter	Directional Sector	Value
	210-240°	0.101
	240-270°	0.134
	270-300°	0.143
	300-330°	0.103
	330-360°	0.07
Albedo	All	0.15
Bowen Ratio	All	0.33

4.2.5 Assessment Area

4.2.5.1 One high resolution uniform cartesian receptor grid was used to define the modelling domain, extended over a 3,600m by 3,600m area with a spacing of 15m in X and Y direction, centred over the stack locations. This ensured the maximum point of impact could be captured to enable a conservative assessment of potential short term impacts. In addition, the discrete receptors identified previously were included within the model as cartesian receptors to assess short and long term impacts at relevant receptor locations.

4.2.6 Terrain Data

4.2.6.1 Topographical features can have a significant impact on pollutant dispersion. Assessment of the site and surrounding area indicates the gradient of the land across the site and surrounding modelling domain exceeds 10% in places. Therefore, terrain data was included in accordance with the relevant guidance[6]. The terrain data used included OS Terrain 5 data, which is Digital Terrain Model (DTM) data at 1:10,000 scale, contoured at 5m vertical intervals, with a grid resolution of 5m spacing in X and Y direction. The data has a Root Mean Square Error (RMSE) value of 1.5m in urban areas and major communication routes with detailed modelling of significant features such as road, quarries and lakes. The AERMAP

[6] LAQM.TG(16), DEFRA, 2016.

terrain processor was used to process the data to assign elevations and hill height scales to all sources, buildings and receptors.

4.2.7 NO_x to NO_2 Conversion

4.2.7.1 Nitric oxide (NO) and NO_2 are normally measured as oxides of NO_x, but when comparing against health based standards, NO_x is usually expressed as it's individual components. NO is oxidised to NO_2 in the presence of ozone. In order to provide a conservative estimate of resulting NO_2 concentrations, it was assumed that 35% of modelled NO_x concentrations are present as NO_2 for short-term concentrations, whilst it was assumed that 70% of modelled NO_x concentrations are present as NO_2 for long term average concentrations. This provides a worst case scenario, in accordance with EA guidance.

4.2.8 Organic Compounds

4.2.8.1 It was assumed that organic compounds comprise 100% benzene for the purpose of this assessment. This provides a worst case assessment, in accordance with government guidance.

4.2.9 Particulate Matter

4.2.9.1 The AQLVs related to particulate matter are for PM_{10} and $PM_{2.5}$. However, ELVs and monitoring data are expressed as total particulate matter. In order to determine resulting PM_{10} and $PM_{2.5}$ concentrations, it was assumed that particulate matter comprises 100% $PM_{2.5}$ and PM_{10} which ensured a worst case scenario.

4.2.10 Model Scenarios

4.2.10.1 The scenarios modelled are contained within Table 4.7. It was assumed that the plant will be operational continuously for 24-hours per day, 365 days per year with no shut down periods which ensured a worst-case scenario.

4.2.10.2 The 24-hour mean AQLV for PM_{10} allows a number of exceedences each year (35). This is equivalent to the 90.4th percentile of 24-hour mean concentrations during each year. Therefore, the model was used to calculate the 90.4th percentile of 24-hour mean concentration for each year for PM_{10} to allow appropriate comparison with the AQLV. The 1-hour mean AQLV for NO_2 allows a number of exceedences each year (18). This is equivalent to the 99.8th percentile of 1-hour mean concentrations during each year. Therefore, the model was used to calculate the 99.8th percentile of 1-hour mean concentrations for each year for NO_2 to allow appropriate comparison with the AQLV.

Table 4.7 - Model Scenarios

Pollutant	Modelled Scenarios
NO_x	Annual mean, 24-hour mean
NO_2	Annual mean, 99.8th percentile 1-hour mean
PM_{10}	Annual mean, 90.4th percentile 24-hour mean
$PM_{2.5}$	Annual mean
CO	Rolling 8-hour maximum, maximum 1-hour mean
Benzene	Annual mean, maximum 1-hour mean

4.3 Assessment of Potential Impacts

4.3.1 In order to assess potential impacts, reference has been made to the permitting air emissions risk assessment guidance on the government website.[7]

[7] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

4.3.2 The government guidance indicates that potential impacts from a process can be considered insignificant if the following screening criteria are met for human receptors and SSSI, SPA, SAC or ramsar sites:

- The long term process contribution (PC) is <1% of the long term environmental standard; and/or,
- The short term PC is <10% of the short term environmental standard.

4.3.3 The guidance also indicates that more detailed assessment of emissions (modelling) for a process may be required if the following criteria are met:

- The long term PC + background concentration is >70% of the long term environmental standard; and/or
- The short term process contribution is >20% (Short term environmental standard minus twice annual mean background concentration).

4.3.4 If any of the criteria above are met for both short and long term modelled concentrations, it can be concluded that potential impacts will be acceptable and there is no requirement for further assessment, in accordance with the relevant guidance. If the above criteria is exceeded, consideration is then given to the potential for exceedence of AQLVs/EALs.

4.3.5 For local nature sites, including NNRs, LWS and ancient woodland areas, impacts are insignificant if the PC is <100% of the relevant environmental standard.

4.4 Model Verification and Uncertainty

4.4.1 There can be a significant degree in uncertainty in predications made by any atmospheric dispersion model, which needs to be considered when assessing results. Such uncertainty can arise as a result of model limitations, uncertainty in input data, including emissions estimates, meteorological data used and background pollutant concentrations used in the assessment.

4.4.2 AERMOD is a commonly used model produced by the US EPA and is approved for use in the UK. The model is well validated and the US EPA present the results of the model validation exercises undertaken on their website. These verify the output of the model in comparison to observed data for a number of scenarios, to ensure predictions are as accurate as possible. The model input code is periodically updated by the US EPA to resolve bugs and errors and to improve the output to take account of latest knowledge. The latest AERMOD model executable file has been used to run the model for the purpose of this assessment.

4.4.3 In addition to the choice of model, the following methods used in the assessment ensure that confidence can be high that potential impacts have not been underestimated:

- Worst case modelled concentrations across 5 years of meteorological data used in assessment;
- Where possible, estimation of existing background pollutant concentrations have been conservative;
- Worst case assumption for conversion of NO_x to NO_2;
- Highly precautionary assumption that particulate matter comprises 100% PM_{10} and $PM_{2.5}$;
- Highly precautionary assumption that organic compounds comprise 100% benzene; and,
- Assumption that plant will operated for 24 hours per day, 365 days per year with no shut down periods.

5 Model Results

5.1 Predicted Pollutant Concentrations at Human Receptor Locations

5.1.1 The tables below contain the maximum modelled ground level pollutant concentrations within the modelling domain and at sensitive human receptors, with comparison to the relevant AQLVs and EALs for each pollutant and scenario. Maximum modelled concentrations from the five years of sequential data have been used to undertake assessment of potential impacts.

5.1.2 In accordance with previous guidance[8], annual mean AQLVs/EALs are considered relevant at receptors where cumulative occupancy exceeds 6 months of the year, eg residential properties. The annual mean AQLVs/EALs are not relevant at building facades of offices and other places of work where members of the public do not have regular access. In order to ensure a conservative, worst case assessment, the maximum point of impact within the modelling domain was used to assess potential worst case impacts on short term AQLVS/EALs.

5.1.3 As is indicated, the maximum modelled PC to the annual mean AQLVs for NO_2, PM_{10}, $PM_{2.5}$ and benzene is <1% at all relevant human receptor locations. As such, long term impacts screen out as insignificant.

5.1.4 The maximum modelled concentrations are predicted to be <10% of the relevant AQLVs/EALs at discrete receptor locations (R1 to R9) for 1-hour mean NO_2, 1 and 8-hour mean CO, 24-hour mean PM_{10} and 1-hour mean benzene concentrations. As such, potential short impacts at receptors R1 to R9 are screened out as insignificant.

[8] LAQM.TG(09), DEFRA, 2009.

5.1.5 The maximum predicted PC to AQLV/EAL for 1-hour mean and 8-hour mean CO concentrations at the maximum point of impact surrounding the plant is <10%. As such, potential impacts are screened out as insignificant.

5.1.6 Although the maximum modelled PC to EAL/AQLV exceeds the 10% screening criteria for 1-hour mean NO_2, 24-hour mean PM_{10} and 1-hour mean benzene concentrations at the maximum point of impact surrounding the plant, the Predicted Environmental Concentration (PEC) is significantly below the AQLV/EAL for these pollutants. As such, confidence is high that a breach of the relevant short term EALs/AQLVs will not occur at any location surrounding the plant. Therefore, potential impacts are not predicted to be significant.

Table 5.1 – Modelled Ground Level Annual Mean NO_2 Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to Annual Mean NO_2 Concentrations (µg.m^{-3})					Maximum PC to AQLV (%)	Maximum Predicted Environmental Concentration (PEC) (µg.m^{-3})	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	0.172627	0.161679	0.182126	0.211652	0.244951	0.61	6.32	15.81
R2	0.112546	0.110376	0.102655	0.122962	0.143829	0.36	6.22	15.56
R3	0.100401	0.11207	0.096635	0.110117	0.139671	0.35	6.22	15.55
R4	0.058079	0.049168	0.052633	0.050386	0.067809	0.17	6.15	15.37
R5	0.072268	0.070581	0.074172	0.074655	0.075915	0.19	6.16	15.39
R6	0.065779	0.065072	0.065128	0.06853	0.069069	0.17	6.15	15.37
R7	0.058674	0.055909	0.056469	0.06209	0.066059	0.17	6.15	15.37
R8	0.157668	0.10731	0.121653	0.140749	0.106526	0.39	6.24	15.59
R9	0.146286	0.123515	0.154539	0.13839	0.094122	0.39	6.23	15.59

Table 5.2 – Modelled Ground Level 99.8th Percentile of 1-Hour Mean NO_2 Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to 99.8th Percentile of 1-Hour Mean NO_2 Concentrations (µg.m^{-3})					Maximum PC to AQLV (%)	Maximum PEC (µg.m^{-3})	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	4.676588	3.7326835	3.144799	4.420843	5.747308	2.87	17.91	8.95
R2	4.262538	3.1268125	2.062799	2.795261	3.802295	2.13	16.42	8.21
R3	2.174214	2.417114	1.880701	2.446826	4.483962	2.24	16.64	8.32
R4	1.473931	0.926723	1.098108	1.044271	1.4704725	0.74	13.63	6.82
R5	1.762625	1.7820565	1.748828	1.848725	1.722826	0.92	14.01	7.00
R6	1.712508	1.7454675	1.532363	1.979261	1.5446165	0.99	14.14	7.07
R7	1.759062	1.845207	2.059071	1.902002	1.7667755	1.03	14.22	7.11
R8	11.25171	6.869121	7.584763	10.11854	7.778344	5.63	23.41	11.71
R9	8.328191	8.5985445	8.265502	7.536813	6.9451165	4.30	20.76	10.38
Maximum Point of Impact	102.8024	104.867179	99.19088	94.48476	93.126789	52.43	117.03	58.51

Table 5.3 – Modelled Ground Level Annual Mean PM_{10} Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to Annual Mean PM_{10} Concentrations ($\mu g.m^{-3}$)					Maximum PC to AQLV (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	0.04953	0.04639	0.05226	0.06074	0.07029	0.18	8.58	21.45
R2	0.0323	0.03167	0.02946	0.03529	0.04128	0.10	8.55	21.38
R3	0.02882	0.03216	0.02773	0.0316	0.04008	0.10	8.55	21.38
R4	0.01667	0.01411	0.0151	0.01446	0.01946	0.05	8.53	21.32
R5	0.02074	0.02025	0.02129	0.02142	0.02179	0.05	8.53	21.33
R6	0.01888	0.01867	0.01869	0.01967	0.01982	0.05	8.53	21.32
R7	0.01684	0.01604	0.01621	0.01782	0.01896	0.05	8.53	21.32
R8	0.04525	0.0308	0.03491	0.04039	0.03057	0.11	8.56	21.39
R9	0.04197	0.03545	0.04435	0.03971	0.02701	0.11	8.55	21.39

Table 5.4 – Modelled Ground Level 90.4th Percentile of 24-hour Mean PM_{10} Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to 90.4th Percentile of 24-Hour Mean PM_{10} Concentrations ($\mu g.m^{-3}$)					Maximum PC to AQLV (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	0.16039	0.14709	0.13779	0.20198	0.19793	0.40	10.24	20.48
R2	0.10077	0.088396	0.069466	0.097895	0.11835	0.24	10.16	20.32
R3	0.087059	0.088981	0.082229	0.082437	0.098855	0.20	10.14	20.28
R4	0.053693	0.042981	0.044351	0.041944	0.059249	0.12	10.10	20.20
R5	0.06889	0.067988	0.069431	0.071709	0.071576	0.14	10.11	20.22
R6	0.064673	0.065279	0.06095	0.062289	0.065859	0.13	10.11	20.21
R7	0.062329	0.054194	0.053118	0.065831	0.063647	0.13	10.11	20.21
R8	0.15235	0.10038	0.091228	0.11586	0.091727	0.30	10.19	20.38
R9	0.14036	0.1397	0.1498	0.14195	0.045443	0.30	10.19	20.38
Maximum Point of Impact	12.45523	12.09095	10.71299	13.33487	9.8756	26.67	23.37	46.75

Table 5.5 – Modelled Ground Level Annual Mean $PM_{2.5}$ Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to Annual Mean $PM_{2.5}$ Concentrations ($\mu g.m^{-3}$)					Maximum PC to AQLV (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	0.04953	0.04639	0.05226	0.06074	0.07029	0.35	5.48	27.40
R2	0.0323	0.03167	0.02946	0.03529	0.04128	0.21	5.45	27.26
R3	0.02882	0.03216	0.02773	0.0316	0.04008	0.20	5.45	27.25
R4	0.01667	0.01411	0.0151	0.01446	0.01946	0.10	5.43	27.15
R5	0.02074	0.02025	0.02129	0.02142	0.02179	0.11	5.43	27.16
R6	0.01888	0.01867	0.01869	0.01967	0.01982	0.10	5.43	27.15
R7	0.01684	0.01604	0.01621	0.01782	0.01896	0.09	5.43	27.14
R8	0.04525	0.0308	0.03491	0.04039	0.03057	0.23	5.46	27.28
R9	0.04197	0.03545	0.04435	0.03971	0.02701	0.22	5.45	27.27

Table 5.6 – Modelled Ground Level Annual Mean Benzene Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to Annual Mean Benzene Concentrations ($\mu g.m^{-3}$)					Maximum PC to AQLV (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	0.01688	0.01582	0.01781	0.02067	0.02393	0.48	0.13	2.68
R2	0.01098	0.01079	0.01002	0.012	0.01404	0.28	0.12	2.48
R3	0.00979	0.01094	0.00945	0.01074	0.01365	0.27	0.12	2.47
R4	0.00567	0.0048	0.00514	0.00492	0.00662	0.13	0.12	2.33
R5	0.00706	0.00689	0.00725	0.00729	0.00741	0.15	0.12	2.35
R6	0.00643	0.00635	0.00636	0.0067	0.00675	0.14	0.12	2.34
R7	0.00573	0.00546	0.00551	0.00606	0.00645	0.13	0.12	2.33
R8	0.01539	0.01047	0.01186	0.01373	0.0104	0.31	0.13	2.51
R9	0.01432	0.01206	0.01511	0.01351	0.0092	0.30	0.13	2.50

Table 5.7 – Maximum Modelled Ground Level 1-Hour Mean Benzene Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Maximum Modelled PC to 1-Hour Mean Benzene Concentrations (µg.m^{-3})	Maximum PC to EAL (%)	Maximum PEC (µg.m^{-3})	Contribution of PEC to EAL (%)
R1	2.38318	1.22	2.60	1.33
R2	2.1577	1.11	2.38	1.22
R3	2.17715	1.12	2.40	1.23
R4	0.64941	0.33	0.87	0.45
R5	1.2281	0.63	1.45	0.74
R6	1.16031	0.60	1.38	0.71
R7	1.23975	0.64	1.46	0.75
R8	3.17922	1.63	3.40	1.74
R9	2.84491	1.46	3.06	1.57
Maximum Point of Impact	26.47296	13.58	26.69	13.69

Table 5.8 – Maximum Modelled Rolling 8-Hour-Mean CO Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Maximum Modelled PC to Rolling 8-Hour Mean CO Concentrations (µg.m^{-3})					Maximum PC to AQLV (%)	Maximum PEC (µg.m^{-3})	Contribution of PEC to AQLV (%)
	2013	2014	2015	2016	2017			
R1	5.73735	4.49177	4.84072	5.95201	6.66882	0.07	117.19	1.17
R2	3.58581	4.9802	5.1005	4.12821	5.15182	0.05	115.67	1.16
R3	5.91961	3.19106	3.27218	4.6809	6.7676	0.07	117.29	1.17
R4	1.76971	1.69808	2.00082	1.37069	1.98047	0.02	112.52	1.13
R5	3.80261	2.29892	5.333	2.08359	1.97175	0.05	115.85	1.16
R6	2.7489	2.26439	5.09655	3.02344	1.55039	0.05	115.62	1.16
R7	2.69865	3.19919	3.04402	2.04762	3.13775	0.03	113.72	1.14
R8	9.74976	8.92055	10.07511	8.10002	5.25337	0.10	120.60	1.21
R9	8.89946	6.70203	12.79747	7.6445	9.66418	0.13	123.32	1.23
Maximum Point of Impact	155.8971	159.79926	156.6082	155.15182	155.51791	1.60	270.32	2.70

Table 5.9 – Maximum Modelled Ground Level 1-Hour Mean CO Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Maximum Modelled PC to 1-Hour Mean CO Concentrations (µg.m^{-3})	Maximum PC to EAL (%)	Maximum PEC (µg.m^{-3})	Contribution of PEC to EAL (%)
R1	29.68332	0.10	187.56	0.63
R2	26.88521	0.09	184.77	0.62
R3	27.12487	0.09	185.00	0.62
R4	8.09148	0.03	165.97	0.55
R5	15.30414	0.05	173.18	0.58
R6	14.45848	0.05	172.34	0.57
R7	15.44926	0.05	173.33	0.58
R8	39.61634	0.13	197.50	0.66
R9	35.45224	0.12	193.33	0.64
Maximum Point of Impact	329.88768	1.10	487.77	1.63

5.2 Predicted Pollutant Concentrations at Ecological Receptor Locations

5.2.1 The tables below present the modelled PC to annual mean and 24-hour mean critical level for NO_x at relevant receptor locations.

5.2.2 As is indicated, the PC is <100% of the critical level at all local nature sites. As such, impacts will not be significant at receptors R10 to R18.

5.2.3 At receptor R19, the PEC is <70% of the annual mean critical level for NO_x. As such, long term impacts are not predicted to be significant at this receptor.

5.2.4 Although the PC exceeds 10% of the critical level for 24-hour mean NO_x concentrations at receptor R19, the PEC is significantly below the critical level (44.62%). As such, confidence is high that a breach of the short term critical level is unlikely and therefore impacts are not predicted to be significant.

Table 5.10 – Modelled Ground Level Annual Mean NO_x Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Modelled PC to Annual Mean NO_x Concentrations ($\mu g.m^{-3}$)					Maximum PC to Critical Level (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to Critical Level (%)
	2013	2014	2015	2016	2017			
R10	9.59202	8.94675	9.78924	9.33822	10.23032	34.10	17.94	59.80
	4.77769	4.18692	4.26991	4.45227	4.61573	15.93	12.49	41.63
	3.49269	2.91741	3.1183	3.30424	2.92685	11.64	11.20	37.34
	3.44756	2.75403	3.15302	3.35774	2.47677	11.49	11.16	37.19
	3.31813	2.71185	3.1954	3.49676	2.13654	11.66	11.21	37.36
	2.37637	2.18928	2.30826	2.9382	1.50524	9.79	10.65	35.49
R11	6.56338	6.45239	7.13242	6.95772	8.22168	27.41	15.93	53.11
R12	0.79894	1.01789	0.73206	0.8558	0.78867	3.39	8.73	29.09
	1.20482	1.52941	0.92386	1.13608	1.12996	5.10	9.24	30.80
	1.77444	1.82207	1.62606	1.71173	1.88513	6.28	9.60	31.98
R13	1.39519	1.44558	1.39941	1.41421	1.37965	4.82	9.16	30.52
	1.39807	1.3885	1.44787	1.39944	1.26521	4.83	9.16	30.53
	1.52266	1.38362	1.3954	1.38383	1.19605	5.08	9.23	30.78
	1.6228	1.56207	1.30085	1.41087	1.05769	5.41	9.33	31.11
R14	0.99305	0.96024	1.07824	1.1243	1.3368	4.46	9.05	30.16
R15	0.34014	0.34835	0.32618	0.32525	0.42825	1.43	8.14	27.13
R16	0.15566	0.16193	0.12957	0.16533	0.19573	0.65	7.91	26.35
R17	0.09276	0.0725	0.07211	0.07636	0.09687	0.32	7.81	26.02
R18	0.09744	0.07286	0.07933	0.08389	0.10194	0.34	7.81	26.04
R19	2.20668	2.1179	1.94304	1.89911	2.06687	7.36	9.92	33.06

Table 5.11 – Maximum Modelled Ground Level 24-Hour Mean NO_x Concentrations at Receptor Locations Based on Worst Case Emission Levels

Receptor	Maximum Modelled PC to 24-Hour Mean NO_x Concentrations ($\mu g.m^{-3}$)	Maximum PC to Critical Level (%)	Maximum PEC ($\mu g.m^{-3}$)	Contribution of PEC to Critical Level (%)
R10	55.60965	74.15	64.71	86.28
	48.51702	64.69	57.62	76.82
	45.93073	61.24	55.03	73.37
	51.21799	68.29	60.32	80.42
	39.25793	52.34	48.36	64.48
	33.82092	45.09	42.92	57.23
R11	29.62186	39.50	38.72	51.63
R12	11.9326	15.91	21.03	28.04
	14.8692	19.83	23.97	31.96
	22.62269	30.16	31.72	42.30
R13	19.69902	26.27	28.80	38.40
	16.92531	22.57	26.03	34.70
	16.04849	21.40	25.15	33.53
	14.47473	19.30	23.57	31.43
R14	11.14178	14.86	20.24	26.99
R15	7.23034	9.64	16.33	21.77
R16	2.14536	2.86	11.25	14.99
R17	1.74688	2.33	10.85	14.46
R18	1.65537	2.21	10.76	14.34
R19	24.36463	32.49	33.46	44.62

5.3 Predicted Nitrogen Deposition at Ecological Receptor Locations

5.3.1 The maximum PC to nitrogen deposition has been calculated from predicted annual mean NO_2 concentrations at sensitive ecological receptors, in accordance with the relevant guidance. Nitrogen deposition arising as a result of resulting annual mean NO_2 concentrations has been calculated using the following formula:

$$F = \left(\frac{Vd \times C \times 10000}{1000000000}\right) \times 0.3 \times 31536000$$

Where: F = deposition flux (Kg N $ha^{-1}Year^{-1}$)

V_d = nitrogen dry deposition velocity, assumed to be 0.003m.s^{-1} for grassland and 0.0015m.s^{-1} for woodland

C = predicted annual mean NO_2 concentration (µg.m^{-3})

10000 = conversion from m^2 to hectares (ha)

1000000000 = conversion from µg to Kg

0.30 = correcting NO_2 to N

31536000 = conversion from seconds to year

5.3.2 Based on the predominant features, a dry deposition velocity of 0.003m.s^{-1} has been assumed for receptors R10, R11 and R14 to R18, suitable for woodland. For receptor R12, R13 and R19, a dry deposition velocity of 0.0015m.s^{-1} has been assumed, suitable for grassland.

5.3.3 It should be noted that wet deposition has not been considered within this assessment. This is in accordance with the relevant guidance[9], which states the following:

[9] A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites, IAQM, June 2019

"Wet deposition is not normally assessed by air quality practitioners because the impacts of a project or local development plan typically occur over short distances and over timescales that are too short for wet deposition to be significant. One exception to this is hydrogen chloride (HCl), which is readily 'washed out' of plumes at short range and can, therefore, be required for some industrial permit applications"

5.3.4 Calculated annual nitrogen deposition at sensitive ecological receptors is presented in the table below, based on worst case modelled annual mean NO_2 concentrations.

5.3.5 As the predicted PC is <100% of the worst case critical load at all local nature sites (R10 to R18), impacts are predicted to be insignificant.

5.3.6 The PC exceeds 1% of the worst case critical load at Receptor R19 by a small margin. However, this is based on continual emissions at the RHI emission limit level. More detailed assessment based on worst case monitored emission levels for the boilers, presented in Table 5.13, indicates that the PC to critical load will be <1% at receptor R19. As such, impacts are not predicted to be significant, based on more detailed analysis of potential impacts from the boilers.

Table 5.12 - Calculated Annual Nitrogen Deposition at Ecological Receptors Based on Worst Case Emission Levels

Receptor	Maximum Modelled Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)	Calculated PC to Annual Nitrogen Deposition ($Kg\ N.ha^{-1}.Year^{-1}$) Based on Modelled Annual Mean NO_2 Concentration	Percentage Contribution to Worst Case Critical Load for Annual Nitrogen Deposition (%)
R10	7.161224	2.032527241	67.75
	3.344383	0.949216161	31.64
	2.444883	0.693916473	23.13
	2.413292	0.684950189	22.83
	2.447732	0.694725087	23.16
	2.05674	0.583752174	19.46
R11	5.755176	1.633457073	54.45
R12	0.712523	0.101115564	3.37
	1.070587	0.151929142	5.06

Receptor	Maximum Modelled Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)	Calculated PC to Annual Nitrogen Deposition ($Kg\ N.ha^{-1}.Year^{-1}$) Based on Modelled Annual Mean NO_2 Concentration	Percentage Contribution to Worst Case Critical Load for Annual Nitrogen Deposition (%)
	1.319591	0.187265798	6.24
R13	1.011906	0.143601604	4.79
	1.013509	0.143829089	4.79
	1.065862	0.151258608	5.04
	1.13596	0.161206356	5.37
R14	0.93576	0.265591146	8.85
R15	0.299775	0.08508334	2.84
R16	0.137011	0.03888701	1.30
R17	0.067809	0.019245822	0.64
R18	0.071358	0.020253113	0.68
R19	1.544676	0.219208061	4.38

Table 5.13 - Calculated Annual Nitrogen Deposition at Receptor R19 Based on Worst Case Monitored Emission Levels

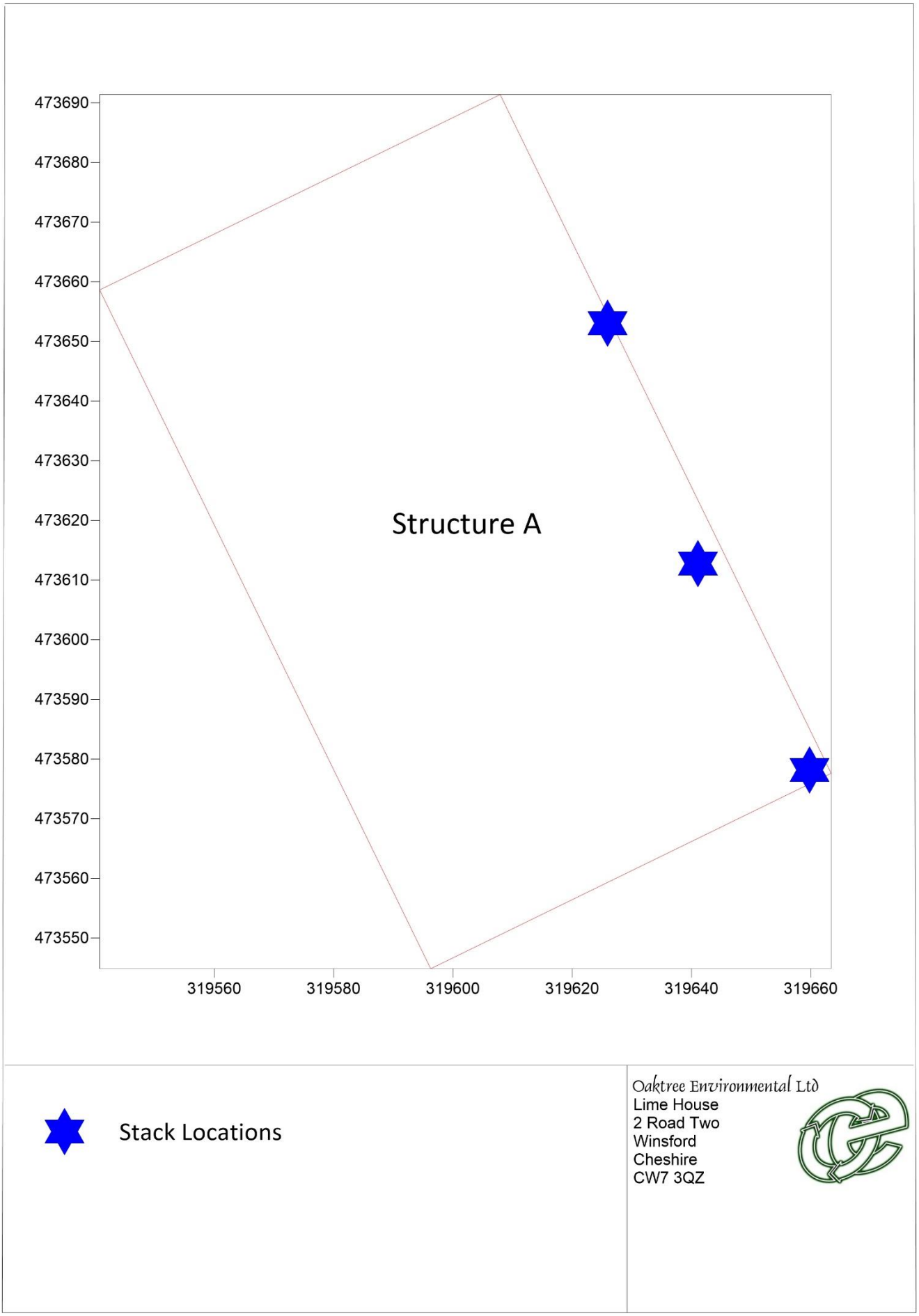
Receptor	Maximum Modelled Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)	Calculated PC to Annual Nitrogen Deposition ($Kg\ N.ha^{-1}.Year^{-1}$) Based on Modelled Annual Mean NO_2 Concentration	Percentage Contribution to Worst Case Critical Load for Annual Nitrogen Deposition (%)
R19	0.556157	0.078925352	0.99

6 Conclusions

6.1 An assessment of potential air quality impacts has been undertaken for the proposed operation of three biomass boilers at JJC Hire Limited, in support of an Environmental Permit/planning application. Modelling has been undertaken using AERMOD to quantify resulting pollutant concentrations at surrounding ground level locations and an assessment undertaken of potential impacts. The modelling results have demonstrated that the proposals will not generate any significant adverse impacts on local air quality. No exceedences of health based Air Quality Standards are predicted at relevant receptor locations. Impacts on critical levels and loads have not been predicted to be significant at ecological receptor locations.

Appendix I

Locations of Buildings and Stacks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473600
473590
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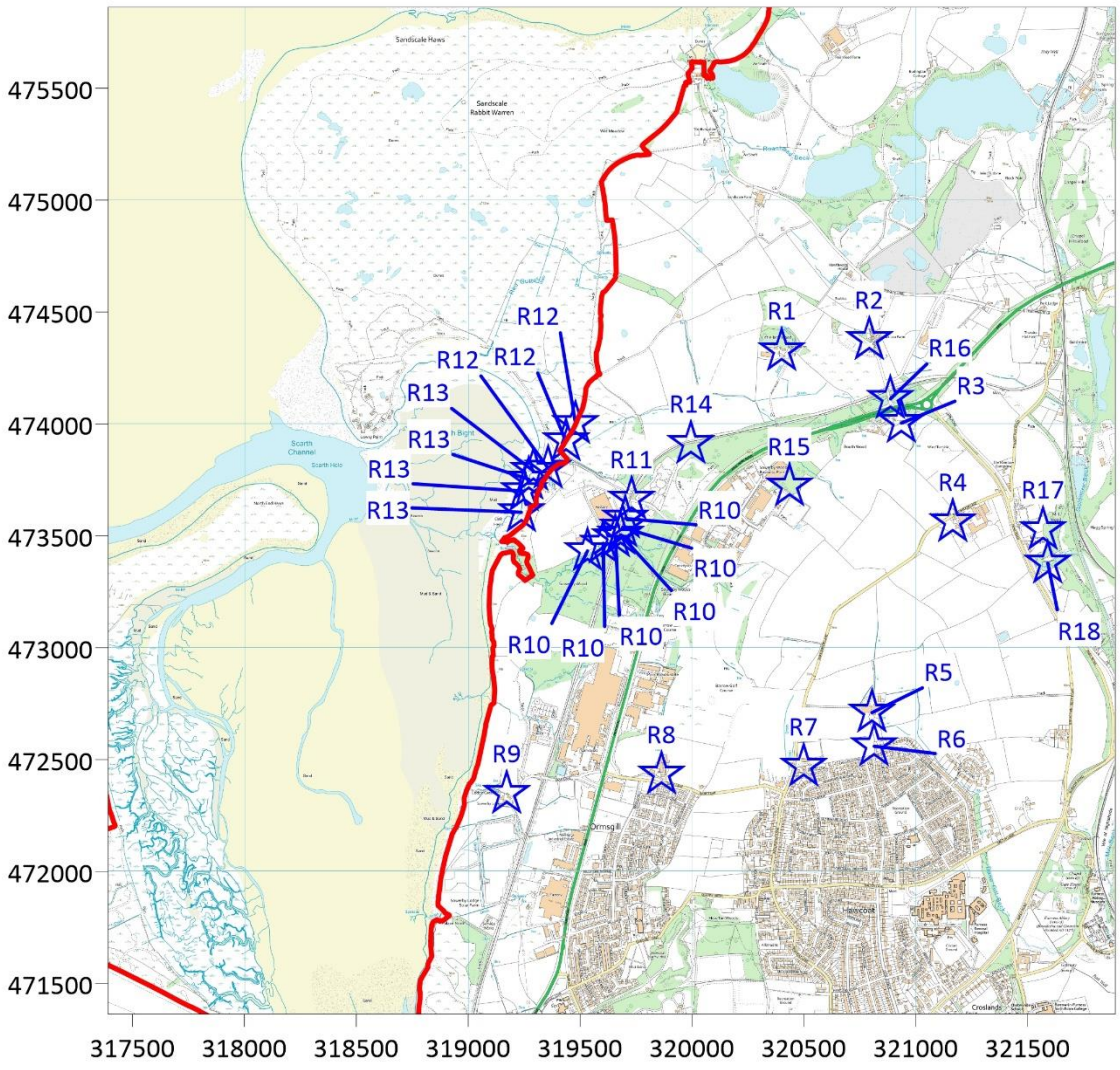
473570
473560
473550
319560
319580
319600
319620
319640
319660
Structure A
Stack Locations
Oaktree Environmental Ltd
Lime House
2 Road Two
Winsford
Cheshire
CW7 3QZ

Appendix II

Sensitive Receptor Locations



Sensitive Receptors

☆ Human Receptor Location

Receptor R19 Boundary

R1 Receptor Identifier

Oaktree Environmental Ltd
Lime House
2 Road Two
Winsford
Cheshire
CW7 3QZ

Appendix III

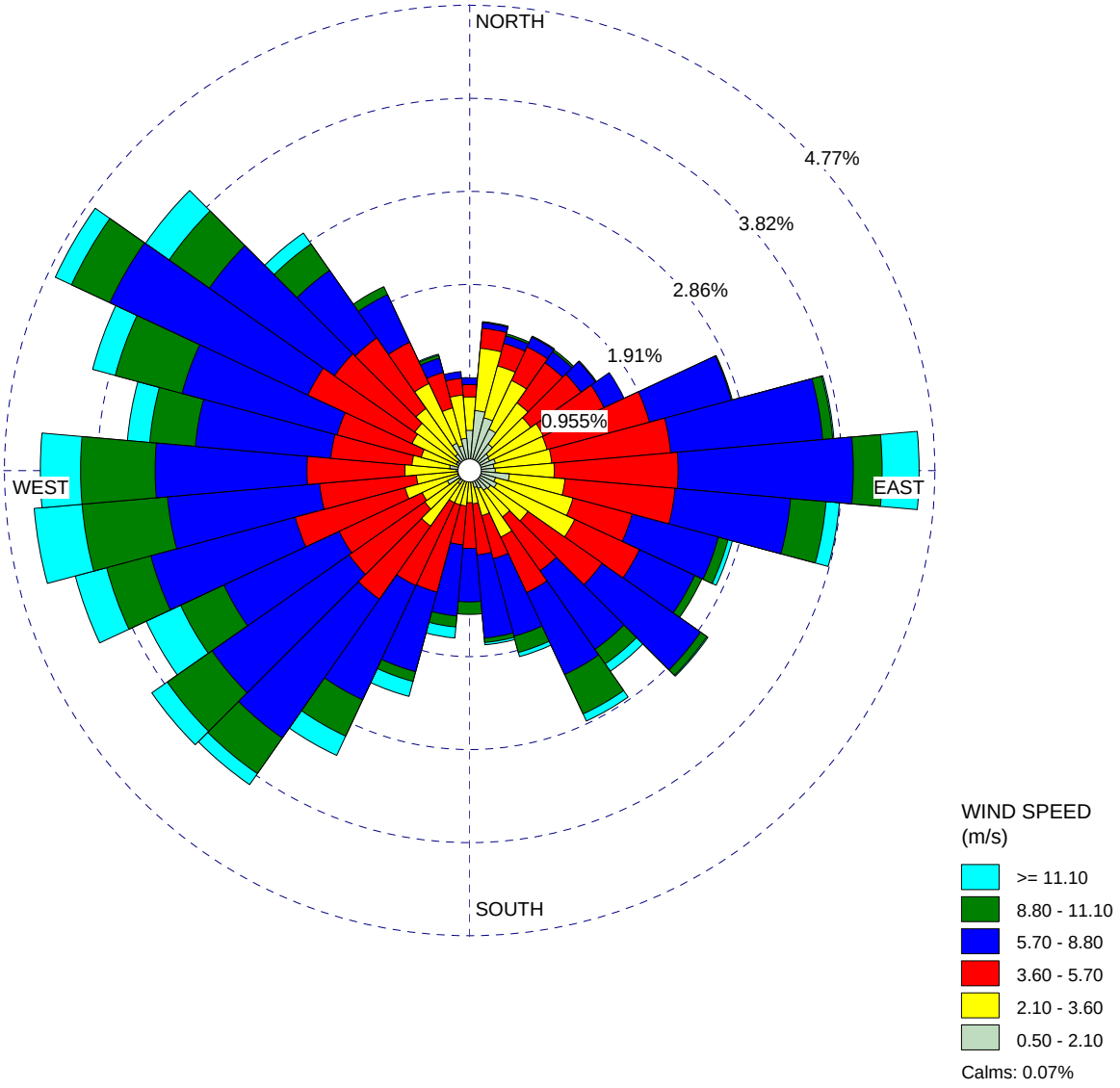
Barrow Wind Roses

WIND ROSE PLOT:

Barrow/Walney Island - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



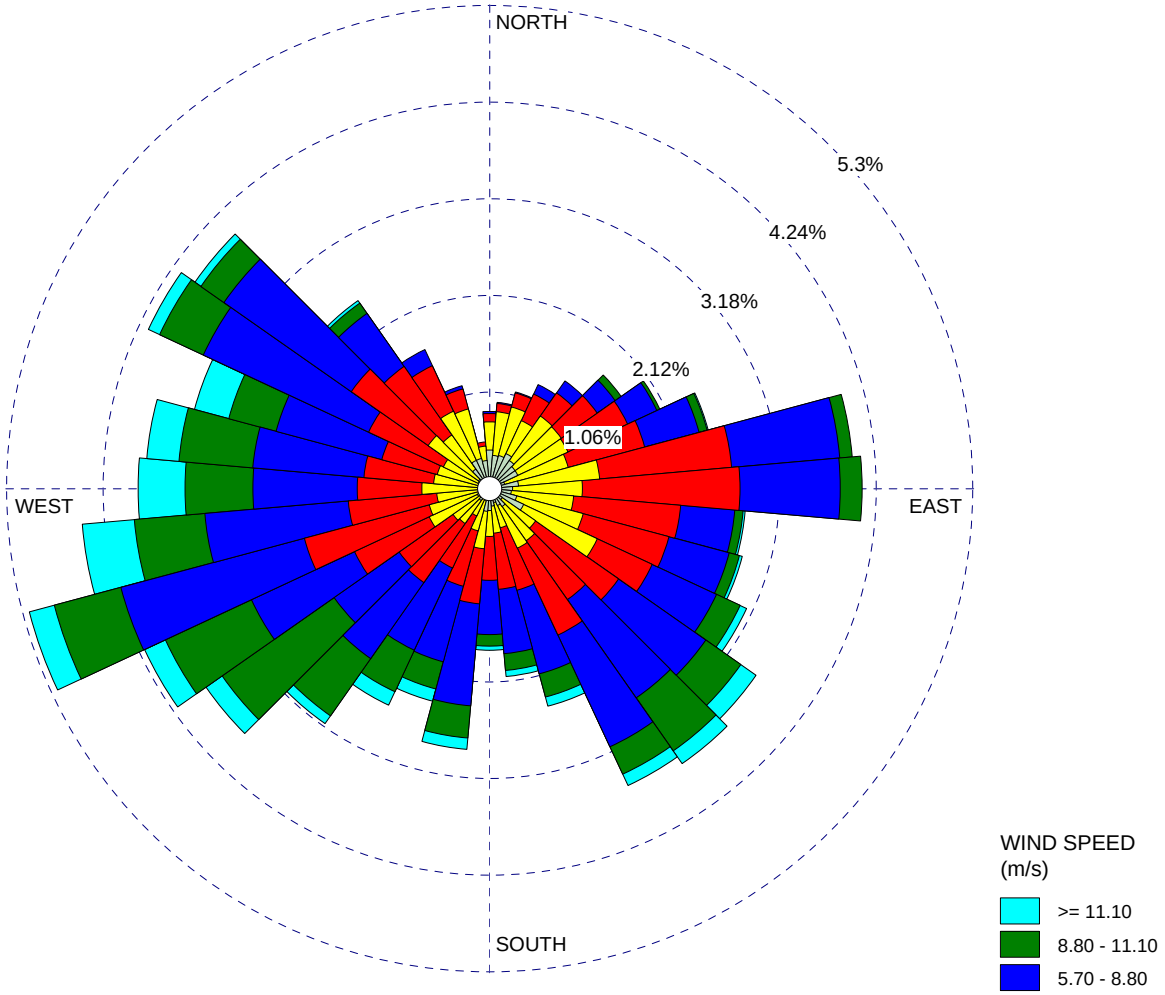
COMMENTS:	DATA PERIOD: **Start Date: 01/01/2013 - 00:00** **End Date: 31/12/2013 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **0.07%**	TOTAL COUNT: **8737 hrs.**	
	AVG. WIND SPEED: **5.49 m/s**	DATE: **21/11/2018**	PROJECT NO.: **3650**

WIND ROSE PLOT:

Barrow/Walney Island - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



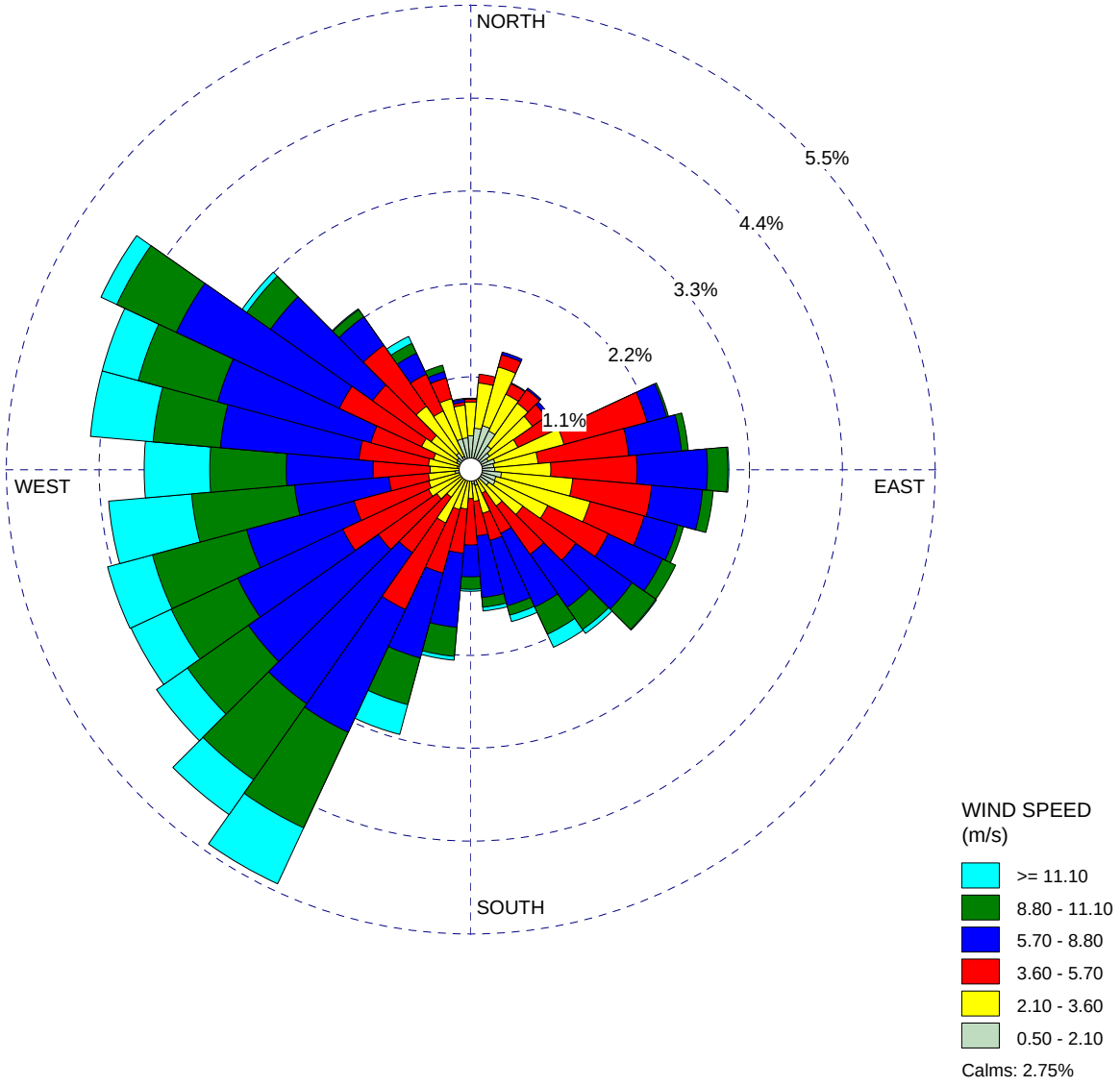
COMMENTS:	DATA PERIOD: **Start Date: 01/01/2014 - 00:00** **End Date: 31/12/2014 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **0.42%**	TOTAL COUNT: **8744 hrs.**	
	AVG. WIND SPEED: **5.47 m/s**	DATE: **21/11/2018**	PROJECT NO.: **3650**

WIND ROSE PLOT:

Barrow/Walney Island - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



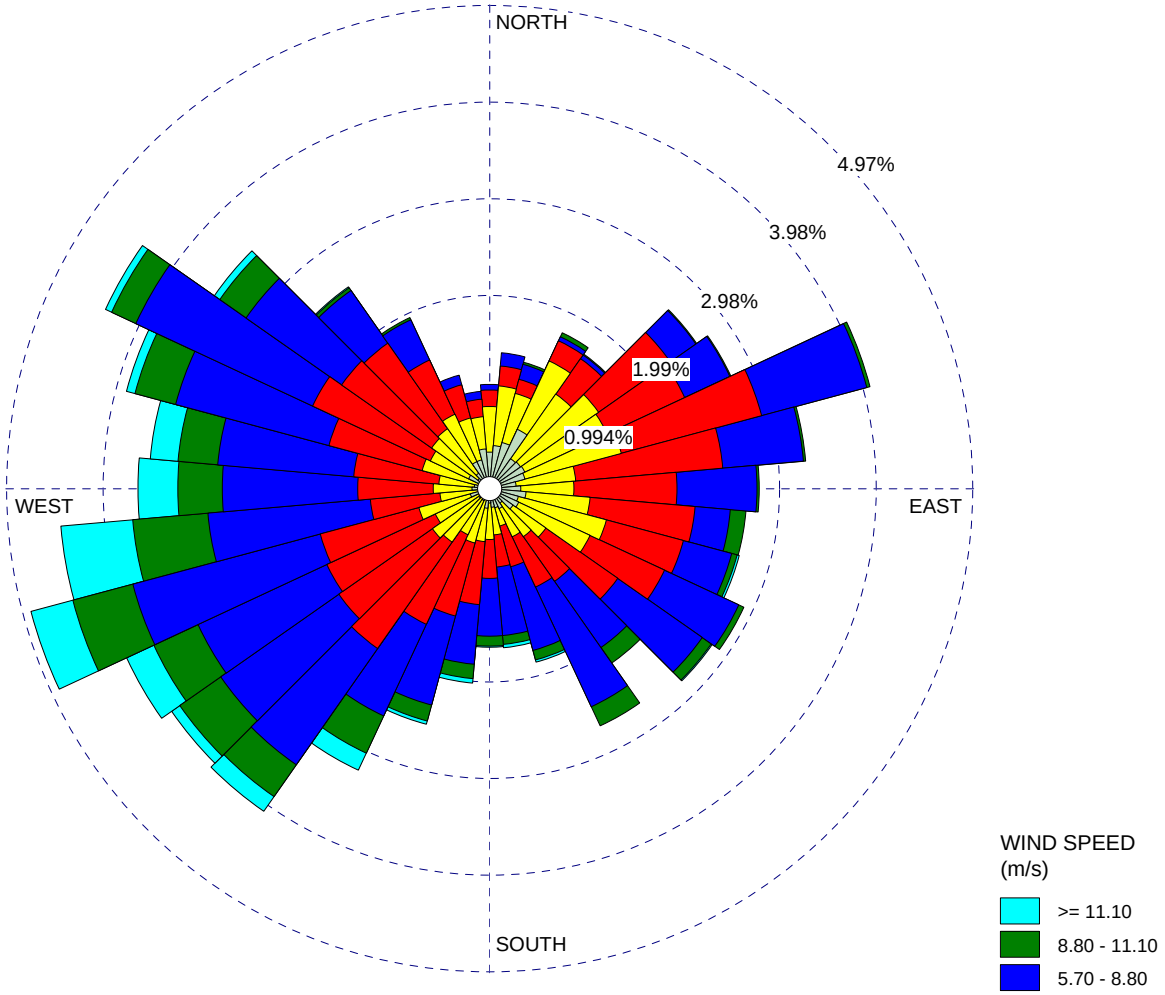
COMMENTS:	DATA PERIOD: **Start Date: 01/01/2015 - 00:00** **End Date: 31/12/2015 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **2.75%**	TOTAL COUNT: **8760 hrs.**	
	AVG. WIND SPEED: **5.67 m/s**	DATE: **21/11/2018**	PROJECT NO.: **3650**

WIND ROSE PLOT:

Barrow/Walney Island - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



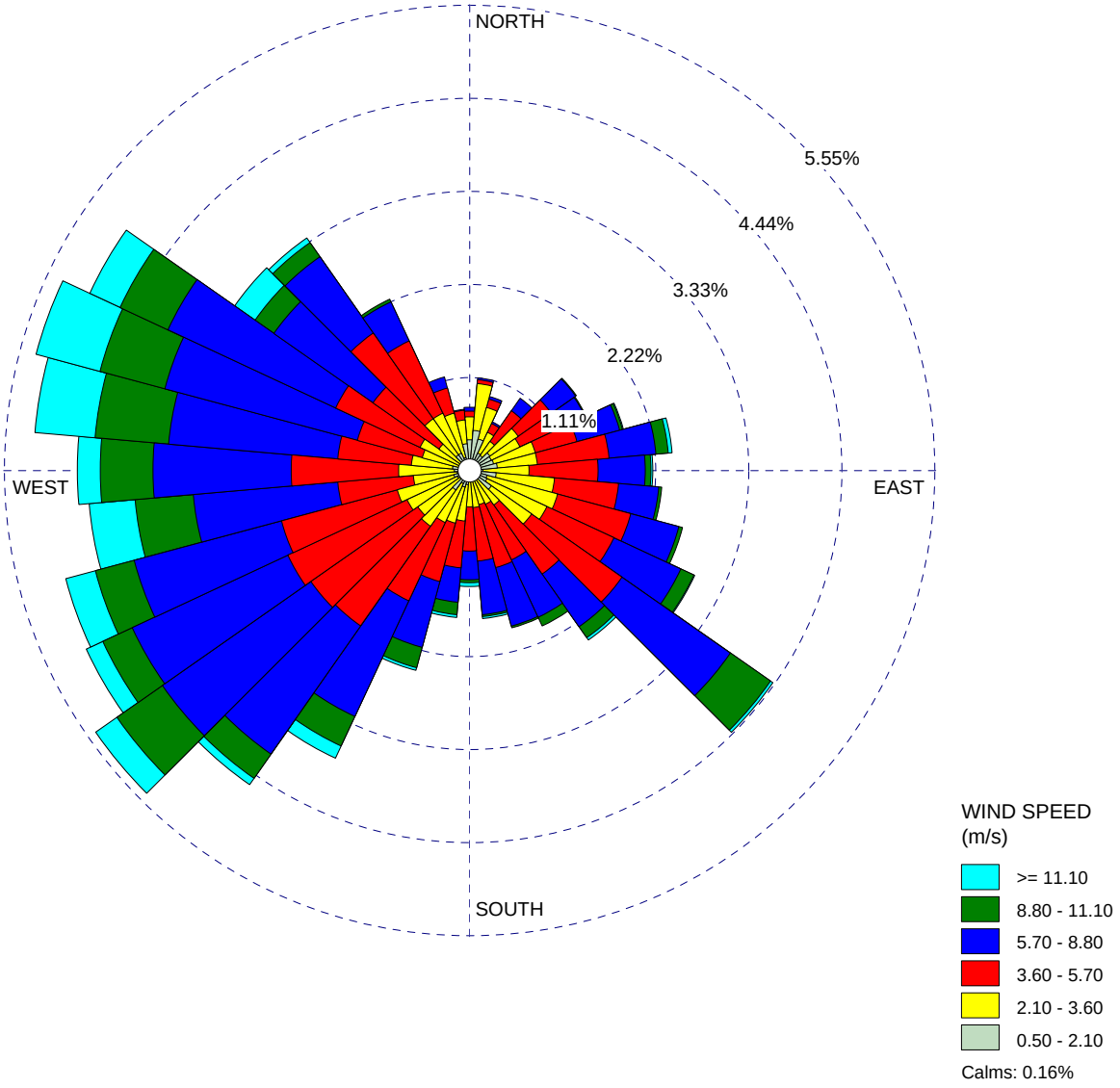
COMMENTS:	DATA PERIOD: **Start Date: 01/01/2016 - 00:00** **End Date: 31/12/2016 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **0.19%**	TOTAL COUNT: **8639 hrs.**	
	AVG. WIND SPEED: **5.13 m/s**	DATE: **21/11/2018**	PROJECT NO.: **3650**

WIND ROSE PLOT:

Barrow/Walney Island - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 01/01/2017 - 00:00** **End Date: 31/12/2017 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **0.16%**	TOTAL COUNT: **8739 hrs.**	
	AVG. WIND SPEED: **5.51 m/s**	DATE: **21/11/2018**	PROJECT NO.: **3650**

Appendix IV

RHI Certificates

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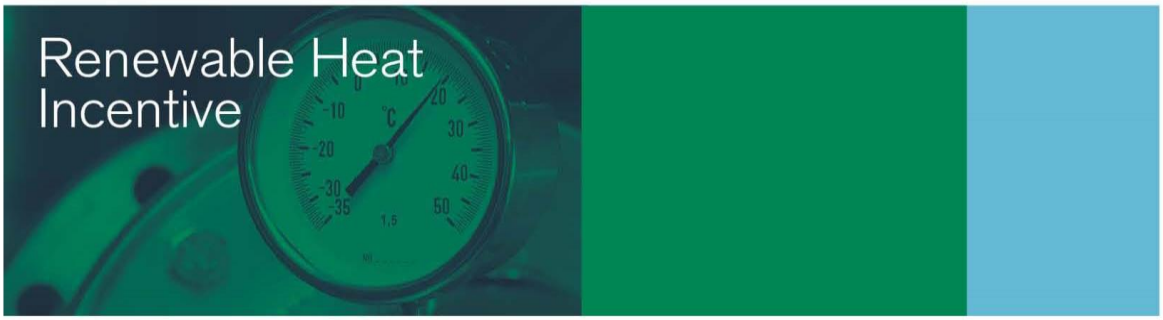

In order to accredit any biomass boiler or stove applications received for the domestic or non-domestic Renewable Heat Incentive (RHI) schemes, Ofgem must be satisfied that a valid emissions certificate exists for the specific model in the application (or alternatively for the non-domestic RHI, an environmental permit for the site). This template incorporates all information required to demonstrate that the tested plant meets the air quality requirements of the RHI. It must be fully completed and issued by a testing laboratory in order to be a valid certificate.

Emissions Certificate

1. TEST HOUSE	
a) Name and address of the testing laboratory that has carried out the required tests and issued this certificate * **if different, include details of both*	**EMCo Air Quality Consultants Ltd** Unit 3, Church Farm, Church Road Eversley, Hants, RG27 0PX
b) Name and signature of the person authorised by the testing laboratory to issue the certificate	Name: Dr A W Stanley
	Signature: 
c) Date of issue of this certificate, together with certificate reference number for this certificate **Please see Note A*	Date: 30 March 2021 (Revised Certificate to amend moisture ranges between A1 and A2 as requested)
	Certificate reference number: **2013-HZm-01-990-7** Reference number of original test report on which this certificate is based: **2013-HZm-01**
d) If the testing laboratory that has carried out the required tests is accredited to BS EN ISO/IEC 17025:2005, date of accreditation and accreditation number *(if testing conducted on or after 24 September 2013, the testing laboratory **must be** BS EN ISO/IEC 17025:2005 accredited at the time of testing)*	Date Laboratory accredited to EN 17025 2005: Initial Registration: United Kingdom Accreditation Service since: **March 2004** Current Registration: EN 17025: Issue **May 2013** (*at the time of testing*)*
	Accreditation number: **2346** (*at the time of testing*) *

**Note EMCo Air Quality Consultants Ltd is no longer a UKAS MCERT accredited laboratory. This Certificate pertains entirely to the works carried out under the former UKAS accreditation and is issued only to clarify fuel categories and re-format the certificate to the current Ofgem Template for ease of use.*

2. PLANT - *Please see Note B*	
a) Name of the plant tested	Biomass Boiler
b) Model of the plant tested* **Please ensure this is the same as in the manufacturer's documentation and boiler nameplate*	RHK-AK 1000
c) Manufacturer of the plant tested	*Heizomat GmbH* Maicha 21 91710 Gunzenhausen Deutscheland
d) Installation capacity* of the **tested** plant in kilowatts (kW) **The total installed peak heat output capacity*	990
e) Is the plant a manually stoked, natural draught plant? (without a fan providing forced or induced draught)	No
f) (i) Date the plant was tested* (ii) Please confirm that NOx and PM have been tested on the same occasion **This is in reference to the emissions testing for PM and NOx, not any wider range of tests. A specific date is required. Please provide the date of test performed at ≥85% of the installation capacity.* *If more than one model has been tested or testing has been conducted on different dates for different fuels, please list each date with details.*	12 December 2013 NOx and Particulate were simultaneously monitored During **ALL** of the tests the plant was operational at ≥ than 85% of its rated value.
g) Please list all the plants in the type-testing range* of the tested plants to which the certificate applies, if any.[1] Please include the **installation capacity** of each model. **This must follow the ratio rules:* *If the smallest plant in the range is 500kW or less, the largest plant in the range can't be more than double the smallest.* *If the smallest plant in the range is over 500kW, the largest plant in the range can't be more than 500kW greater than the smallest.*	All plants covered with the type-testing range of plants to which this certificate applies are listed below: **RHK-AK 500 500kW** **RHK-AK 650 650kW** **RHK-AK 800 800kW** **RHK-AK 900 900kW** **RHK-AK 1000 990kW**

3. FUELS	
a) Types of fuels used when testing *(where relevant, this should include how the fuel has been processed and based if relevant on classifications from EN14961 or EN303-5. eg. wood pellets/compressed wood, wood chip. We don't expect broader categories such as 'beech', 'wood'.)*	***The plant was fuelled by Wood Chip: Manufacture confirmed that it complies with: EN 14961-4 (M25, A2 and P45)***
b) Based on the testing, list the range of fuels that can be used in compliance with the emission limits of 30 grams per gigajoule (g/GJ) net heat input for particulate matter (PM), and 150 g/GJ net heat input for oxides of nitrogen (NOx) *(where relevant, this should include how the fuel has been processed and based if relevant on classifications from EN14961 or EN303-5. eg. wood pellets/compressed wood, wood chips. We don't expect broader categories such as 'beech', 'wood')*	***Wood Chips to EN 14961-4: Class A1 and Class A2, M25 and P45)***
c)Moisture content of the fuel used during testing	***Moisture content 25%***
d) Maximum allowable moisture content* of fuel that can be used with the certified plant(s) that ensures RHI emission limits are not exceeded. **This value may be obtained from ranges specified in EN 303-5 based on the fuel type(s) tested.*	**Range< 35% for A2 woodchip** and/or **Range ≤25% for A1 woodchip**

Corrections (Ver5): 2g. Power added and RHK-AK 850 changed to RHK-AK 800 to reflect current models.
3a. A1 changes to A2: 3b. A1 becomes A1 and A2:3d. range extended from 25% to 35%

[1] The type-testing approach enables testing laboratories to provide assurance that all boilers in a given range meet the air quality requirements, without needing to specifically test each boiler.

4. TESTS	
Confirm which requirements the emissions of NOx and PM have been tested in accordance with. **Either 4a or 4b must be confirmed to be a valid RHI certificate.**	
a) **Was the testing carried out in accordance* with all of the provisions relevant to emissions of PM and NOx in either BS EN 303-5:1999 or BS EN 303-5:2012?**[2] **It is **not** a requirement that the tested plant must be within the scope of one of these standards, as long as the test lab can confirm that **all of the relevant provisions** were followed appropriately*	**N/A**
b) **Was the testing carried out in accordance with all of the following requirements?** (i) - EN 14792:2005 in respect of NOx emissions - EN 13284-1:2002 or ISO 9096:2003 in respect of PM emissions[3]	**(i) Yes**
(ii) emissions of PM represent the average of at least three measurements of emissions of PM, each of at least 30 minutes duration	**(ii) Yes**
(iii) the value for NOx emissions is derived from the average of measurements made throughout the PM emission tests.	**(iii) Yes**
c) Please confirm the plant was tested at ≥85% of the installation capacity of the plant.	**Yes**
d) Please confirm the test shows that emissions from the plant were no greater than 30 g/GJ PM and 150 g/GJ NOx.	**Yes**
e) Measured* emissions of PM in **g/GJ** net heat input **This average value should be from the test confirmed in 4c Results from partial load tests are not required. This value must be in the specified units.*	**13.7**
f) Measured* emissions of NOx in **g/GJ** net heat input **This average value should be from the test confirmed in 4c. Results from partial load tests are not required. This value must be in the specified units.*	**54.1**

Note A: If details from a previously issued certificate or an original test report are being transferred to this RHI emission certificate template, please note that this document must be **issued by the testing laboratory** as a separate certificate. The issue date and certificate reference number should be in relation to *this* certificate produced using the RHI template, not the issue date and reference number of the original certificate or test report.

Note B: If you are including multiple tested plants on one certificate, please ensure that all sections are completed for each tested plant, and are laid out such that it is clear which details relate to which tested plant. If a type-testing range is included as well, please show clearly which type-testing range relates to which tested plant(s), following the type-testing range ratio rules outlined in 2g.

[2] BS EN303-5:1999 and 2012 explain what should be measured and when.
[3] These standards explain how to make the PM and NOx measurements.

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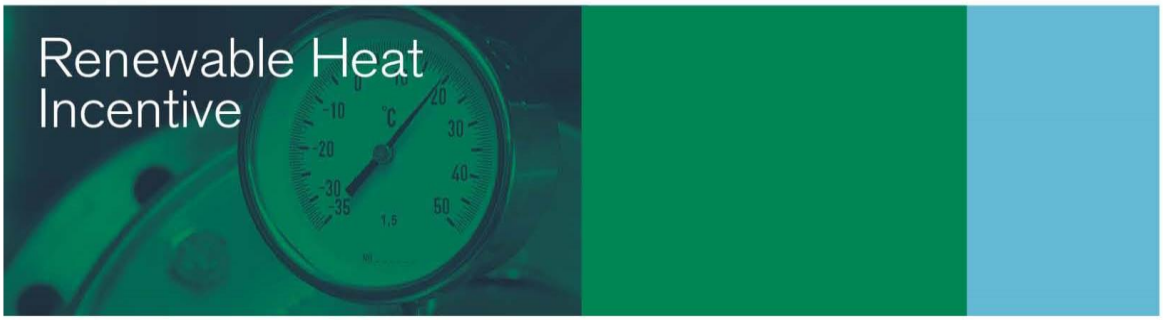

In order to accredit any biomass boiler or stove applications received for the domestic or non-domestic Renewable Heat Incentive (RHI) schemes, Ofgem must be satisfied that a valid emissions certificate exists for the specific model in the application (or alternatively for the non-domestic RHI, an environmental permit for the site). This template incorporates all information required to demonstrate that the tested plant meets the air quality requirements of the RHI. It must be fully completed and issued by a testing laboratory in order to be a valid certificate.

Emissions Certificate

1. TEST HOUSE	
a) Name and address of the testing laboratory that has carried out the required tests and issued this certificate * **if different, include details of both*	**EMCo Air Quality Consultants Ltd** Unit 3, Church Farm, Church Road Eversley, Hants, RG27 0PX **Environmental Compliance Limited** Unit G1, Main Avenue Treforest Industrial Estate Pontypridd, CF37 5BF
b) Name and signature of the person authorised by the testing laboratory to issue the certificate	Name: Dr A W Stanley Signature:
c) Date of issue of this certificate, together with certificate reference number for this certificate **Please see Note A*	Date: 20 October 2020 (Revised Certificate to include additional boiler in type-testing and current boiler plate details as approved by ofgem 09 April 2020) Certificate reference number: **2016-ETs-03(4)** Reference number of original test report on which this certificate is based: **(P2614)2016-ETs-03**
d) If the testing laboratory that has carried out the required tests is accredited to BS EN ISO/IEC 17025:2005, date of accreditation and accreditation number *(if testing conducted on or after 24 September 2013, the testing laboratory **must be** BS EN ISO/IEC 17025:2005 accredited at the time of testing)*	Date Laboratory accredited to EN 17025 2005: Initial Registration: United Kingdom Accreditation Service since: **January 2004** Current Registration: EN 17025: Issue 032 **25 July 2017** Accreditation number: **2499**

Version 2.2: Issued March 2014

2. PLANT - *Please see Note B*	
a) Name of the plant tested	Heizomat Biomass Boiler
b) Model of the plant tested* **Please ensure this is the same as in the manufacturer's documentation and boiler nameplate*	RHK-RK-1000
c) Manufacturer of the plant tested	*Heizomat GmbH* Maicha 21 91710 Gunzenhausen Deutscheland
d) Installation capacity* of the **tested** plant in kilowatts (kW) **The total installed peak heat output capacity*	990
e) Is the plant a manually stoked, natural draught plant? (without a fan providing forced or induced draught)	NO
f) (i) Date the plant was tested* (ii) Please confirm that NOx and PM have been tested on the same occasion **This is in reference to the emissions testing for PM and NOx, not any wider range of tests. A specific date is required. Please provide the date of test performed at ≥85% of the installation capacity.* *If more than one model has been tested or testing has been conducted on different dates for different fuels, please list each date with details.*	17 February 2016 NOx and Particulate were simultaneously monitored During **ALL** of the tests the plant was operational at ≥ than 85% of its rated value.
g) Please list all the plants in the type-testing range* of the tested plants to which the certificate applies, if any.[1] Please include the **installation capacity** of each model. **This must follow the ratio rules:* *If the smallest plant in the range is 500kW or less, the largest plant in the range can't be more than double the smallest.* *If the smallest plant in the range is over 500kW, the largest plant in the range can't be more than 500kW greater than the smallest.*	All plants covered with the type-testing range of plants to which this certificate applies are listed below: **RHK-AK 500 500kW** **RHK-AK 650 650kW** **RHK-AK 800 800kW** **RHK-AK 900 900kW** **RHK-AK 1000 990kW** **RHK-AK 2000 1490kW**

3. FUELS	
a) Types of fuels used when testing *(where relevant, this should include how the fuel has been processed and based if relevant on classifications from EN14961 or EN303-5. eg. wood pellets/compressed wood, wood chip. We don't expect broader categories such as 'beech', 'wood'.)*	***The plant was fuelled by Recycled Wood Chip: Manufacture confirmed that it complies with EN 14961-4 (M30, B2)***
b) Based on the testing, list the range of fuels that can be used in compliance with the emission limits of 30 grams per gigajoule (g/GJ) net heat input for particulate matter (PM), and 150 g/GJ net heat input for oxides of nitrogen (NOx) *(where relevant, this should include how the fuel has been processed and based if relevant on classifications from EN14961 or EN303-5. eg. wood pellets/compressed wood, wood chips. We don't expect broader categories such as 'beech', 'wood')*	**Grade B & C Recycled Wood Chip** ***EN 14961 (M30, B2)***
c)Moisture content of the fuel used during testing	**Less than 30%**
d) Maximum allowable moisture content* of fuel that can be used with the certified plant(s) that ensures RHI emission limits are not exceeded. **This value may be obtained from ranges specified in EN 303-5 based on the fuel type(s) tested.*	**Range between 15% to 30%**

[1] The type-testing approach enables testing laboratories to provide assurance that all boilers in a given range meet the air quality requirements, without needing to specifically test each boiler.

4. TESTS	
Confirm which requirements the emissions of NOx and PM have been tested in accordance with. **Either 4a or 4b must be confirmed to be a valid RHI certificate.**	
a) **Was the testing carried out in accordance* with all of the provisions relevant to emissions of PM and NOx in either BS EN 303-5:1999 or BS EN 303-5:2012?**[2] **It is **not** a requirement that the tested plant must be within the scope of one of these standards, as long as the test lab can confirm that **all of the relevant provisions** were followed appropriately*	**N/A**
b) **Was the testing carried out in accordance with all of the following requirements?** (i) - EN 14792:2005 in respect of NOx emissions - EN 13284-1:2002 or ISO 9096:2003 in respect of PM emissions[3] (ii) emissions of PM represent the average of at least three measurements of emissions of PM, each of at least 30 minutes duration (iii) the value for NOx emissions is derived from the average of measurements made throughout the PM emission tests.	**(i) Yes** **(ii) Yes** **(iii) Yes**
c) Please confirm the plant was tested at ≥85% of the installation capacity of the plant.	**Yes**
d) Please confirm the test shows that emissions from the plant were no greater than 30 g/GJ PM and 150 g/GJ NOx.	**Yes**
e) Measured* emissions of PM in **g/GJ** net heat input **This average value should be from the test confirmed in 4c Results from partial load tests are not required. This value must be in the specified units.*	**3.85**
f) Measured* emissions of NOx in **g/GJ** net heat input **This average value should be from the test confirmed in 4c. Results from partial load tests are not required. This value must be in the specified units.*	**49.03**

Note A: If details from a previously issued certificate or an original test report are being transferred to this RHI emission certificate template, please note that this document must be **issued by the testing laboratory** as a separate certificate. The issue date and certificate reference number should be in relation to *this* certificate produced using the RHI template, not the issue date and reference number of the original certificate or test report.

Note B: If you are including multiple tested plants on one certificate, please ensure that all sections are completed for each tested plant, and are laid out such that it is clear which details relate to which tested plant. If a type-testing range is included as well, please show clearly which type-testing range relates to which tested plant(s), following the type-testing range ratio rules outlined in 2g.

[2] BS EN303-5:1999 and 2012 explain what should be measured and when.
[3] These standards explain how to make the PM and NOx measurements.

Appendix III

Environmental Management System

EMS - BIOMASS BOILERS, SANDSCALE PARK

JJC Hire Limited

VERSION:	1.2	DATE:	1 September 2021		
DOC. REF:	3650-2272-B	AUTHOR:	DY	CHECKED:	
CLIENT NO:	2272	JOB NO:	3650		

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Waste, Planning & Environmental Consultants

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REGISTERED IN THE UK | COMPANY NO. 4850754

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1.0	22/11/2018	DY		Draft for client approval
1.1	07/02/2019	DY		Approved by applicant
1.2	01/09/2021	DY		Updated to include the addition of two further biomass boilers

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Appendix I - Permit Boundary Plan and Site Layout Plans

Appendix II - Record Keeping Forms

Appendix III - Complaints Procedure

Appendix IV - Environmental Permit (to be added later)

1 General Considerations

1.1 Site Operator/Permit Holder

1.1.1 JJC Hire Limited hold a Part B Environmental Permit (EP) (ref: PPC/B/35) to operate a biomass boiler to provide renewable heat for their site at Sandscale Park, Barrow-in-Furness. An application has been submitted to Barrow-In-Furness Borough Council to vary the existing EP to include the addition of two biomass boilers. In addition to virgin timber, the boilers will be fuelled by Grade A waste wood, eg waste wood that is predominantly clean and uncontaminated.

1.1.2 The contact details for JJC Hire Limited are as follows:

JJC Hire Limited
Sandscale Park
Barrow-in-Furness
Cumbria
LA14 4QT

Contact: John Cooper
Position: Site Manager
Contact Number: 01229 827046

1.1.3 Oaktree Environmental Ltd have been engaged to act as consultants for JJC Hire Limited to assist in the preparation of this Management System and to submit an application to vary the site EP.

1.1.4 Contact details for Oaktree Environmental Ltd are as follows:

Oaktree Environmental Ltd
Lime House
Road Two
Winsford Industrial Estate
Winsford
CW7 3QZ

Contact: David Young
Position: Senior Consultant
Tel: 01606 558833
Fax: 01606 861182
E-mail: david@oaktree-environmental.co.uk

1.2 Site Location

1.2.1 The biomass boilers are located at Sandscale Park, Barrow-in-Furness. Reference should be made to Drawing No. 2272-004-02 in Appendix I for details of the site location.

1.3 Permit Area

1.3.1 The area which is the subject of the EP is outlined in red on Drawing No. 2272-004-02. The EP is required for the operation of three biomass boilers fuelled by Grade A waste wood, eg wood that is predominantly clean and uncontaminated. The wider site outside the Part B permit boundary will include the biomass fuel handling/processing operations. This EMS provides a documented system for site management to minimise risk of air pollution to assist with compliance with the permit.

1.3.2 Reference should be made to the infrastructure plans in Appendix I for the layout of the operations.

1.4 Hours of Operation

1.4.1 The operating hours of the site for delivery of wood fuel to the biomass fuel store will be as follows, in accordance with the wider waste recycling site:

Monday to Friday	07:00 – 19:00
Saturday	07:00 – 19:00
Sundays and Bank Holidays	Closed

1.4.2 The boilers will be operated on a continuous basis, 24 hours per day, 7 days per week, except during periods of maintenance. Wood is fed continuously to the boilers from the biomass fuel storage area via walking floor loading systems. The wood storage areas will provide sufficient capacity for wood storage to ensure the boilers can run continuously outside of the above hours.

1.4.3 The only other activities on site which will be permitted outside of the above hours are maintenance works, general office use and work not connected with the permit.

1.4.4 During times where the site is closed or not in operation, the site will be secured to prevent unauthorised vehicular and/or pedestrian access.

1.5 Staffing

1.5.1 Training will be provided to nominated members of staff on weekly upkeep of the biomass boilers. This will be supplemented by a quarterly full service by an external contractor, A weekly check sheet and quarterly service sheet will be maintained by the applicant. In addition to regular staff, external contractors will be used for boiler maintenance and monitoring who will be periodically hired in.

2 Operations

2.1 Biomass Boiler Make, Model and Configuration

2.1.1 The boilers to be used include one Heizomat RHK-AK 1000 boiler and two Heizomat RHK-AK-900 boilers. The location of the biomass boilers and flue is illustrated on Drawing No. 2272-004-02. The boilers are served by elevated flues to release residual emissions, following abatement. The flue locations are shown on drawing nos. 2272-004-02 and 2272-004-03, denoted as 'A1', 'A2' and 'A3'.

2.2 Boiler Fuel Types and Quantities

2.2.1 In addition to virgin wood/biomass, the boilers will be fuelled by Grade A waste wood. No use of Grades B, C and D waste wood will be permitted.

2.2.2 The boilers will be fuelled continuously at a rate of up to 285kg.hour^{-1} (dependent on moisture content and calorific value), generating renewable heat for use on the adjacent site. This document outlines the procedures that will be implemented by the site operator to ensure that the permit can be complied with, eg. assurance that in additional to virgin wood/biomass, only Grade A waste wood will be used to fuel the boilers.

2.3 Plant and Machinery

2.3.1 The following plant and machinery (or similar replacement plant if not available) will be used for unloading/loading and handling of wood:

- Telehandler; and,
- Loading shovel.

2.4 Procedures for Wood Inspection and Handling

2.4.1 The procedures and regulations for the receipt and processing of waste wood at the adjacent site are outside the scope of this permit and are a matter for EA permitting/exemptions and regulation. However, this section contains documented procedures for the visual identification of Grade A waste wood to

ensure that in addition to virgin wood/biomass, only Grade A waste wood is used in the boilers, eg wood that is predominantly clean and uncontaminated.

2.4.2 The permit strictly prohibits the use of any other grades of waste wood in the boilers apart from Grade A (clean, uncontaminated).

2.4.3 It is likely that the Grade A waste wood that is used will be comprised predominantly of clean wooden packaging and pallets. Single use wooden packaging and pallets manufactured in the UK are unlikely to have been subject to any form of non-visible treatment other than being kiln dried. Pallets arising from outside of Europe may have been treated with methyl bromide for biosecurity purposes. Any such pallets will be marked with an 'M' and will be rejected as treated wood. Given the above, clean, uncontaminated wooden packaging can be easily identified.

2.4.4 The table below outlines the waste codes that will be acceptable for receipt and use in the biomass boilers. Upon receipt of the Grade A waste wood on-site, the Waste Transfer Note will be checked to verify the assigned waste code and to check that it meets the allowable codes. The wood will also be checked for other restrictions detailed in the table below. In the case of pallets and wooden packaging, these streams must be visibly clean and checks will be undertaken upon arrival on-site. As detailed previously, any clean pallets can be easily visually verified as being of Grade A waste wood status.

Table 1 List of Acceptable European Waste Codes

European Waste Code	Description	Other Restriction
02 01 03	Plant-tissue waste from agriculture, horticultural and forestry	
02 01 07	Waste from forestry	
03 01 01	Waste bark and cork from wood processing and the production of panels and furniture, pulp, paper and cardboard	Visibly clean, no treatments applied
03 01 05	Sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04 from wood processing and the production of panels and furniture, pulp, paper and cardboard	Visibly clean, no treatments applied
03 03 01	Waste bark and wood from pulp, paper and cardboard production and processing	Visibly clean, no treatments applied
15 01 03	Wooden packaging	Visibly clean, such as visibly clean wood pallets. Any pallets stamped with 'M' will be prohibited for use
19 12 07	Wood other than that mentioned in 19 12 06	Visibly clean wood, including visibly clean wooden packaging such as pallets. Any pallets stamped with 'M' will be prohibited for use

3 Control of Air Emissions, Monitoring and Reporting

3.1 Site Diary/Logbook and Record Keeping

3.1.1 A site diary/logbook will be maintained which contains details of all site inspections, monitoring and improvements made. All plant malfunctions and spillages will also be recorded within the log book along with the remedial action taken. All inspections will be completed by a person who is familiar with the requirements of the management system and permit for the site. A minimum of two years records will be kept on site and will be made available for inspection upon request by the LPA. Example record keeping forms are included in Appendix II of this EMS.

3.2 Control of Boiler Exhaust Emissions

3.2.1 The boilers are fitted with heat exchanger turbulators which create a cyclonic flow through each tube, removing the majority of particulate matter. Carbon monoxide (CO) and nitrogen oxides (NO_x) emissions are minimised via control of combustion conditions, including excess air.

3.3 Spillages

3.3.1 Good housekeeping will be maintained on site at all times to minimise risk of fugitive dust release. All site surfaces will be inspected daily when the site is in operation. Debris will be swept as required and placed in a skip for disposal to a suitably permitted site.

3.3.2 All spillages of waste and windblown litter will be cleared by the end of the working day in which they occur.

3.4 Control of Mud and Debris

3.4.1 Vehicles will be visually inspected before exit from site to check that loads are safe and that no mud or debris is carried out on the wheels or body of the vehicle. Visual inspections of the site roads will be carried out daily, however, staff will

report any problems with mud or debris on the site roads immediately to the Site Manager.

3.4.2 The deposit of material on the access road or public highway will be treated as an emergency and will be cleared immediately by the operator using either a brush and shovel or vacuum tanker/road sweeper if necessary.

3.5 Control of Dust

3.5.1 A series of dust mitigation measures will be implemented to ensure dust emissions are controlled as far as is practically possible. The measures include:

- Sheeting of vehicles delivering materials to the site (if necessary);
- Sheeting of vehicles transporting potentially dusty loads off site;
- Use of mobile bowser to damp down materials stockpiles, vehicle running surfaces, vehicle loads and areas on and around machinery which may give rise to dust, especially during dry and windy conditions;
- Cleaning of any spillages using wet cleaning methods;
- Drop heights minimised to prevent dust emissions; and,
- Enclosure of biomass fuel stores, boilers and fuel loading system within a building, controlling fugitive emission.

3.5.2 A permanent water supply will be made available on site in all climatic conditions to ensure that the dust suppression systems can function effectively. Any external water pipes will be lagged to prevent frost damage during winter months.

3.5.3 All plant and machinery will be operated in accordance with manufacturer specification. Any spillages will be cleaned using wet cleaning methods.

3.6 Boiler Emissions Monitoring

3.6.1 The biomass boilers will be fitted with the following equipment to continuously monitor emissions:

- Lambda sensor to monitor exhaust oxygen content to enable control of excess air and air/fuel ratios.

3.6.2 Given that the boilers will be fuelled by a consistent type of feedstock (virgin biomass and Grade A waste wood), will be continuously loaded with fuel and have sensors in place to monitor and control excess air, monitoring of CO emissions is not required, in accordance with the relevant guidance. Emissions of CO will be monitored at least annually by a suitably qualified contractor, using approved methods.

3.6.3 Particulate matter and organic compounds will be monitored at least annually by a suitably qualified contractor, using approved methods.

3.6.4 NO_x emissions will be monitored upon commissioning of the boilers and after any subsequent substantial change to the installation.

3.6.5 Oxygen will be continuously monitored using a Lambda probe.

3.6.6 All monitoring will be undertaken in accordance with the methods detailed in DEFRA Process Guidance Note 1/12(13), or by alternative equivalent method agreed with the LPA.

3.6.7 The emission limits which apply to the boilers are outlined in Table 3. Emissions monitoring is required to demonstrate compliance with these emission limits.

Table 2 Boiler Emission Limits

Pollutant	Emission Limits ($mg.m^{-3}$) Expressed at Reference Conditions of 11% O_2, 273K, no correction for moisture
CO	250
Total Particulate Matter	60
NO_x	400
Organic Compounds	20

3.6.8 All monitoring results and subsequent actions will be recorded in the site log book and kept available for the regulator to examine for a minimum period of two years.

3.6.9 In the event of adverse results (non-compliance) for both continuous and non-continuous emissions monitoring, investigation will be immediately undertaken by the site operator, who will:

- Identify the cause and take corrective action;
- Clearly record as much detail as possible regarding the cause and extent of the problem, and the remedial action taken; and,
- Re-test to demonstrate compliance as soon as possible and inform the regulator of the steps taken and the re-test results.

3.7 Visual Monitoring - General

3.7.1 Site operatives will continuously visually monitor dust emissions whilst the site is in operation and will report back to the Depot Supervisor/Manager for advice if required.

3.7.2 In the event of complaints regarding visual emissions or dust beyond the site boundary, which in the opinion of the regulator may be attributable to the installation, the site operator will investigate to ascertain which part of the permitted operation is the cause, if applicable. Whilst issues are on-going, a visual check will be made at least once per day/shift by the site operator, with a record made of time, location and result of checks along with prevailing weather conditions at the time, including wind speed and strength. Once the source of emission is identified, corrective action will be taken without delay.

3.8 Visual Monitoring of Stack Exhaust

3.8.1 Emissions from the combustion process should be free from visible smoke. During start up and shut down of the boilers, emissions should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:2009. All emissions from air should be free from droplets and persistent visible emissions. Stack emissions will be visually monitored on an ongoing basis by site staff.

3.9 Complaints Procedure

3.9.1 A complaints procedure will be maintained during operation of the site to ensure that any complaints made in relation to air emissions (eg dust) are investigated, documented and action taken as necessary. Reference should be made to Appendix III for a copy of the complaints procedure.

4 Site Management and Training

4.1 General

4.1.1 A log book will be kept on site which will contain records of all monitoring results, visual assessments, inspections and maintenance undertaken. All plant malfunctions and spillages will also be recorded within the log book along with the remedial action taken. A minimum of two years records will be kept on site and will be made available for inspection upon request by the LPA. Any records maintained off-site will be made available within one week of request by the regulator.

4.2 Management Structure

4.2.1 The site will be managed by regular staff who have received appropriate training and the boilers will undergo regular servicing as detailed previously.

4.3 Health and Safety

4.3.1 Personal Protective Equipment (PPE) will be issued to all plant operators to ensure their safety. Such items may include safety goggles, gloves, hi-visibility vests/jackets, ear defenders/plugs, hard hats and safety boots.

4.4 Staff Training - General

4.4.1 All staff will be made aware of their responsibilities under the permit and receive training on the following:

- Steps necessary to minimise emissions during start-up and shut-down; and,
- Actions to be taken should abnormal conditions, accidents or spillages occur.

4.4.2 The operator will maintain a statement of training requirements for each operational post and maintain records of training received by each member of staff.

4.5 Training Needs Assessment

4.5.1 All new and existing site staff are subject to a specific training regime based on their responsibilities at the site to ensure all operations are carried out without harm to the environment or amenity of the surrounding area. Training with regard to the individual responsibilities of the site staff will help to prevent incidents occurring which may have an adverse impact on the environment and/or the employees and their co-workers.

4.6 Site Rules and Infrastructure Training

4.6.1 This information will be provided to all employees, visitors and contractors with a full understanding of the site's conditions of use, which will be communicated and documented at induction for all staff with specific induction for visitors and contractors.

4.6.2 Competency should be demonstrated within this field to ensure the employee is fully aware of the site's surroundings and operations to ensure their safety and compliance with specific operating conditions at the site.

4.7 Vehicle /Plant Preventative Maintenance Training

4.7.1 This training is provided specifically for the vehicle and plant operators in order to ensure that all plant and machinery is checked regularly to prevent any occurrences which may lead to any adverse impacts on the environment or human health.

4.7.2 Training will be based on the preventative maintenance schedule supplied by the plant/equipment manufacturer.

4.7.3 The same training will be provided to senior management enabling a dual-level maintenance programme.

4.8 Plant Operation Training

4.8.1 Any employees who are required to operate loading or processing plant for the movement or processing of wood or other fuels/wastes will be required to undertake the necessary qualifications for the operation of the specific item of plant in question. This will be required prior to operating the plant and will be obtained through necessary external certification programmes.

4.8.2 Regardless of general plant operation certification, all operatives will be fully inducted in the operation of the specific make and/or model of plant used on site.

4.9 Permit /Management System Training

4.9.1 All employees will be inducted into the operating conditions as prescribed in the Environmental Permit for the site. Whilst much of the above training will provide specific guidance on many aspects of these documents, all employees will be made aware of the location of the Environmental Permit in the site office. All managerial positions will be made fully aware of the site operating conditions.

4.10 Training for Contractors

4.10.1 General site training will be provided to any contractors who are working on the site on a temporary basis.

4.10.2 Additional training will be provided to contractors in their area of expertise. If they are dealing with specific items of plant/machinery, site operating conditions and a general understanding of the Environmental Permit conditions will be provided to prevent any adverse impacts on the environment.

5 Maintenance

5.1 The site operator will maintain a written maintenance programme for all pollution control equipment and keep records of any maintenance that has been undertaken within the logbook.

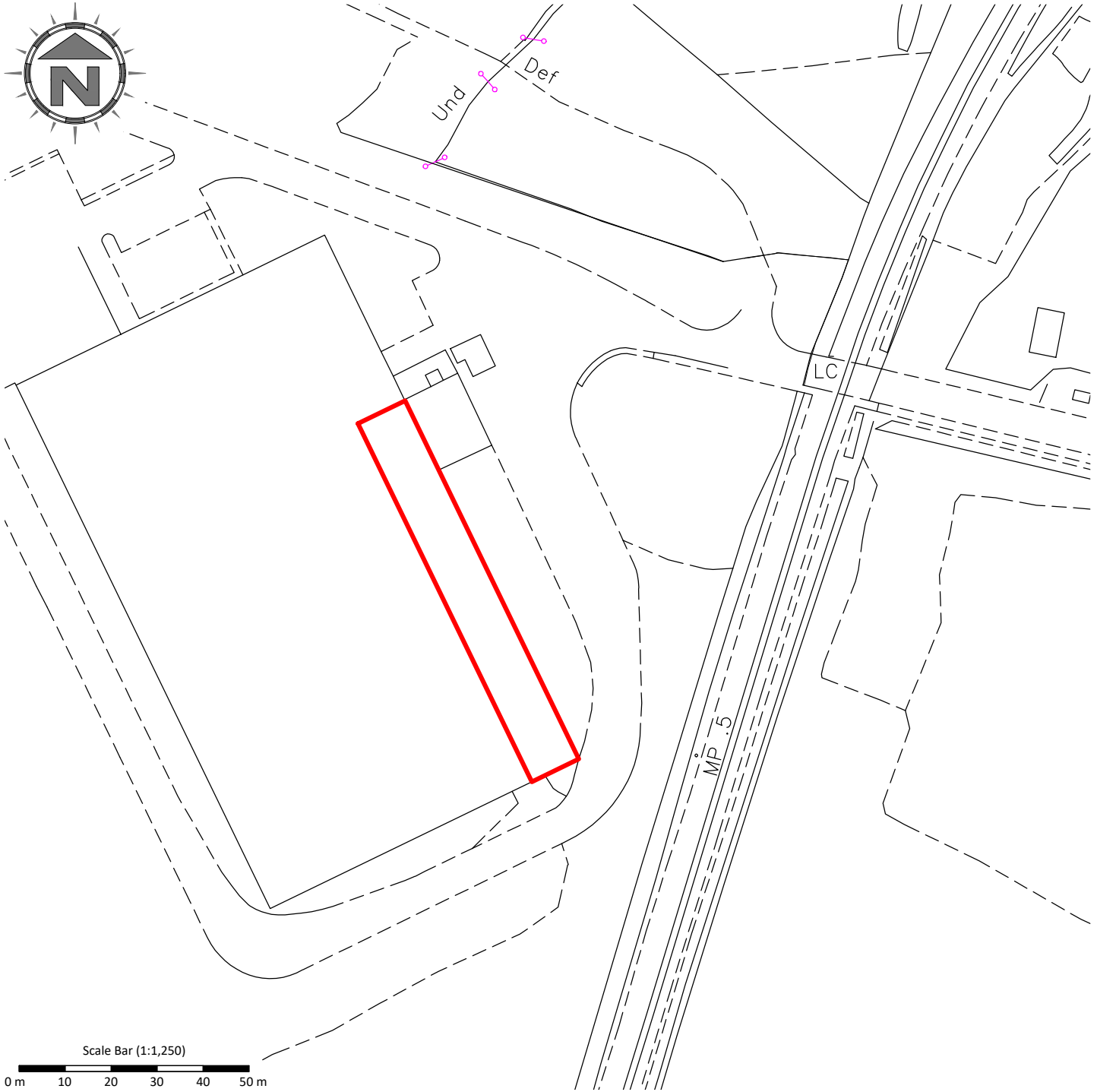
5.2 Essential spares for plant maintenance will be kept on site at all times.

5.3 All checks on plant and equipment will be recorded within the log book.

5.4 Good housekeeping will be maintained at all times on site. Any spillages will be cleaned on a regular basis.

Appendix I

Permit Boundary Plan and Site Layout Plan



NOTES

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REVISION HISTORY

Rev:	Date:	Init:	Description:
-	06.09.21	RS	Initial drawing

KEY:

Permit boundary

Oaktree Environmental Ltd

Waste, Planning and Environmental Consultants

DRAWING TITLE

PERMIT BOUNDARY PLAN

CLIENT

JJC Hire Ltd

PROJECT/SITE

Sandscale Park, Barrow-in-Furness

SCALE @ A4	CLIENT NO	JOB NO
1:1,250	2272	004

DRAWING NUMBER	REV	STATUS
2272-004-02	-	Issued

DRAWN BY	CHECKED	DATE
RS	RS	06.09.21

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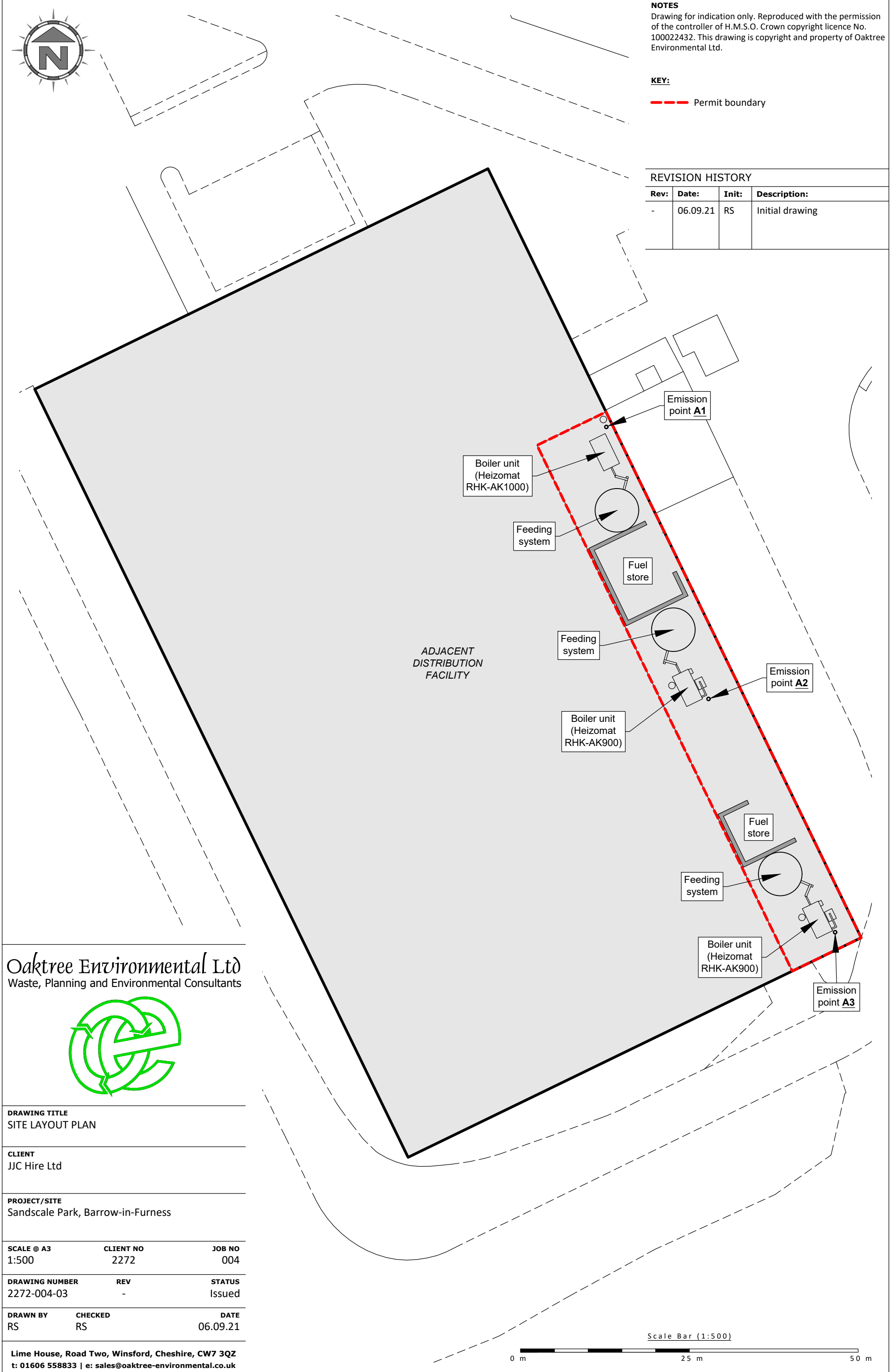
KEY:

Permit boundary

REVISION HISTORY

Rev:	Date:	Init:	Description:
-	06.09.21	RS	Initial drawing



Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants

DRAWING TITLE
SITE LAYOUT PLAN

CLIENT
JJC Hire Ltd

PROJECT/SITE
Sandscale Park, Barrow-in-Furness

SCALE @ A3	CLIENT NO	JOB NO
1:500	2272	004

DRAWING NUMBER	REV	STATUS
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RS	RS	06.09.21

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Appendix II

Record Keeping Forms

STAFF TRAINING/REVIEW FORM										
EMPLOYEE NAME				DATE						
POSITION				REVIEW DUE						
TRAINING CARRIED OUT BY										
POSITION										
TRAINING REQUIRED	GENERAL OPERATIVES		HGV DRIVERS		PLANT OPERATOR		DEPOT MANAGER/SUPERVISOR		OTHER	
CARRIED OUT?	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE		
SITE RULES AND INFRASTRUCTURE										
EMERGENCY PROCEDURES										
FIRE SAFETY/ FIRE FIGHTING										
RECOGNITION OF WASTE TYPES										
STORAGE AREAS/LIMITS										
RECORD KEEPING										
VEHICLE CHECKS (Preventative Maintenance)										
PLANT CHECKS (Preventative Maintenance)										
DUTY OF CARE WASTE TRANSFER NOTES										
PLANT OPERATION - LOADING PLANT										
PLANT OPERATION - BOILERS										
MANAGEMENT SYSTEM & PERMIT										
OTHER 1 (PLEASE SPECIFY)										
OTHER 2 (PLEASE SPECIFY)										

Appendix III

Complaints Procedure

JJC HIRE LIMITED - COMPLAINTS REPORT FORM

Date Recorded:	Reference Number:
Name and address of caller	
Telephone number of caller	
Time and Date of call	
Nature of complaint (noise, odour, dust, other) (date, time, duration)	
Weather at the time of complaint (rain, snow, fog, etc.)	
Wind (strength, direction)	
Any other complaints relating to this report	
Any other relevant information	
Potential reasons for complaint	
The operations being carried out on site at the time of the `	
Follow Up	
Actions taken	
Date of call back to complainant	
Summary of call back conversation	
Recommendations	
Change in procedures	
Changes to Written Management System (EMS)	
Date changes implemented	
Form completed by	
Signed	
Date completed	

COMPLAINT RECORDING PROCEDURE:

1) Any complaints received will be recorded on the above form. This form will normally be completed, signed and dated by the Site Manager; if they are not available the Office Manager will complete the form.

2) The name, address and telephone number of the caller will be requested.

3) Each complaint will be given a reference number.

4) The caller will be asked to give details of:

    a. the nature of the complaint;
    b. the time;
    c. how long it lasted;
    d. how often it occurs;
    e. Is this the first time the problem has been noticed; and
    f. what prompted them to complain

5) The person completing the form will then, if possible, make a note of:

    a. the weather conditions at the time of the problem (rain, snow, fog etc.)
    b. strength and direction of the wind; and
    c. the activity or activities taken place on the site at the time the noise was detected, particularly anything unusual.

6) The reason for the complaint will be investigated and a note of the findings added to the report.

7) The caller will then be contacted with an explanation of the source of the complaint if identified and the action taken to prevent a recurrence of the problem in future.

8) If the caller is unhappy about the outcome or unwilling to identify themselves the caller will be invited to contact the Local Authority.

9) Following any complaint the relevant management plan(s) will be reviewed to ensure appropriate actions are in place to counter any problems.

Appendix IV

Environmental Permit (to be added later)