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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

ENDLESS ENERGY LIMITED

ENDLESS ENERGY FACILITY

MONITORING

SEPTEMBER 2018

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CONTENTS

TABLES

Drawings

SH11087-026	Site Drainage Plan
SH11087-027	Point Source Emissions to Air

1 INTRODUCTION

1.1.1 Emissions from the facility will be subject to comprehensive monitoring to ensure that impacts on the environment are minimised. Monitoring will be carried out in accordance with the Industrial Emissions Directive (IED) and indicative BAT described in Sector Guidance Notes EPR S5.01 and EPR S5.06.

1.1.2 Endless Energy Ltd will carry out monitoring in accordance with written procedures, complying with MCERTS standards wherever applicable, to ensure quality control of the data that is collected.

1.1.3 Records of all monitoring data will be kept in an electronic form to allow the analysis of trends so that any potential issues can be picked up at an early stage and remedial action can be taken to prevent any breach of the permit conditions.

2 EMISSIONS TO AIR

2.1.1 There are 10 emission points to air from the proposed facility. However only the 60m main flue gas stack (Flue 1), will be in constant use. This main stack will contain one outlet flue. The stack is supplied by CNIM as a self-supported duct. It includes a platform with access for the two flue analysers and sampling kit. The stack is fully equipped with lightning and night marker lights at the top. The top of stack is accessed by a single ladder. The emissions will be monitored in accordance with relevant legislation, Monitoring Technical Guidance Notes, and MCERTS.

2.1.2 Silo emission points include the Lime Silo filter outlet (Flue 2); the PAC Silo filter outlet (Flue 3); and the Residue Silo filter outlet. These emission points are located after filter units on each of the respective storage silos. Of the substances specified in IED Annex VI, for these smaller flues (0.3m flue diameter compared with the 1.45m flue diameter of Flue 1) only particulate matter is relevant as a potential release, with a condition set for average concentrations as being less than 10 mg/m^3.

2.1.3 A list of emission points is as follows:

- A1 – stack;
- A2 – lime silo filter outlet;

- A3 – PAC silo filter outlet;
- A4 – residue silo filter outlet;
- A5 – emergency diesel generator;
- A6 – turbogenerator hall vents and pressure release valves;
- A7 – steam silencer;
- A8 – expansion duct;
- A9 – expansion duct;
- A10 – bottom ash vent;
- F1 – emission to foul sewer; and
- S1 – surface water discharge.

2.1.4 Monitoring of Flue 1 will be in accordance with the Industrial Emissions Directive (IED) which sets standards for monitoring of incinerators (including gasification and pyrolysis plants).

2.1.5 Monitoring of the stack will include the parameters in Table 2:1 and Table 2:2 below which is considered appropriate to demonstrate compliance with emission limits.

Table 2:1 Monitoring Requirements and Methods for the Main Stack (Flue 1) – Process Monitoring			
Parameter	**Monitoring Frequency**	**Method**	**Monitoring Standard**
Gas flow	Continuous	Pitot tube	Traceable to national standards
Exhaust gas water vapour content	Continuous	Zirconium cell probe type analyser	BS EN 15267-3 BS EN 14181
Exhaust gas pressure	Continuous	SMART type transmitter	BS EN 61326
Exhaust gas oxygen content	Continuous	Combustion O2 analyser Zr probe	BS EN 15267-3 BS EN 14181
Exhaust gas temperature	Continuous	Resistance probe & thermocouple	Traceable to national standards
Temperature (˚C) (location close to the Combustion Chamber inner wall or as identified and justified in application)	Continuous		Traceable to national standards
Wind speed and direction	Continuous		Anemometer

2.1.6 Monitoring of gas emissions from the stack will include the parameters in Table 2 below. The monitoring parameters, frequency and method is considered appropriate to demonstrate compliance with emission limits.

Table 2:2: Monitoring Requirements and Methods for the Main Stack (Flue 1) – Point Source Emissions to Air				
Parameter	**Reference Period**	**Monitoring Frequency**	**Method**	**Monitoring Standard**
Carbon monoxide	Daily average	Continuous plus extractive every 6 months	Infra-red analyser and wet or dry for gas extractive samples	BS EN 15267-3 BS EN 14181
NO_X (nitrogen dioxide and nitrogen oxide expressed as NO_2)	½ hour average Daily average	Continuous plus extractive every 6 months	Infra-red analyser or UV spectroscopy, and wet or dry for gas extractive samples	BS EN 15267-3 BS EN 14181
NH_3	½ hour average and daily average	Continuous		
Total dust (particulate matter)	½ hour average Daily average	Continuous plus (extractive every 6 months)	Light diffusion	BS EN 15267-3 BS EN 14181
Total organic carbon (TOC)	½ hour average Daily average	Continuous (plus extractive every 6 months)		BS EN 15267-3 BS EN 14181
Hydrogen Chloride (HCl)	½ hour average	Continuous plus extractive every 6 months	Infra-red analyser and wet or dry for	BS EN 15267-3

Table 2:2: Monitoring Requirements and Methods for the Main Stack (Flue 1) – Point Source Emissions to Air				
Parameter	**Reference Period**	**Monitoring Frequency**	**Method**	**Monitoring Standard**
	Daily average		gas extractive samples	BS EN 14181
SO_2	½ hour average Daily average	Continuous plus extractive every 6 months	Infra-red analyser and wet or dry for gas extractive samples	BS EN 15267-3 BS EN 14181
Hydrogen fluoride (HF)	Periodic, over a minimum 1-hour period	Quarterly in first year. Then bi-annually	Gas extraction and subsequent analysis.	ISO 15713:2006
Cadmium (Cd) & thallium (Tl) and their compounds (total)	Periodic, over a minimum 30 minute, maximum 8-hour period	Quarterly in first year then biannually		BS EN 14385:2004
Mercury (Hg) and its compounds	Periodic, over a minimum 30 minute, maximum 8-hour period	Quarterly in first year then biannually		BS EN 13211:2001
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	Periodic, over a minimum 30 minute, maximum 8-hour period	Quarterly in first year then biannually		BS EN 14385:2004
Nitrous oxide (N_2O)	Periodic over minimum 1-hour period	Quarterly in first year then biannually		BS EN ISO 21258:2010
Dioxins/Furans	Periodic over minimum 6 hours, maximum 8-hour period	Quarterly in first year then biannually		BS EN 1948:2006 parts 1-3
Dioxin-like PCBs	Periodic over minimum 6 hours, maximum 8-hour period	Quarterly in first year then biannually		BS EN 1948-4

2.1.7 All monitoring results will be normalised at standard conditions of 273°K, pressure of 101.3kPa and 11% oxygen in dry air.

2.1.8 Information from the continuous monitoring equipment will be fed back to the Distributed Control System (DCS), an automated control system to ensure continuous proper functioning of the plant 24 hours a day. For the emissions monitoring, this will comprise a computer station in order to perform data storage and calculations concerning the flue emissions (and other performance of the plant). This dedicated control equipment will consist of a "2- station" PC (main and auxiliary) with long-term data storage capacity.

2.1.9 This system will issue all emissions reports requested by the regulatory authorities. All data will be published in the standard format required and then expressed in daily, weekly and monthly reports. monitoring with comply to all stipulated IED limits including half hourly average emission limit values set in Annex VI of the IED.

2.1.10 As emission values and associated parameters ("2 seconds" temperature, Oxygen, "combustion", etc.) are necessary for the control of the process, and primary correction calculations will be made for this purpose directly by the main control system (DCS). Furthermore, auxiliary calculations (time-averages, peak values, etc.) will be calculated by the auxiliary station.

2.1.11 All the information from the combustion and the flue gas treatment system will then be made available from the auxiliary station which allows on-screen monitoring and reports to be printed, if required. This system will issue all reports requested by the regulating bodies with regards to pollutant emissions. All the data will be expressed in the standard format and then published in daily, weekly and monthly reports.

2.1.12 In the unlikely event that a 'normal operation' IED limit is breached staff will be alerted by an alarm and waste fed to the combustion system will automatically shut down to limit emissions to the atmosphere. All monitoring results will be recorded on appropriate software, allowing analysis of trends and comparisons to emission limit values. In abnormal operations, it is noted that within the IED a 4 hour limit is afforded for any single abnormal operations event with a 60 hour

annual maximum. The plant will be operated in accordance with the Directive and should a breach occur waste feed to the plant will cease within these periods.

2.1.13 Monitoring of the emissions will be undertaken during all operating conditions when waste is being combusted, including commissioning, start up and shut down to demonstrate that emissions are meeting the required levels such that there are no unacceptable impacts on local air quality.

2.1.14 Sampling will be via a sample line in the flue gas duct. Such sampling may be carried out with flues in the horizontal plane to allow safe access. Sampling points will be provided in compliance with BS EN15299.

2.1.15 Continuous monitoring will be from instruments located within the flue gas duct at an appropriate location, in order to achieve representative results. Installation of this equipment will be in accordance with the Environment Agency's Guidance note M1, "Sampling Requirements for Stack Emission Monitoring". Monitoring methods will be in accordance with the Environment Agency's Guidance note M2, "Monitoring of Stack Emissions to Air". MCERTS standards will be followed wherever they are applicable.

2.1.16 Continuous emissions monitoring systems (CEMs) will be selected, installed calibrated and maintained in accordance with EN14181, "Quality Assurance of Automated Measuring Systems" to ensure that they are fit for purpose and continue to operate effectively throughout the life of the facility.

2.1.17 Continuous monitoring will be provided in accordance with Article 48 of the IED for NO_X, CO, particulates, TOC (VOCs), HCl and SO_2. In addition, ammonia will be continuously monitored to ensure proper functioning of the NOx reduction system. The plant also includes effective abatement against acid gases and the emission limit for HCl and SO_2 will not be exceeded.

2.1.18 In addition, during routine daily inspections of the site the stack will be subject to visual inspection to ensure that emissions are generally colourless. No routinely visible plume should be seen though occasionally, in damp cold weather, some steam may be visible.

2.1.19 Monitoring of the flue gas controls is also carried out.

2.1.20 Additional emission points, as shown on drawing SH11087-027 will not require regular monitoring. Emissions to air will occur only during activities such as emergency generator use, releases of steam, releases of air and deliveries / movement of materials within silos, when air within the silos is displaced and pre-existing materials disturbed. At any other time, there will be no emissions from the filter outlets.

3 MONITORING OF EMISSIONS TO SURFACE WATER & SEWER

3.1.1 The only emissions to surface water will be from roofs and clean areas of the site. There will be no discharges to surface water from the site plant or waste storage areas. As such no monitoring for these sources is proposed. Clean surface water will pass through a hydrocarbon interceptor prior to exiting the site on Marley Road.

3.1.2 Only spent boiler water will be discharged to foul sewer. Monitoring of water discharged to sewer will be undertaken at point F1, shown on drawing SH11087-026. Boiler water quality will be monitored according to EN 12952-12:2003 - Water-tube boilers and auxiliary installations. Requirements for boiler feedwater and boiler water quality.

3.1.3 This will be managed under a trade effluent discharge consent agreed with Yorkshire Water. An application for a trade effluent discharge consent will be made in due course.

3.1.4 The monitoring regime for discharged boiler water is detailed in Table 3:1 below:

Table 3:1: Boiler Water Feed Quality

Item		Frequency	Limit Values	Remarks
pH	SÖR	Continuous	8.5 to 9.5	This should preferably be maintained at between 8.8 and 9.3.
Direct conductivity	(µg/cm)	Daily	<12	
Dissolved O2	Mg/kg		<0.01	
pH	SÖR	Weekly if there are	8.5 to 9.5	This should preferably be maintained at between 8.8 and 9.3.

Table 3:1: Boiler Water Feed Quality				
Item		**Frequency**	**Limit Values**	**Remarks**
Iron content	Fe Mg/kg	continuous controls in place	<0.02	
Silica content	Si_{O_2} Mg/kg		<0.02	Frequency to be increased in the event that permitted water quality values in the boiler are exceeded.
Silica content	Si_{O_2} Mg/kg	Monthly	<0.02	A monthly analysis is sufficient during normal operation, if continuous controls are in place. Frequency to be increased in the event that permitted water quality values in the boiler are exceeded.
Sodium content	Na + K Mg/kg		<0.01	Sampling frequency to be increased if permissible cationic conductivity values are exceeded.
Chlorides	Cr Mg/kg		<0.07	Measurement in the event of an unjustified exceeding of the pH and / or the conductivity.
Copper content	Cu Mg/kg	Quarterly	<0.003	This installation does not contain any copper parts. This makes this measurement optional. A quarterly confirmatory analysis may be carried out. This provision should be reviewed in the event that copper-alloy items are added at a later date.
Oil content	Mg/kg		<0.05	This parameter is not operational. Generally speaking, oil is not allowed into the boiler: a confirmatory quarterly analysis is recommended. In the case of this installation, the presence of oil is unlikely. Accidental introduction is possible if there is a failure in the rotary machine lubrication circuits in the water / steam system. Oil is difficult to measure. It may be replaced by a TOC (total organic carbon) measurement – same limit values.

4 RESIDUE QUALITY MONITORING

4.1.1 Bottom ash and fly ash will be sampled to demonstrate compliance with the requirements of IED and allow appropriate recycling or disposal.

4.1.2 Sampling will be undertaken in accordance with Environmental Services Association (ESA) A Sampling and Testing Protocol for the Assessment of Hazard Status of Incinerator Bottom Ash (CEN Technical Report 15310-2). The sampling regime is as follows:

- Sampling will be representative of IBA that routinely leaves the site. Two randomly chosen time periods will be selected during an identified day to collect samples.
- A minimum of 20 incremental samples will be taken from the chosen load of IBA. A primary sample will be produced combining the 20 increments.
- The equipment used to produce each sample will be at least twice the size of the largest particle size of IBA.
- The primary sample will be approximately 200kg in weight.
- The primary sample will be mixed and a sub-sample taken. The sub-sample must be placed into a sealed plastic container(s) and sent to the designated testing house within 24 hours of sample collection.
- Samples will be identified using a code. The sample code will include: *Plant name / IBA / Sample collection number 1 or 2 / Date (of sample collection) / Batch no. in year / Initial of sampler. For multiple containers use codes 1 of 3 etc.*

4.1.3 If six or fewer of the 24 samples in the first year of monitoring are classed as exceedances, the IBA should be classed as non-hazardous. If seven or more of the 24 samples exceed the H14 hazard threshold in the initial 12-month period, the IBA will be classed as hazardous. When shown as hazardous, the IBA will continue to be deemed hazardous unless it can be proven otherwise.

4.1.4 The frequency of sampling can be amended depending upon whether the IBA is hazardous or not. Further information relating to the sampling and testing of the hazard status of incinerator bottom ash can be found in CEN Technical Report 15310-2.

4.1.5 The frequency of bottom ash and APC residue monitoring, including parameters, limits and monitoring standard, is shown in Table 4:1 below:

Table 4:1: Residue Quality					
Emissions Point Reference or Source or Description of Point Measurement	**Parameter**	**Limit**	**Monitoring frequency**	**Monitoring Standard or Method***	**Other Specifications**
Bottom Ash	TOC	<3%	Monthly in the first year of operation. Then Quarterly	Environment Agency ash sampling protocol.	
Bottom Ash	Metals (Antimony, Cadmium, Thallium, Mercury, Lead, Chromium, Copper, Manganese, Nickel Arsenic, Cobalt, Vanadium, Zinc) soluble fractions	No limit set	Monthly in the first year of operation. Then Quarterly	Sampling and analysis as per Environment Agency ash sampling protocol.	
Bottom Ash	Total soluble fraction and metals (Antimony, Cadmium, Thallium, Mercury, Lead, Chromium Copper, Manganese, Nickel, Arsenic, Cobalt, Vanadium, Zinc) soluble fractions	No limit set	Before use of a new disposal or recycling route	Sampling and analysis as per Environment Agency ash sampling protocol.	
APC Residues	Metals (Antimony, Cadmium, Thallium, Mercury, Lead, Chromium, copper, Manganese, Nickel, Arsenic, Cobalt, Vanadium, Zinc) and their compounds, dioxins/furans and dioxin-like PCBs.	No limit set	Monthly in the first year of operation. Then Quarterly	Sampling and analysis as per Environment Agency ash sampling protocol.	
APC Residues	Total soluble fraction and metals (Antimony, Cadmium, Thallium, Mercury, Lead, Chromium, Copper, Manganese, Nickel, Arsenic, Cobalt, Vanadium, Zinc) soluble fractions	No limit set	Before use of a new disposal or recycling route	Sampling and analysis as per Environment Agency ash sampling protocol.	

4.1.6 Endless Energy Ltd will audit the recycling and disposal routes and keep appropriate records to ensure full compliance with the duty of care.

4.1.7 Records will be kept quantifying the waste sent off site to each of the recycling/disposal routes and these will be collated and reported to the regulatory authorities in accordance with permit conditions.

5 ENVIRONMENTAL MONITORING BEYOND THE INSTALLATION BOUNDARY

5.1.1 It is not considered that formal monitoring beyond the installation boundary will be required as a matter of routine.

5.1.2 Impermeable surfacing, bunding and engineered drainage system at the site mean that there will be no emissions to surface water, soils or groundwater from the permitted processes.

5.1.3 Emissions to air and sewer will be monitored at the point of discharge allowing control over emissions from the site and preventing any pollution of the environment.

5.1.4 Monitoring of bio-aerosols is not considered necessary as all waste will be loaded, stored and unloaded inside the buildings or within enclosed tanks or silos. The comprehensive dust and odour control system provided for the site buildings will prevent fugitive emissions of bioaerosols.

5.1.5 Inspections will be made around the site boundary on a daily basis to ensure that there are no unacceptable emissions of noise, odour or litter.

5.1.6 Should complaints arise regarding these issues, further visual and olfactory monitoring will be undertaken at and around the receptor to assess whether emissions are occurring and to plan appropriate remedial action. Such monitoring will be recorded in accordance with Endless Energy Ltd's complaints procedure.

6 PROCESS MONITORING

6.1.1 The plant will be subject to continuous monitoring to ensure that it is operating effectively, as described in section 2.5. In terms of installation activity, monitoring and environmental controls this is described above, showing how parameters such as pressure, temperature and raw material use will be monitored and will provide feedback for the proper control of the plant.

6.1.2 Waste inputs will also be monitored to ensure that they remain within set parameters to allow for effective treatment within the plant. Waste will be accepted only from pre-determined contracts and will be subject to visual assessment on arrival at the facility.

wardell-armstrong.com

STOKE-ON-TRENT
Sir Henry Doulton House
Forge Lane
Etruria
Stoke-on-Trent
ST1 5BD
Tel: +44 (0)178 227 6700

BIRMINGHAM
Two Devon Way
Longbridge Technology Park
Longbridge
Birmingham
B31 2TS
Tel: +44 (0)121 580 0909

CARDIFF
22 Windsor Place
Cardiff
CF10 3BY
Tel: +44 (0)292 072 9191

CARLISLE
Marconi Road
Burgh Road Industrial Estate
Carlisle
Cumbria
CA2 7NA
Tel: +44 (0)122 855 0575

EDINBURGH
Great Michael House
14 Links Place
Edinburgh
EH6 7EZ
Tel: +44 (0)131 555 3311

GLASGOW
2 West Regent Street
Glasgow
G2 1RW
Tel: +44 (0)141 433 7210

LONDON
46 Chancery Lane
London
WC2A 1JE
Tel: +44 (0)207 242 3243

MANCHESTER (City Centre)
76 King Street
Manchester
M2 4NH
Tel: +44 (0)161 817 5038

MANCHESTER (Greater)
41-50 Futura Park
Aspinall Way
Middlebrook
Bolton
BL6 6SU
Tel: +44 (0)194 226 0101

NEWCASTLE UPON TYNE
City Quadrant
11 Waterloo Square
Newcastle Upon Tyne
NE1 4DP
Tel: +44 (0)191 232 0943

SHEFFIELD
Unit 5
Newton Business Centre
Newton Chambers Road
Thorncliffe Park
Chapeltown
Sheffield
S35 2PH
Tel: +44 (0)114 245 6244

TRURO
Baldhu House
Wheal Jane Earth Science Park
Baldhu
Truro
TR3 6EH
Tel: +44 (0)187 256 0738

International offices:
ALMATY
29/6 Satpaev Avenue
Regency Hotel Office Tower
Almaty Kazakhstan
050040
Tel: +7(727) 334 1310

MOSCOW
21/5 Kuznetskiy Most St.
Moscow
Russia
Tel: +7(495) 626 07 67

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