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Our ref: LP/MB/SH/SH11087/LET/001/V1.0 *Date*: 9 November 2020
Your ref:

Permitting and Support Centre
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99 Parkway Avenue
Parkway Business Park
Sheffield
S9 4WF

For the attention of [*name redacted]*

Dear [name redacted]

Endless Energy Facility EPR/ZP3537AT/A001 – Response to information request

Please find below our response to the request for information dated 02/09/2020.

Energy efficiency calculation and BAT AEEL

1. The gross electrical efficiency calculation was based on electrical production of 13.26 MW. However the application documents were based on electricity production of 11.35 MW. Explain the difference in the values.

We would advise the application documents state that there will be a **net** electrical production of 11.35MW. 13.26MW is the figure for **gross** electrical production. To explain, the plant will generate 13.26MW of electricity, of this 1.91MW will be used within the installation, to power the plant and the other 11.35MW will be exported to the National Grid.

2. The gross electricity efficiency calculation submitted on 11/11/2019 shows a value of 34.6%. The calculation included several internal uses of steam under Qi to a total of 10 MWth. Several of the steam uses under Qi appear to be uses which in themselves will contribute to the production of steam which will lead to double counting of the steam demands. Provide further information as follows:

- *i. Justify the internal steam uses claimed for as part of Qi*
- *ii. Explain what each steam use is*
- *iii. Provide an amended calculation of gross electrical efficiency if required*

iv. *If an amended gross electrical efficiency is calculated, justify why the value is BAT taking into account BAT conclusion number 20 and footnote 3 to the BAT AEEL table in BAT C 20.*
v. *Explain why the energy values in the indicative R1 calculation differ from those in the energy efficiency calculation and amend if required.*

Having reviewed the calculations we can confirm that some internal uses of steam included within the second version of the calculation of gross electrical efficiency (GEE) (i.e. the 34.6% version) are used in the production of steam or power and therefore were included incorrectly.

We would respectfully highlight that the new BAT Conclusions were only published towards the end of 2019 and the calculations were new to industry, technology providers and regulators. The draft guidance issued by the Confederation of European Waste to Energy Plants (CEWEP) notes that," the calculation method is different from the traditional way of calculating it" indeed the annex within the guidance which addresses the calculation of energy efficiency runs to 17 pages, indicating the complexity of this.

The CEWEP guidance explains which uses of steam can legitimately be included in Qi and which should not. Where the calculation is given in the BREF note itself, it defines Q_i as "thermal power (as steam or hot water) that is used internally (e.g. for flue-gas reheating), in MW". Further explanation is not given at this point in the document, so it not easy to interpret which uses of steam should be included and which should not.

It may have been this, along with the clear steer from the Environment Agency that CNIM expected the percentage to be higher, that led to some misinterpretation.

This has now been reviewed and we have enclosed an amended calculation, which shows that the gross electrical efficiency of the plant will be 27.4%. In this version of the calculation the uses of steam which have been included in the Qi figure are:

a. Steam sent to the Vapolab for use in flue gas treatment and
b. Steam used by the vacuum ejectors.

These uses of steam are related to the effective operation of the plant and pollution control but are not used in raising steam. They are listed in the guidance as relevant uses of steam that can be legitimately included in Qi.

In terms of whether a gross electrical efficiency of 27.4% represents BAT, the BAT Conclusions state that new plant should reach an efficiency of between 25% and 35%. At 27.4% the plant clearly falls within this category.

As further justification, in compiling the BREF note data was gathered from 122 incinerators across Europe burning MSW, other non-hazardous waste or contaminated wood. The graphs presented in the BREF note suggest that, of these, 72 plants had a GEE of less than 25%. Only the top performing plants reached a GEE of 27% or more, with just 9 plants reaching an efficiency of over 30%. The top end of the new BAT standard (35%) was achieved by just 1 plant. The Endless Energy Facility therefore compares well against existing plants across Europe and the plant is considered to be BAT for energy efficiency. We have enclosed a copy of a page from the BREF Note which shows the performance of the top 40 plants to illustrate this and it is clear that the new EfW will rank among these.

The R1 calculation has been reviewed and is considered to be valid and correct. The result is considered compatible with expected GEE of 27.4%. Inevitably the two calculations look different as the GEE is based on the rating of the plant (measured in MW) and provides an actual measure of efficiency; whilst R1 uses energy production over a year (measured in MWh) and does not give a percentage efficiency but rather provides an indicator of how the performance of the plant compares with a hypothetical power plant used in the calculation as a reference.

We have taken this opportunity to review all information related to energy efficiency and have also noted two small typographical errors in Table 1.1 of the Energy Report. These have been corrected and a revised Energy Report is enclosed with Table 1.1 and 1.2 updated.

Odour

3 - The odour management plan received on 11/11/2019 did not include the updates made in the OMP received on 01/07/19. The omissions carried through into the OMP received on 25/02/20. Submit a single consolidated OMP to incorporate all of the changes.

An updated OMP is included with this response. This document incorporates the updates made in the OMP received 01/07/19.

4 - The OMP states that all waste delivery vehicles will be enclosed. Other documents refer to enclosed or covered where possible. Please clarify.

From our review of the application and further information provided we believe the only reference to waste delivery vehicles being enclosed or covered “where possible” is found in the Operating Techniques document. This document has therefore been updated in line with the rest of the permit application, confirming that all waste delivery vehicles arriving at the site will be enclosed or covered. This requirement will be communicated to waste producers delivering waste to the site as part of the waste pre-acceptance checks.

Quarantine Area

5 - For the quarantine area please confirm:

- *Whether rejected odorous wastes will be stored here – The OMP states that malodorous waste loads will be rejected.*
- *If odorous waste will be stored in the quarantine area provide information to show how odour will be controlled given that quarantine area is outdoors.*
- *Whether skips used for rejected waste will be covered.*

Malodorous wastes will not be stored in the quarantine area.

Malodorous wastes identified at the weighbridge upon arrival will not be allowed to enter the site and discharge their load. The waste rejection process will be implemented and they will be instructed to leave the site without delay in order to ensure that the risk of odour is minimised.

Malodorous wastes identified after tipping in the bunker will be loaded into the hopper as soon as identified to ensure that they are thermally treated as soon as possible and cease to present a risk of odour.

Skips used for rejected wastes that are stored in the quarantine area will be covered to prevent the potential for fugitive emissions and rainwater ingress.

We trust the information provided above addresses the outstanding questions and we look forward to hearing from you.

Yours sincerely
for Wardell Armstrong LLP

[*Name and signature redacted]*
Service Director – Waste Resource Management

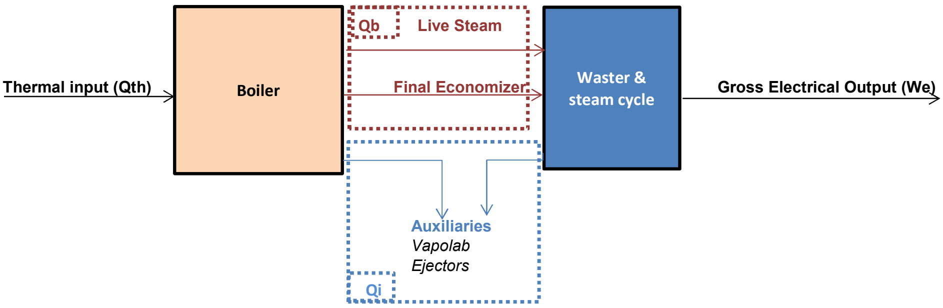
ENC. Revised calculation of gross electrical efficiency
Graph from BREF Note showing performance of the top 40 plants out of 122
Odour Management Plan Version 4
Operating Techniques Version 2
Energy Report Version 2

Energy efficiency levels associated with BAT-AEELs

Gross electrical efficiency	$\eta_e = \frac{W_e}{Q_{th}} \times (Q_b/(Q_b - Q_i))$

Where:

- W_e: electrical power generated, in MW;
- Q_{he}: thermal power supplied to the heat exchangers on the primary side, in MW;
- Q_{de}: directly exported thermal power (as steam or hot water) less the thermal power of the return flow, in MW;
- Q_b: thermal power produced by the boiler, in MW;
- Q_i: thermal power (as steam or hot water) that is used internally (e.g. for flue-gas reheating), in MW;
- Q_{th}: thermal input to the thermal treatment units (e.g. furnaces), including the waste and auxiliary fuels that are used continuously (excluding for example for start-up), in MW_{th} expressed as the lower heating value.



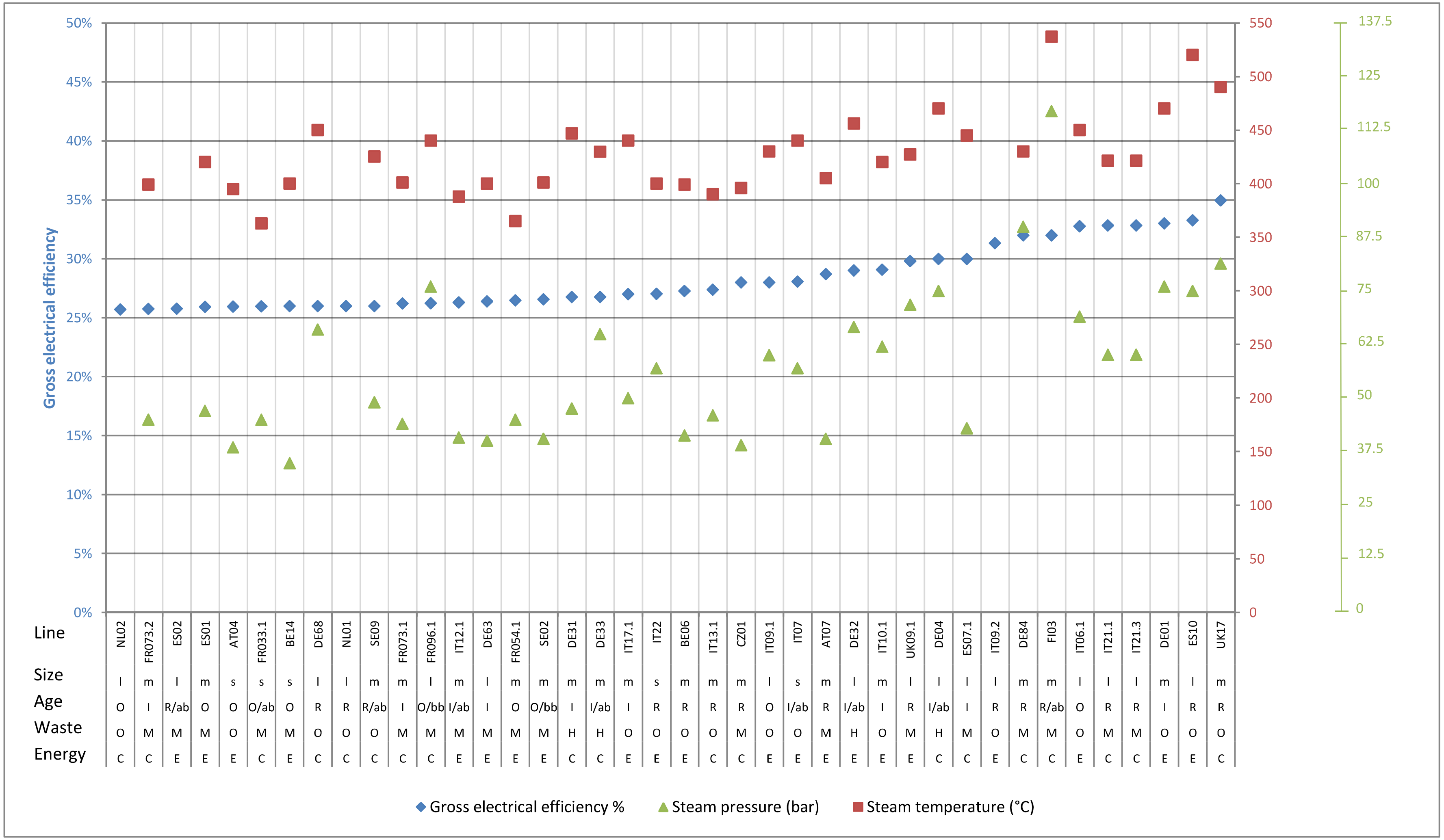
W_e	13,26 MWe	W_e (MWe) = Gross Electrical Power output
Q_{th}	49,0 MWth	Q_{th} (MWth) = Waste flowrate x Lower Heating Value of waste (LHV_{waste}) = Q_{waste} x LHV_{waste}
Q_b	46,1 MWth	Q_b (MWth) = Live Steam thermal power + Final economizer thermal power = Q_{steam} x ΔH_{steam} + $Q_{flue\ gas}$ x $\Delta H_{flue\ gas}$ ΔH_{steam} → Enthalpy difference between live steam and feedwater $\Delta H_{flue\ gas}$→Enthalpy difference of flue gas between Final Eco inlet and outlet.
Q_i	0,6 MWth	Q_{i1} (MWth) = Thermal power of steam sent to vapolab for flue gas treatment = $Q_{vapolab}$ x ΔH ΔH → Enthalpy difference between Vapolab steam and make-up water Qi2 (MWth) = Thermal power of steam sent to Vacuum ejectors = Qejectors x ΔHej ΔHej → Enthalpy difference beteen hp steam and condensation at 1 bar

Applying the BAT-AEEL Gross Electrical Efficiency formula:

η_e = 27,4%	corresponds to new plant requisition margin (25-35%)

BAT-AEEL (%)				
Plant	Municipal solid waste, other non-hazardous waste and hazardous wood waste		Hazardous waste other than hazardous wood waste (1)	Sewage sludge
	Gross electrical efficiency (2) (3)	Gross energy efficiency (4)	Boiler efficiency	
New plant	25–35	72–91(5)	60–80	60–70 (6)
Existing plant	20–35			

(1) The BAT-AEEL only applies where a heat recovery boiler is applicable.
(2) The BAT-AEELs for gross electrical efficiency only apply to plants or parts of plants producing electricity using a condensing turbine.
(3) The higher end of the BAT-AEEL range can be achieved when using BAT 20 f.
(4) The BAT-AEELs for gross energy efficiency only apply to plants or parts of plants producing only heat or producing electricity using a back-pressure turbine and heat with the steam leaving the turbine.
(5) A gross energy efficiency exceeding the higher end of the BAT-AEEL range (even above 100 %) can be achieved where a flue-gas condenser is used.
(6) For the incineration of sewage sludge, the boiler efficiency is highly dependent on the water content of the sewage sludge as fed into the furnace.



NB:
Plant size: s = small; m = medium; l = large.
Plant age: O = old ; I = intermediate ; R = recent // year of retrofitting: bb = before previous WI BREF (2006); ab = after previous WI BREF (2006).
Prevalent waste burnt: M = municipal solid waste; O = other non-hazardous waste; H = hazardous wood waste.
Energy production: E = Electricity; H = Heat; C = Combined heat and electricity.
Source: [81, TWG 2016]

Figure 3.89: Gross electrical efficiency of plants incinerating predominantly municipal solid waste, other non-hazardous waste, and hazardous wood waste (3/3)

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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

ODOUR MANAGEMENT PLAN

VERSION 4

NOVEMBER 2020

CONTENTS

TABLES

1 INTRODUCTION

1.1.1 The development site is located on the valley bottom on vacant brownfield land, approximately 3km to the east of Keighley town centre, and 12km to the north west of Bradford City Centre. The site is bordered by the A650 Airevalley Road to the north and east, a railway line to the south and existing industrial works to the west. Green belt land is located to the north and south of the site.

1.1.2 In summary, the proposals comprise:

- A Endless Energy Facility with an expected throughout of approximately 148,800tpa and a stack of 60m height above ground level. Power generation of approximately 11.35MW of electricity for export to the National Grid;
- Grid connection cables, plant and equipment including a high voltage power distribution system to enable electricity to be supplied to the public supply network;
- Infrastructure to enable CHP including the provision of a steam take off;
- A workshop and store, office facilities and administrative building, compressed air room and fire water tank;
- Two storey office building with capacity for 99 personnel for commercial let;
- Installation of weighbridges, access and internal roads and parking facilities; and
- The provision of SuDS system.

1.1.3 This OMP has been prepared as part of the permit application for the development.

2 OBJECTIVES OF THE ODOUR MANAGEMENT PLAN

2.1.1 In accordance with the Environment Agency (EA) H4 guidance[1], an OMP should be designed to:

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

[1] Environment Agency (2011) H4 Odour Management: How to Comply with your Permit

2.1.2 An effective OMP should consider the sources of odour associated with the relevant process, how odour may be released as a result of activities taking place and what the related impacts might be. The OMP should demonstrate the competence and commitment of the operator to controlling these potential odour releases, through a range of measures.

2.1.3 It should also be noted that an OMP is a working document which requires continuous review and, where necessary, revision.

3 SITE AND SURROUNDING AREA

3.1 Development Site

Current Use

3.1.1 As previously discussed, the site is currently comprised of vacant brownfield land across an area of approximately 3.5 hectares, with the site access from Airevalley Road to the north. All above ground structures associated with the site's former use as a gasworks have been removed, with the exception of a single brick building structure. The site has been remediated.

Description of Energy Recovery Technologies

3.1.2 The following section provides a summary of the processes that will be used within the Clean Energy Facility, with a focus on the identification and description of the activities which are considered to be potential sources of odour release.

Delivery of Waste

3.1.3 The Endless Energy Facility is designed for the incineration of refuse derived fuel produced from commercial and industrial wastes. Waste that consists entirely of high concentrations of only one component (e.g. plastic, biowaste, rubber etc.) can adversely affect the performance of the installation and will be avoided. Wastes accepted alongside RDF will comprise mixed municipal waste, wood, plastic, paper, card and plant matter with only minor quantities of other wastes.

3.1.4 Waste will be delivered to the facility by bulk haulage vehicle (20 tonne), accessing the site from Airevalley Road to the north.

3.1.5 Vehicles will enter the site and pass through the weighbridge. Following acceptance, they will travel to the Waste Reception Hall and will be directed to an area for tipping.

3.1.6 The process of vehicles accessing the Waste Reception Hall, to deliver their waste load, is one of the main potential sources of odour associated with the operation of the facility. To minimise the potential for odour releases, the delivery door will open only as the vehicle reverses into the Waste Reception Hall.

3.1.7 Once the vehicle is fully within the Waste Reception Hall, the door will close immediately to minimise any escape of process air from within the fully enclosed building. This should ensure that the potential for odour releases are minimised.

3.1.8 Once the vehicle has discharged its load and has been cleared to leave the Waste Reception Hall by the Mobile Plant Operator or Operations Technician, the driver will be directed to exit by site signage through the same reception door to return to the weighbridge.

3.1.9 Roller shutter doors will be installed at the tipping hall entrance / egress points. The roller shutter doors to the tipping hall will be automatic, working from induction loops and/or sensors that detect vehicles. There will also be a manual override at each door should this be required.

3.1.10 The process building will benefit from a negative pressure system ensuring that emissions of dust and odour are limited to a minimum. The system will draw combustion air from the waste pit into the incineration process, in doing so airborne dust and odour is drawn from the tipping hall into the combustion process via the bunker. The air intake over the pit is fitted with a grid, which controls air velocity. The air velocity through the grid is kept low (<4 m/s) to minimise clogging by paper, plastic sheets, and other debris. A duct is run from the air intake down to the forced draught fan. The forced draught fan discharges into the combustion air heater.

Waste Acceptance

3.1.11 Waste accepted at the site will consist of non-hazardous waste majority sourced from waste transfer stations in the local area and comprising commercial and industrial solid wastes.

3.1.12 Full pre-acceptance and acceptance criteria are included in Chapter 4 – Operating Techniques of this permit application. A list of accepted waste codes is included as an appendix to the operating techniques documentation.

3.1.13 Unsuitable waste will not be accepted. Unsuitable waste will consist of wastes not listed in the waste codes accepted, non-combustible waste, bulky wastes not suitable for full combustion in the furnace and those which do not satisfy all waste acceptance criteria either as a result of waste composition or documentation.

Storage of Waste

3.1.14 Incoming waste will be stored in an enclosed waste storage bunker. The bunker will facilitate the continuous operation of the plant, as it enables material delivered during the day to be stored and used on a 24hour basis. The bunker will also provide sufficient storage to allow weekend and bank holiday operation when there are no waste deliveries, and for deliveries to continue during maintenance or plant shutdown.

3.1.15 The delivery of waste will be restricted to 07:30-18:00 (Monday to Friday) and 07:30-12:00 (Saturday) with no waste deliveries on Sundays or Bank Holidays. The bunker has a hydraulic volume capacity of 2,647m^3, equivalent to approximately 926 tonnes of waste feedstock. In addition, there is a stacking volume capacity of 5,956m^3. Assuming a conservative estimate that a 1/3rd of the stacking volume is utilised for weekend / bank holiday storage a total storage volume of 4,632m^3 (1,620 tonnes) is available. The hourly throughput of the plant is 18.6 tonnes per hour at design point. This provides a minimum of 3.63 days capacity in the bunker.

3.1.16 For a normal weekend closure from 12:00 Saturday to 07:30 Monday the combustion process requires 809 tonnes of feedstock. For bank holiday Mondays this increases to 1,256 tonnes feedstock requirement. Should Christmas Day / Boxing Day bank holidays fall on a Monday and Tuesday the feedstock storage capacity requirement will be 1,702 tonnes to ensure uninterrupted operation.

3.1.17 Waste will be turned and mixed whilst in the bunker to prevent heating. A crane will be mixing waste for 60% of the time, which equates to over 14 hours per day. During the remaining time the crane will be loading waste to the hopper.

3.1.18 The enclosed nature of the waste storage bunker should ensure that the potential for odour releases are minimised.

3.1.19 Once storage capacity in the bunker is reached no more waste will be accepted until capacity becomes available. All incoming waste will be redirected to a suitable alternative location for disposal or treatment during this period.

3.1.20 Cleaning will be undertaken at suitable intervals to ensure that the release of odorous emissions is prevented. All equipment will be cleaned and maintained in line with the relevant operating manual to ensure optimum mechanical condition and prevent any associated performance issues which may lead to odour emissions.

3.1.21 The tipping hall will be swept regularly to prevent build-up of material and periodically washed down to prevent the accumulation of waste and maintain a clean area. Wider site inspections will be undertaken daily with site wide clean up as necessary. All spillages on site will be cleaned up immediately using appropriate methods dependent on composition, this will include spillages form waste delivery vehicles in the tipping hall.

Feeding of Waste into Processes

3.1.22 Waste will be transported from the storage bunker to the feed grate hopper by a travelling crane equipped with a mechanical grab, operating on tracks running across the width of the Waste Bunker Hall.

3.1.23 As a result of the enclosed nature of this step of the process, the potential for odour releases is considered to be low.

Processing of Waste

3.1.24 Once within the feed grate, the waste is converted to gases, which are cooled and cleaned. This takes place in three stages: firstly through the drying, gasification, ignition and combustion of the waste; then through its oxidisation; and finally through cooling. The gasses complete the combustion process as they pass through the boiler stage of the process, where air is added.

3.1.25 The boiler serves to transfer the energy/heat in the flue gases to the water cooling circuit where steam is raised. The high temperature and high pressure steam is then fed into a steam turbine linked to a generator producing electrical power for export to the national grid.

3.1.26 The end products are flue gases, which are cleaned and discharged to atmosphere, and residual ash (Bottom Ash) which falls from the end of the grate and is quenched in a discharger water bath situated under the grate.

3.1.27 These processes take place within an enclosed environment and therefore the potential for odour release is considered to be low.

End Products

3.1.28 As detailed within the Waste Minimisation Plan, the end products associated with these processes are flue gases, bottom ash Air Pollution Control (APC) residues (solid residues comprising fly ash, lime and carbon), ferrous metals, process water, oil and boiler dust.

3.1.29 Exhaust gases from the combustion process are normal products of gas combustion and are not considered to be a source of odour.

3.1.30 The bottom ash is quenched and cooled in the discharger water bath, which make it possible to remove without odour nuisance. Once it has been treated, to remove metals, it can be used as an aggregate replacement.

3.1.31 The APC residues are transported off site for disposal under the relevant regulations, as this is considered to be a hazardous waste. These residues are not considered to be a source of odour.

Facility Control Systems

3.1.32 Process control at the facility will be an important factor in odour control. The facility will be equipped with an automatic process control unit (the Distributed Digital Control System, DCS), which measures and records various process parameters that indicate whether the process is operating within design parameters. The facility operator can control the process via the Human Machine Interface (HMI) which delivers a complete overview of the process components, reports system status and shows any alarms.

3.1.33 The Emergency Shut Down (ESD) system is a separate system that is used to detect emergency situations and perform emergency shutdowns.

Spillage Review Procedure

3.1.34 Following any spillage on site in the delivery or processing of waste, and storage and offtake of waste and process materials a review procedure will be implemented in line with the sites Environmental Management System.

3.1.35 An investigation will be conducted to identify the cause(s) of an accidental spillage. This will include consideration of any possible mitigation methods which will prevent future repeats of the occurrence, limit the effects of the spillage, or improve the response to the event. This investigation will be the responsibility of the plants operational management team and will be instigated immediately following the event clean up.

3.1.36 Where practicable improvement measures are identified these will be implemented as part of the site maintenance and improvements schedule at an appropriate interval and at the earliest suitable opportunity.

3.2 Existing Sensitive Receptor Locations

3.2.1 The Endless Energy Facility is bordered by Airevalley Road to the north and east, with green belt land located beyond including Marley Activities Coaching Centre and Airedale Cricket Club. As a result, there are no existing residential properties located in the vicinity of the facility in these directions.

3.2.2 The facility is bordered to the south by a railway line, beyond which lies green belt land. There are however residential dwellings located at 'The Croft', approximately 0.1km to the south west. In addition, the settlements of Thwaites Brow and Thwaites are located approximately 0.5km to the south and south west, respectively.

3.2.3 To the west of the facility lies an operational gasworks and Dalton Lane Industrial Estate. There are a small number of residential properties located approximately 0.2km away.

3.3 Existing Odour Sources in the Local Area

3.3.1 The Endless Energy Facility is located on the edge of the Keighley urban area, in a predominantly industrial area but surrounded by open land on three sides. Existing source of odour could include:

- Existing industrial uses to the west of the site, including the operational gas works along Gas Works Road**;**
- Existing agricultural uses at nearby farms; and
- The existing Marley Sewage Treatment Works (STW) located to the east.

4 ODOUR MANAGEMENT AND RISK ASSESSMENT

4.1 Introduction

4.1.1 This section sets out the control measures/operational procedures that will be put in place at the Site in order to reduce the potential for odour releases and associated nuisance for local residents. In addition, a risk assessment has been undertaken to consider the effectiveness of these measures and procedures.

4.1.2 Table 4:1 taken from EA guidance[2], sets out the measures and procedures to be put in place, as well as the residual risk of odour nuisance, during normal operational practices. Table 4:2 includes the same details, but for abnormal operational practices.

4.1.3 The risk assessment indicates that the residual risk of odour nuisance should not be significant.

[2] Environment Agency (2011) Horizontal Guidance Note H1, Annex A: Amenity and Accident Risk from Installations and Waste Activities

Table 4:1 Odour Risk Assessment and Management Plan for Normal Operation Conditions						
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	*What is at risk? What do I wish to protect?*	*How can the hazard get to the receptor?*	*What measures will you take to reduce the risk? (Who is responsible?)*	*How likely is this contact?*	*What is the harm that can be caused?*	*What is the risk that still remains?*
Odour from waste being delivered to the Waste Reception Hall	Care home and residential properties at The Croft. Residential properties off Murdoch Street, Aire valley Road and in the settlements of Thwaites and Thwaites Brow	Air	**Physical Control Procedures** Ensure that all vehicles delivering waste to the facility are fully enclosed Ensure that self-closing roller doors on the Waste Reception Hall are only opened for the arrival of a delivery vehicle and that they are closed once the vehicle is fully within the building **Procedural/Managerial Control Measures** Continuous monitoring of the process using the Distributed Digital Control System A complaints procedure will be put in place to ensure that potential issues are identified and rectified as soon as possible A preventative maintenance programme will include the regular inspection of all plant and control measures	Unlikely	Odour annoyance	Not significant, if managed carefully
Odour from storage of waste in storage bunker	Care home and residential properties at The Croft.	Air	**Physical Control Measures** Ensure all incoming waste is stored within the enclosed storage bunker	Unlikely	Odour annoyance	Not significant, if managed carefully

Table 4:1 Odour Risk Assessment and Management Plan for Normal Operation Conditions						
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	*What is at risk? What do I wish to protect?*	*How can the hazard get to the receptor?*	*What measures will you take to reduce the risk? (Who is responsible?)*	*How likely is this contact?*	*What is the harm that can be caused?*	*What is the risk that still remains?*
	Residential properties off Murdoch Street, Aire valley Road and in the settlements of Thwaites and Thwaites Brow		Ensure that all waste is managed to minimise the time between initial receipt of waste and input into the grate **Procedural/Managerial Control Measures** Continuous monitoring of the process using the Distributed Digital Control System A complaints procedure will be put in place to ensure that potential issues are identified and rectified as soon as possible A preventative maintenance programme will include the regular inspection of all plant and control measures			

Table 4:2: Odour Risk Assessment and Management Plan for Abnormal Operation Conditions						
What Do You Do That Can Harm and What Could Be Harmed			**Managing the Risk**		**Assessing the Risk**	
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	*What is at risk? What do I wish to protect?*	*How can the hazard get to the receptor?*	*What measures will you take to reduce the risk? (Who is responsible)*	*How likely is this contact?*	*What is the harm that can be caused?*	*What is the risk that still remains?*
Odour from accidental spillage or leak of odorous	Care home and residential properties at The Croft. Residential properties off Murdoch Street, Aire valley Road and in the settlements	Air	**Procedural/Managerial Control Measures** Continuous monitoring of the process using the Distributed Digital Control System	Very unlikely	Odour annoyance	Potentially significant

Table 4:2: Odour Risk Assessment and Management Plan for Abnormal Operation Conditions						
What Do You Do That Can Harm and What Could Be Harmed			**Managing the Risk**		**Assessing the Risk**	
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	*What is at risk? What do I wish to protect?*	*How can the hazard get to the receptor?*	*What measures will you take to reduce the risk? (Who is responsible)*	*How likely is this contact?*	*What is the harm that can be caused?*	*What is the risk that still remains?*
material outside designated storage areas	of Thwaites and Thwaites Brow		A complaints procedure will be put in place to ensure that potential issues are identified and rectified as soon as possible A preventative maintenance programme will include the regular inspection of all plant and control measures			
Odour as a result of unplanned downtime	Care home and residential properties at The Croft. Residential properties off Murdoch Street, Aire valley Road and in the settlements of Thwaites and Thwaites Brow		**Physical Control Procedures** Stop waste deliveries until the plant is back online Containerised carbon filters will be hired and placed at doorways to prevent the escape of odour if required The bunker will be emptied to prevent the generation of odour in the event of a plant shutdown lasting for longer than 3-4 days **Procedural/Managerial Control Measures** A complaints procedure will be put in place to ensure that potential issues are identified and rectified as soon as possible			

Table 4:2: Odour Risk Assessment and Management Plan for Abnormal Operation Conditions						
What Do You Do That Can Harm and What Could Be Harmed			**Managing the Risk**		**Assessing the Risk**	
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the Overall Risk?**
What has the potential to cause harm?	*What is at risk? What do I wish to protect?*	*How can the hazard get to the receptor?*	*What measures will you take to reduce the risk? (Who is responsible)*	*How likely is this contact?*	*What is the harm that can be caused?*	*What is the risk that still remains?*
			A preventative maintenance programme will include the regular inspection of all plant and control measures			

4.1.4 Should Odour be detected during routine monitoring or day to day operation the actions outlined in Table 4.3 will be implemented.

Table 4.3: Odour Contingency Plan

Trigger	Contingency Actions	Target Time
Malodourous waste arrives on site	Inspection of waste delivery	Immediate action
	Reject load and record actions in the site log	
Unknown odour detected at site boundary	Undertake a site investigation to identify the source of the odours and implement corrective measures where necessary. For example, prioritising particular waste for treatment or arranging cleaning, dependent on the cause of the odour	Immediate action
	Undertake repeat olfactory monitoring ensure the issue has been resolved	Within 2 hours of preventative action being taken and followed up each two hours if further work is needed.
	Notify nearby receptors and the Environment Agency in the event of an odour escaping the boundary which may take some time to resolve, providing details of remedial actions to be taken and anticipated time scales	Before the end of the working day on which the problem first arose.
Negative pressure system fails	Ensure doors of the tipping hall remain closed, to prevent any odours from escaping. Stop further deliveries of waste to site	Immediate action
	Deploy containerised carbon filters	
	Identify system failures	
	Organise system repairs	
	Remove waste from tipping hall (if unprocessed)	Within 3 days
Shut down of facility	Ensure doors of the tipping hall remain closed, to prevent any odours from escaping	Immediate action
	Stop waste deliveries until the plant is back online	Immediate action
	Containerised carbon filters will be hired and placed at doorways to prevent the escape of odour if required	Within 48 hours
	Empty the waste bunker to prevent the generation of odour	Within 3 / 4 days
Leak of ammonia from storage tank	Clean spills using spill kits, while wearing suitable PPE	Immediate action
	Undertake repairs or arrange for alternative tank	As soon as possible
	Wet scrubber over tank will start automatically	Immediate

5 ODOUR CONTROL

5.1.1 Odour will be managed by drawing air from above the waste bunker into the furnace for use as combustion air. In this way the tipping hall will be kept under negative pressure and any odour compounds will be destroyed within the furnace.

5.1.2 Air is drawn into the system at a low flow rate, to prevent drawing in any debris or light waste and clogging the filter. However, the air is drawn across a relatively wide area via an $18m^2$ grid above the waste bunker.

5.1.3 The tipping hall has an area of $1,630m^2$ whilst the roof is 12m high at the eaves and 15m high at the apex. An average height of 13.5m has therefore been assumed. This gives a volume of $22,005m^3$ for the tipping hall.

5.1.4 Air is to be extracted to the furnace at a rate of $65,700m^3$ an hour.

5.1.5 It can therefore be seen that in normal operation there will 2.99 air changes an hour. This is in line with the 3 air changes an hour generally considered good practice for odour management. For example, a figure of 3 air changes per hour is quoted in the Scottish Environment Protection Agency “Odour Guidance” 2010.

6 REPAIR AND MAINTENANCE

6.1.1 The Site will be inspected daily by the operator by means of a visual check and will be serviced and maintained by a competent third party in regular intervals in accordance with the operational manual and manufacturer’s instructions.

6.1.2 Results of the daily visual check will be recorded in the site log book. Records of all servicing and maintenance visits will be held on site.

7 MONITORING

7.1.1 It is proposed to undertake olfactory monitoring once the facility is operational. It is proposed that a site operative will undertake the survey and record the results daily in a log book.

7.1.2 The route of the survey will be along the site boundary. Log book entries will comprise the following details:

- Time and date of test;
- Name of surveyor;
- Weather conditions, including wind direction; and
- Intensity of the odour at various test locations. This should include notes on the duration of the test and whether odour was constant or intermittent during that period, as well as a description of the odour and the likely source.

7.1.3 We are aware that this sort of testing may prove insufficient due to staff being more used to site odours or having become more adapted to them. As a result it is possible that subjective issues, such as the intensity and the description of the smell (offensiveness), may not be same as perceived by a nearby sensitive receptor.

7.1.4 Wherever possible monitoring should be undertaken by a member of office or off-site staff, as appropriate, to ensure that they will not be acclimatised to the odour on site.

7.1.5 In addition to routine testing all unusual or excessive odours, as identified by all site staff or visitors, will be reported and logged. In each instance management staff will undertake an investigation to identify the source of the odour and establish its longevity and if any mitigating measures can be taken to reduce the impact. If appropriate measures are identified which can prevent reoccurrence of the event these will be put in place at the earliest convenience.

7.1.6 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 Limited's complaints. All incidents will be recorded in the site log. The complainant will be informed of the results of the investigation and any corrective actions proposed.

8 NEIGHBOURHOOD ENGAGEMENT

8.1.1 Endless Energy Limited is committed to developing a good relationship with the public and is committed to deal with any complaints, including those with regard to odour, in an open and timely manner.

8.1.2 Visitors, customers and neighbours expressing dissatisfaction with the facilities or operations carried out at the site will be invited to enter a record in the Complaints File. The complaint will be dealt with by the facility operator for analysis and actions required, engaging specialist third parties wherever needed.

8.1.3 Any complaints will be forwarded to the Site Manager, or another senior member of staff in their absence. The complaint will be noted in the site log with contact details of the complainant (unless they request anonymity), the time the odour was detected, the nature and intensity of the odour and the wind direction and weather conditions at the time.

8.1.4 A senior member of staff will visit the complaint location to substantiate the odour and will then undertake an investigation to identify the source of the odour and establish its longevity and what mitigating measures can be taken to reduce the impact.

8.1.5 The complainant will be informed of the results of the investigation and any corrective actions proposed.

8.1.6 Complaints will be reviewed on an annual basis to identify trends and, if necessary, plan and implement further measures to prevent reoccurrence of common issues.

9 STAFF COMPETENCY/TRAINING

9.1.1 The facility operator will be fully trained by the technology provider, or a chosen training provider, in the correct operation of all elements of the Clean Energy Facility. The facility operator will be equipped with an operations manual which will support him during the day to day running of the plant. It will also contain all necessary details regarding inspection and maintenance intervals, and contact details of contractors.

9.1.2 All involved staff will be trained in emergency and incident response relating to the operation of the facility. Training records will be held at the site as part of the operations manual.

10 ODOUR CONTINGENCY AND EMERGENCY ARRANGEMENTS

10.1.1 In the event of an incident or emergency which may give rise to an odour event, contingency arrangements will be implemented to limit the environmental impacts of uncontrolled odour emissions. These will fall within the wider management system and site contingency plans. Odour contingency arrangements will be subservient to operational safety contingency requirements.

10.1.2 Incidents which require odour contingency arrangements could include plant failures, plant availability and spillages. The contingency plan provides the following procedures:

- Report incident and open incident log;
- Determine location of incident;
- Management team to identify nature of incident, potential hazards, access to incident location, requirement or otherwise to halt operations, potential receptors, mitigation measures, priorities, and requirement for emergency services;
- Implement mitigation and control measures to bring situation under control (could involve hiring equipment or directing waste to alternative facilities);
- Conduct review of procedures, response and impacts; and,
- Draw conclusions, actions required, implement actions and close incident log.

10.1.3 Contingency actions will be dependent on the nature of the event. Response times will vary accordingly. In all cases where an event is identified the initial response will be immediate to determine the urgency of mitigation and control measures.

10.1.4 In the event of plant shut-down contingency measures will involve the identification of alternative sites for the redirection of all waste deliveries. If shut-down duration is unknown, hiring of odour suppression equipment will be required to prevent emissions. Where there is a full plant shutdown of unspecified duration then arrangements will be made to remove waste from the site. The waste reception area has been designed to allow this.

10.1.5 For less severe events, for example damage to tipping hall doors and failure or poor performance of negative pressure system, once the incident cause has been identified maintenance and replacement arrangements will be instigated. Interim measures will be deployed should replacement be necessary to allow the plant to continue operation until planned shutdown.

10.1.6 Spillage events will require immediate clean-up to prevent prolonged emissions of odour. Spillages will be assessed to determine if they are likely to be repeated. Where appropriate, measures will be put in place to prevent future occurrences.

10.1.7 The facility manager will develop an emergency plan for response to emergencies including, but not limited to, environmental incidents, natural disasters, personnel emergencies, civil disorder events and response to emergency services requests.

10.1.8 The Emergency Plan will consider vulnerability of all employees, plant and property; the site security; access for all emergency services, equipment and personnel; emergency drill schedules and requirements; emergency procedures and contacts; evacuation procedures; and, the aforementioned contingency arrangements.

10.1.9 In the event of an emergency, when safe to do so, contingency arrangements will be implemented to limit odour emissions from the plant using appropriate methods, including removal of waste materials, repair of odour abatement equipment, and installation of temporary odour controls. These will be determined to reflect the nature of the emergency event and requirements to prevent odorous emissions.

11 SUMMARY AND CONCLUSIONS

11.1.1 The Endless Energy Facility is located to the east of Keighley. Existing sensitive receptors are located more than 80m away.

11.1.2 The facility will utilise commercial and industrial refuse derived waste to generate electricity for export into the national grid. The additional end products include flue gases, bottom ash, sediments and APC residues.

11.1.3 The main source of odour at the facility is associated with the delivery and storage of waste prior to treatment. Waste will be delivered by bulk haulage vehicles, which will access the Waste Reception Hall through roller shutter doors. These doors will only open to allow vehicles to enter and exit the building, thus minimising the potential for odour releases. The roller shutter doors to the tipping hall will be automatic working from induction loops and/or sensors that detect vehicles. There will also be a manual override at each door should this be required.

11.1.4 Incoming waste will be stored in an enclosed storage bunker and will be managed in accordance with strict management procedures. It is not therefore considered likely that there will be a significant potential for odour releases.

11.1.5 A negative pressure system will operate in the process building, drawing air from the tipping hall into the bunker and then into the combustion process. It is therefore not considered likely that there will be a significant potential for odour emissions.

11.1.6 The remainder of the process will take place in an enclosed environment and is not therefore considered likely to have the potential to lead to odour emissions.

11.1.7 The facility will be equipped with an automatic process control unit, which measures and records various process parameters that indicate whether the process is operating within design parameters. A separate emergency shut down system is used to detect emergency situations and perform emergency shutdowns.

11.1.8 The odour management plan presented in this report, comprising physical control measures combined with management procedures, is considered to reduce the risk of odour emissions so that odour nuisance is considered to be not significant.

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ENDLESS ENERGY (KEIGHLEY) LIMITED

ENDLESS ENERGY FACILITY

OPERATING TECHNIQUES

NOVEMBER 2020

CONTENTS

FIGURES

APPENDICES

DRAWINGS

1 INTRODUCTION

1.1.1 This document comprises a review of operating procedures and techniques which will be carried out at the Endless Energy Facility. It is proposed that the facility will recover energy from predominantly commercial and industrial wastes.

1.1.2 Endless Energy (Keighley) Ltd will build and operate the facility. The facility is expected to have an annual waste throughput of 148,800tpa and generate approximately 11.35MWe of electricity as the net annual average. Under the Environmental Permitting (England and Wales) Regulations 2016, burning of non-hazardous waste with a capacity of 3 tonnes or more per hour is a listed activity under Schedule 1, Section 5.1, *Part A (1) (b) the incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.*

1.1.3 The facility meets the criteria to be defined as a recovery operation (as defined in the revised Waste Framework Directive) and has been designed to have an energy efficiency rating of 0.74.

1.1.4 The technology which will be used incorporates the latest efficient and low pollution technology but is also proven, with over 250 plants implemented worldwide using the reverse-acting grate in the combustion chamber. Further information is provided in Section 5.

1.1.5 The process and design selection has also been based upon the following premises:

- Compliance with the Industrial Emissions Directive (IED);
- Optimisation of efficiency and energy recovery;
- Minimising the use of resources such as water and chemicals;
- Reliability through use of proven technology;
- Flexible processing capacity in order to operate continuously with low calorific value (LCV) waste from 9,000 to 14,000 Kj/kg, which accommodates a broad range of waste types; and
- Compliance with all local and national statutory requirements.

1.1.6 A Process Diagram of the general waste throughput and overall operations is shown below, with specific drawings relating to particular processes within the facility being shown in the appropriate sections of this document.

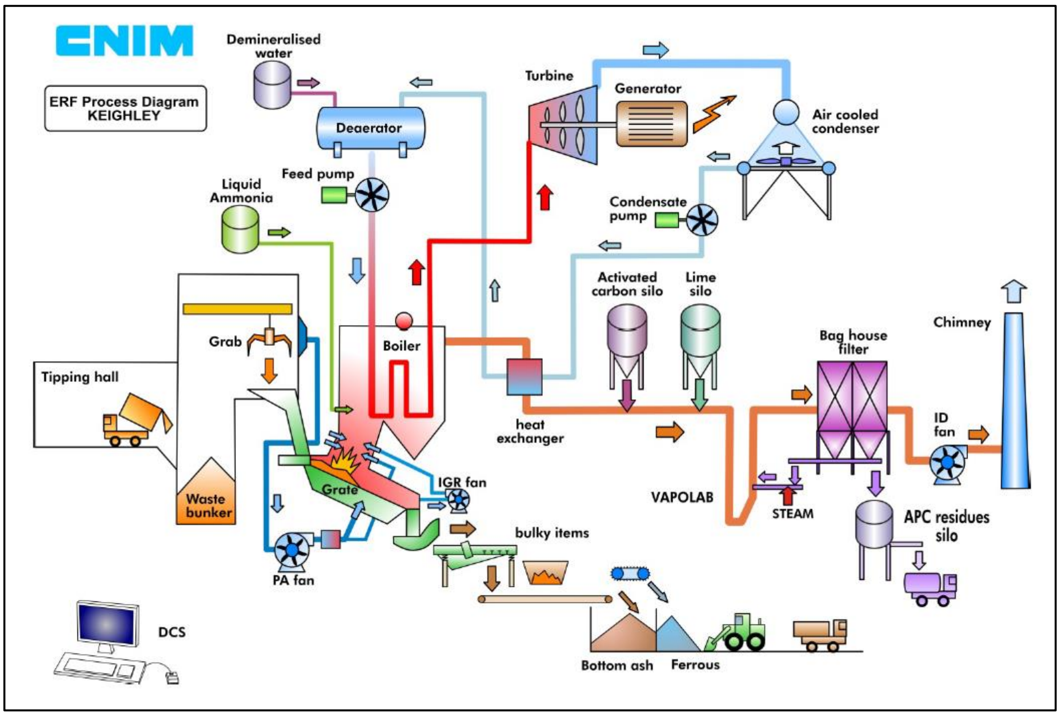


Figure 1:1 Main Process Diagram

1.1.7 Endless Energy (Keighley) Ltd will submit a Commissioning Plan to the Environment Agency for approval prior to the commissioning of the plant. The requirement for a commissioning plan will be agreed under a pre-operational condition. The plan will summarise the environmental performance of the plant as installed against the design parameters set out in the application. The report will include a review of the performance of the facility against the conditions of this permit and details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions.

1.1.8 The site will be operated under a management system which will achieve ISO14001 accreditation. A summary of the Management System is provided as Appendix 1.

1.1.9 The site covers an overall area of 3.5 hectares, currently comprising hard standing, disused buildings and rough vegetation. Drawing SH11087-025 shows the finished site layout following construction of the clean energy facility. The facility will comprise a number of components including a waste reception hall, waste bunker, waste treatment and flue gas treatment hall, bottom ash hall, tank farm, stack and other infrastructure as discussed in Section 2.

1.1.10 Wastes must pass stringent pre-acceptance and acceptance criteria prior to being accepted at the site for incineration. Non-hazardous wastes only will be accepted at the site, consisting of primarily commercial and industrial wastes. Further information is provided in Section 3.

1.1.11 Waste will be accepted at the waste reception hall, where vehicles will tip their loads directly into the enclosed waste bunker. From there, wastes will be moved to the feed hopper by a grab operated from a crane. Further information is provided in Section 4.

1.1.12 Combustion will occur using a reverse-acting grate. The hopper will feed waste onto the grate, where it will be dried and incinerated. Residual ash falls from the end of the grate and will be quenched in a water bath situated under the grate. A variety of combustion control systems will be employed in the process, all of which will monitor or control the process as necessary. Further information is provided in Section 5.

1.1.13 Heat produced as a result of the incineration of waste will generate steam within a boiler, as detailed in Section 6.

1.1.14 The steam will be fed into a steam turbine linked to a generator producing electrical power for export to the national grid. Where steam exits from the turbine it will be fed into a condenser where it will be cooled and the condensate fed back into the boiler system. The steam turbine will be designed to continuously operate, with water reused within the process. Further information is provided in Section 7.

1.1.15 Flue gases will be treated to remove hazardous substances. Flue gas treatment consists of the use of hydrated lime, quick lime and activated carbon to reduce the chemical contamination and acidity of the gas. Bag filters will capture particulates and used reagents before the treated gas is passed to atmosphere via a stack. Ash will be removed to the bottom ash storage area by means of a vibrating conveyor and belt conveyors. Further information is provided in Section 8.

1.1.16 The facility will be equipped with a Distributed Digital Control System (DCS), which gives control of several site operations to autonomous computer systems. Computer systems will undertake emissions monitoring, and log data for processes such as the flue gas treatment system. Further information, including details of the proposed emissions monitoring control equipment, is provided in Section 9.

1.1.17 Process water will be continuously reused as bottom ash quench water. The site will aim to minimise water consumption, with zero process waste water rejections and minimal amounts of potable water used. Clean roof water will be stored and used as a backup water supply.

1.1.18 A compressed air plant will provide general service air and instrument air for the whole incineration plant, with service air filtered and dried.

1.1.19 Thermal insulation will be provided on all directly accessible externally-insulated surfaces, with the thickness dependent upon the nature of the surfacing.

1.1.20 Further information relating to process water, air and thermal insulation is provided in Section 10.

1.1.21 Measures will be employed throughout the life of the permit to ensure that operations do not impact on the environment or amenity of the local area. Measures will be in place to prevent emissions of odour, litter, pests and vermin. Further information is provided in Section 11.

2 SITE INFRASTRUCTURE

2.1 Site Entrance

2.1.1 Vehicles will access the facility via an access road from A650 Airevalley Road. Authorised vehicles arriving at the facility will be directed to the weighbridge by clear on-site signage.

2.1.2 Two weighbridges will be installed at the facility, with video links to the main control room. The weighbridges will be supplied with a weighing terminal including automatic vehicle recognition (proximity tag), weatherproof casing, digital display, ticket printer, two-way intercom system, induction loops, entrance and exit barriers, and traffic lights.

2.1.3 Traffic signs necessary for ensuring the safety of vehicles and pedestrians using the facility will be erected, made clearly visible, and maintained at strategic locations. Traffic signs installed at the facility will include the following, where applicable:

- Signage showing access and egress from the Site;
- Pedestrian walkways;
- Speed limit;
- Give way;
- One way; and
- Keep left direction signs.

2.2 Tipping Hall

2.2.1 Waste will be accepted inside a purpose-built Tipping Hall, constructed to be reasonably air tight and provide good containment of odorous air. All unloading will take place inside the building with the doors closed. Fast acting roller shutter doors will be provided. These will be kept closed other than when a vehicle enters or exits the building.

2.2.2 In order to provide good control of odour all site personnel will be reminded to close pedestrian doors behind them.

2.2.3 An air extraction system will operated in the waste reception hall to ensure that it is kept under negative pressure and air flow will tend to be into rather than out of the building. The negative pressure will be maintained by utilising air from the reception hall as combustion air in the incineration process, thereby ensuring that any odorous compounds are destroyed at high temperature during the combustion process.

2.2.4 The building will be provided with an impermeable concrete floor with drainage to direct any free water from waste storage and processing areas towards the waste water pit. This reinforced concrete pit with sealed base and sides will be used to supply the bottom ash quench. All process water will likewise be directed to the central tank for reuse in the quench. Because quench water can be reused there are no regular emissions of water from the site, instead the quench water will be returned to the holding tank. If necessary, small quantities of waste water may be tankered offsite for disposal or treatment at a permitted facility.

2.3 Waste Bunker

2.3.1 Vehicles will tip waste directly into the enclosed waste bunker. The bunker will facilitate the continuous operation of the plant as it enables materials to be stored and used on a 24-hour basis.

2.3.2 Combustion air for use in the incineration process will be drawn from the bunker. This will minimise odour production. Further information is provided in Section 4.

2.4 Incineration of Waste

2.4.1 Wastes are transported from the storage bunker to the hopper by a roof mounted grab operating on tracks running across the width of the bunker building. The hopper will guide the waste onto the grate.

2.4.2 A reverse acting grate will be used at the site. The waste will be initially dried on the first section of the grate. Gasification and oxidisation occur on the next section. Burn out will be completed on the final grate section, in addition to the cooling of material. Further information is provided in Section 5.

2.4.3 Residual ash falls from the end of the grate and will be quenched in a water bath situated under the grate. A conveyor will take the ash from the water bath and discharges it into a storage bunker prior to its treatment including the removal of metals. Further information is provided in Section 5.

2.4.4 The heat from the flue gasses generates steam within a boiler. This will be used by the steam turbine to produce electrical power via a generator. Steam exiting the turbine will be fed into a condenser, where it will be cooled and the condensate fed back into the boiler system. Further information is provided in Section 7. Generator equipment, including condensate pumps and feed water pumps are located within the Turbogenerator Hall, shown on drawing 0H80 07 02 02 / 62 G 010.

2.5 Treatment of Gas, Ash and Water

2.5.1 Flue gasses will be cleaned in a dedicated cleaning plant. Systems will be in place at the cleaning plant for the storage and injection of lime and activated carbon. A reduction system will be used to reduce NOX within the flue gasses. The injection of lime and carbon takes place before a reaction tower where the gasses mix with the materials. The flue gas will then be fed into a series of bag filters where particulates and used reagents are captured. Further information is provided in Section 8.

2.5.2 Treated gases are discharged to air via the stack. Air Pollution Control Residue (APCR) will be discharged to a silo for storage. Bottom ash will be discharged using conveyor belts to an ash storage area. The conveyor will remove oversize objects, and metals will be removed using a magnet. Within the Bottom Ash Hall, ferrous metals, bottom ash and oversize objects are stored separately, as shown on drawing 0H80 07 02 02 / 62 G 010. Further information is provided in Section 8.

2.5.3 Water used within the process falls to an industrial waste water pit, which provides water for use in the bottom ash quench. The industrial waste water pit neighbours the rain water pit to the north of the main building. The pits are shown on drawing 0H80 07 02 02 / 62 G 010.

2.6 Water Supply

2.6.1 Recycled water and water drawn from the Yorkshire Water mains supply network feed the raw water tank at the Water Treatment Hall. The raw water tank feeds the demineralised water tank, provides cooling water for the flash tank and water for make-up. A dedicated tank will be used to store demineralised water at the Water Treatment Hall. The demineralised water will be used within the main steam / water cycle to provide feed for the boiler and associated processes.

2.6.2 A firewater tank will be constructed on site, for the dedicated use of providing water for firefighting. The tank will be charged from Yorkshire Water mains supply network. There is also a fire hydrant close to the site, which can provide additional mains water in the event of a fire. Neither the onsite firefighting water tank or the hydrant will involve regular daily use of water from the supply network, they will be used only in an emergency.

2.6.3 Clean roof water from the facility will be collected in the rainwater pit for use in site processes, as detailed in Section 10.1.2. The rainwater pit will overflow into attenuation tanks as part of the sustainable urban drainage system (SUDS) when full. The attenuation tanks will initially store the water, prior to releasing the water into the surface water drain at a steady rate. This will prevent flooding of the surface water drain, which takes water from the roof of the facility and clean run-off from outdoor hardstanding. The surface water drain passes through a hydrocarbon interceptor prior to exiting the site on Marley Road.

2.7 Additional Infrastructure

2.7.1 The site will be equipped within a black start diesel generator. The generator will be located adjacent to the water treatment hall, shown on drawing 0H80 07 02 02 / 62 G 010.

2.7.2 A sub-station (containing a DNO Switchgear and metering rooms, and step-up transformer) will be located on the site's north western boundary.

2.7.3 The facility will produce electricity but will be CHP enabled to allow the supply of heat if a potential user is available. Electricity generated by the facility will be exported to the National Grid and used to power the site.

2.7.4 The site will be enclosed by a 2.4m high perimeter fence which will ensure the site remains secure.

3 WASTE PRE-ACCEPTANCE AND ACCEPTANCE

3.1.1 The wastes to be accepted will comprise commercial and industrial waste. A full list of waste types is provided as Appendix 2 to this report.

3.1.2 Wastes will largely be sourced from waste transfer stations though waste may also be accepted directly from commercial and industrial operators. Only non-hazardous waste will be accepted.

3.1.3 In every case a pre-acceptance form will be completed detailing the waste to be accepted. This will include collection of details regarding the:

- Waste producer;
- Process generating the waste;
- Waste quantity;
- Waste type;
- Classification under the list of waste regulations; and
- Chemical analysis of the waste (if necessary to confirm its suitability for treatment).

3.1.4 An assessment will be made by a competent member of staff and only wastes that are suitable for burning, with a CV in within the acceptance window for the plant, will be approved for receipt. No waste will be accepted on site unless a pre-acceptance form has been completed and the waste has been approved for receipt.

3.1.5 All customers will be advised of their responsibilities under the Waste (England and Wales) Regulations 2011 to pre-sort waste for recycling. Only residual waste will be accepted. Should any wastes regularly contain high levels of recyclable material, such as paper or dense plastics, the customer will be advised and will be required to improve their waste segregation.

3.1.6 Records of all enquiries will be kept with pre-acceptance documentation maintained in the site office. When a load of waste is delivered to the site, this pre-acceptance documentation can then be cross-referenced against the details given on the relevant waste transfer notes/season tickets accompanying the waste and the contents of the load when waste is delivered to the site.

3.1.7 On arrival at the site the waste will be weighed in and will be inspected as far as is practical at the weighbridge. The waste will be checked against the details in the waste transfer note, the pre-acceptance form and the environmental permit. All transfer notes will be completed in accordance with the Waste (England and Wales) Regulations 2011 and will be kept for a minimum of two years in either paper or electronic form.

3.1.8 For all new customers a check will made to ensure that they are registered as waste carriers with the Environment Agency. All carrier's registrations will be reviewed after every three years to ensure that they have been correctly renewed. Carriers will be refused entry to the site if they do not have a valid registration.

3.1.9 Waste will not be accepted if for any reason there is insufficient storage capacity available or if the site is inadequately manned.

3.1.10 Following acceptance, all vehicles delivering waste will be instructed to proceed from the weighbridge to the waste reception hall.

3.1.11 In the waste reception hall a member of staff will inspect each waste load during unloading to ensure that it is acceptable. Should non-conforming waste be detected this will wherever possible be reloaded onto the delivery vehicle and rejected from the site.

3.1.12 Any discrepancies found as a result of the checks detailed above will result in:

- Referral to the Technically Competent Manager;
- Referral to the waste producer or the waste carrier's base, to confirm the nature of the waste load;
- Referral to the Environment Agency where there is a possible breach of a permit condition or an imminent risk of pollution; and
- A written record being made in the site log to record the nature of the waste and the action taken.

3.1.13 Where appropriate waste will either be returned to the producer/ previous holder or re-directed to an appropriate authorised facility.

3.1.14 Waste materials dispatched from the site to an authorised facility, will be removed in accordance with the Duty of Care. A registered waste carrier will be used and copies of relevant waste transfer notes/season tickets will be maintained in the site office.

3.1.15 All documentation will be made available for inspection by warranted officers of the Environment Agency on request.

4 WASTE RECEPTION AND HANDLING

4.1.1 The initial waste handling will be carried out in the waste reception and handling area which comprises the following:

- Facility access gates;
- Gatehouse;
- Weighing station;
- Tipping hall; and
- Waste bunker and gantry crane with grab.

4.1.2 After the waste has been accepted at the weighbridge it will be driven by the carrier to the fully enclosed Tipping Hall. The vehicle will tip its load directly into the waste bunker.

4.1.3 The bunker will be constructed from waterproof reinforced concrete, providing an overall storage capacity of 2,200m^3. The bunker will be provided with a travelling crane equipped with a mechanical grab. The grab will be capable of picking up waste from any point within the waste bunker. During operations, the grab will be used for mixing waste (to ensure that the waste loaded in the hopper has a constant calorific value) and for feeding the combustion grate hopper.

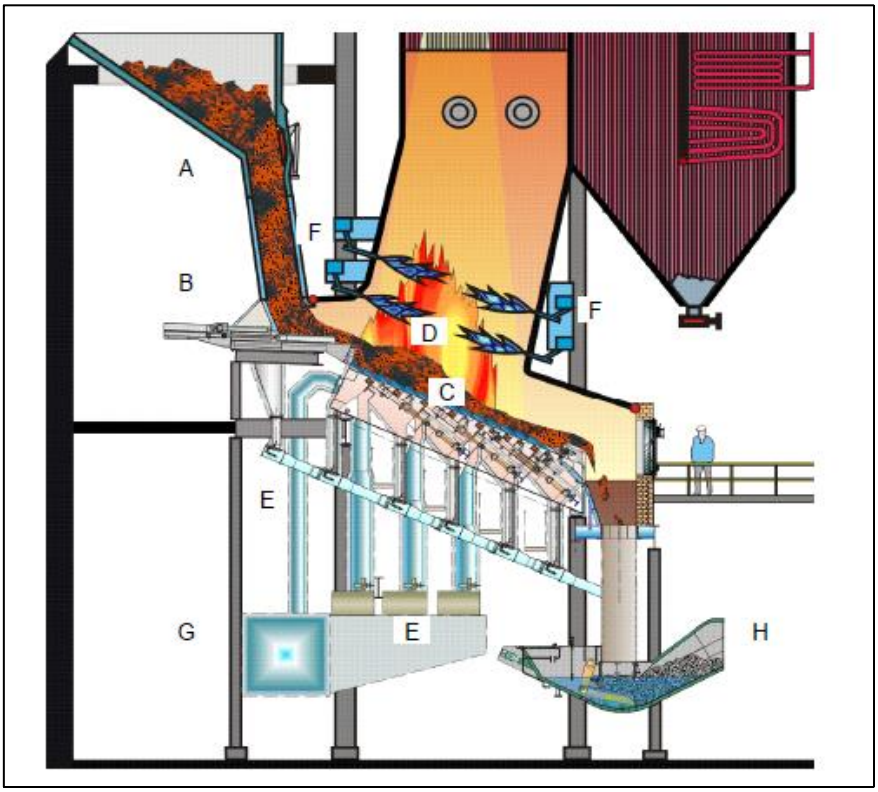
4.1.4 The grab will be operated from the control room to ensure a clear view to any part of the bunker. The grab will be fitted with a remote-control system to allow the operation from the Control Room in manual or semi-automatic mode. In the semi-automatic mode, the waste will be manually picked, then sent and dropped automatically into the selected feed hopper.

4.1.5 The waste grab will be "orange peel" type and hydraulically powered. A load cell-based weighing device will be fitted to the grab, to enable records to be held in the distributed control system (or DCS, see section 7) of the weight of the waste being fed into the combustion hopper.

4.1.6 The waste grab will pick up the waste and deposit it into the feed hopper of the combustion system, which is described in section 5.

5 COMBUSTION

5.1.1 The main component of the combustion system will be the CNIM/Martin reverse-acting grate which was specifically developed for fuels with a high heating value and a low inert content. This is shown in Figure 5:1 below.



A Feed hopper feed chute	B Feeder	C Reverse-acting grate vario
D Furnace	E Underfire air	F Overfire air
G Air preheater	H Discharger	

Figure 5:1: CNIM/MARTIN Waste Combustion Process

5.1.2 The reverse-acting grate operates using the following attributes:

- Wide heating value range with capacities for handling fluctuations in waste composition (firing diagram is provided as Appendix 3);
- Rapid transition of the fuel from a cold state into the combustion phase in order to prevent smouldering which adversely affects emissions;
- High and uniform fuel bed temperature;
- Intense and continual agitation of the fuel bed;
- Grate speed can be individually set per run and zone;

- Clear delimitation between combustion zone and burned-out bottom ash over the entire grate width;
- Good bottom ash burnout by adjusting the grate speed in the various zones in response to varying waste quality;
- Uniform covering of the grate surface;
- Low thermal load on grate bars;
- No air supply due to mechanical requirements (e.g. cooling of cast-steel parts);
- Easily controlled supply of combustion air as required;
- Low fly ash discharge from the combustion system;
- Direct response to control operations;
- Rapid start-up and shutdown of the grate; and
- Easy replacement of grate bars.

5.1.3 The above attributes result in the following advantages for the combustion system operation: high levels of availability, long grate surface service lives, recyclable residues and consistent compliance with emission requirements whilst maintaining high efficiency and burnout values. Further technical specification and details of the operation of the reverse-acting grate is provided below.

5.1.4 An automatically operated feeder will supply the waste to the grate. Above the feeder there will be a feed chute which will consist of a feed hopper and a chute shaft. When the combustion line is in operation, the feed chute will be filled with waste which will be drawn downwards by gravity. The waste column will create an air-tight seal between the furnace and the refuse pit, and this will prevent false air in-leakage, which could adversely affect combustion conditions and create fires in the chute.

5.1.5 The waste will be fed by means of a ram-type feeding device. The waste will be compressed by gravity in the feed chute shaft and loosened by rams, thereby achieving uniform distribution of fuel on the grate. Uncontrolled sliding of the waste column through the feed chute shaft will not be not possible as the waste's vertical downward movement becomes a horizontal movement towards the combustion grates. Each grate run will have its own hydraulically driven feed ram and the number of strokes, stroke length and stroke speed can be set individually. The feeding cycle will be integrated in the combustion control system, and manual control will be possible locally, if necessary.

5.1.6 This system ensures a column of waste which will prevent uncontrolled ingress of air to the combustion chamber and therefore ensure good control of oxygen levels within the plant. Adjustment of the operation of the feeding rams will allow the rate of feed to the combustion chamber to be varied to suit the particular waste being treated at the time, ensuring full burn-out.

5.1.7 Waste will pass from the lower end of the feed chute across a feed table and over the feed edge onto the grate. Good ignition and combustion will be achieved as a result of this additional breaking up of the compacted waste, even in the case of low heating values.

5.1.8 Once the waste has passed over the feed edge it will progress onto the reverse-acting grates which will be horizontally inclined at an angle of 24° from the feeder to the discharger, and comprise stationary and moving steps in alternating order. By means of the reverse-acting motion of the moving grate steps, directed against the natural downward movement of the fuel bed on the grate, the fuel will be first mixed through an upward and then through a downward movement. Continual mixing of the waste layers at the front end of the grate and in the vicinity of the grate surface with red hot particles from the main combustion zone will be ensured. A vigorous, stable fire, in which all the combustion phases (drying, gasification, ignition and combustion) occur simultaneously and consecutively, will develop at the front end of the grate and the constant stoking motion effects a uniform heat release ensures excellent burnout values. The stoking motion of the grate is illustrated in Figure 5:2 below:

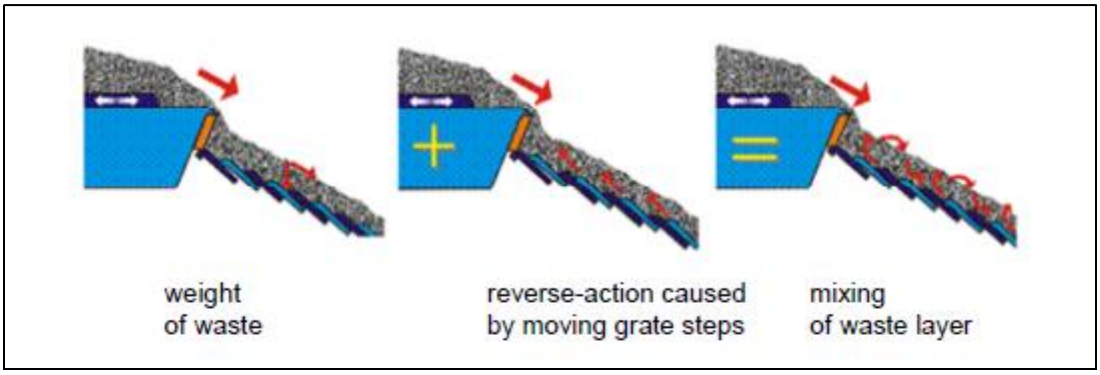


Figure 5:2: Stoking Motion

5.1.9 The moving grate steps will perform approx. 20 – 30 strokes per hour in the direction of the front end of the grate. The number of strokes, i.e. the grate speed, will agitate the fuel bed. The speed will have only a minimal influence on throughput. The residence time of the waste on the grate will be approx. 60 -70 minutes. Rapid clearance of the grate will take approximately 30-45 minutes.

5.1.10 Secondary combustion, i.e. oxidation of unburned gases, will take place in the flame body forming above the main combustion zone. Virtually complete gas burnout will be achieved by adapting the overfire air supply to the waste conditions prevailing at any time.

5.1.11 The formation of carbon monoxide and halogenated hydrocarbons is essentially prevented by the intensive agitation and mixing of the gases emitted by the flames immediately above the main combustion zone using a targeted supply of overfire air.

5.1.12 The basic structure of the reverse-acting grate is shown in 5:3 below.

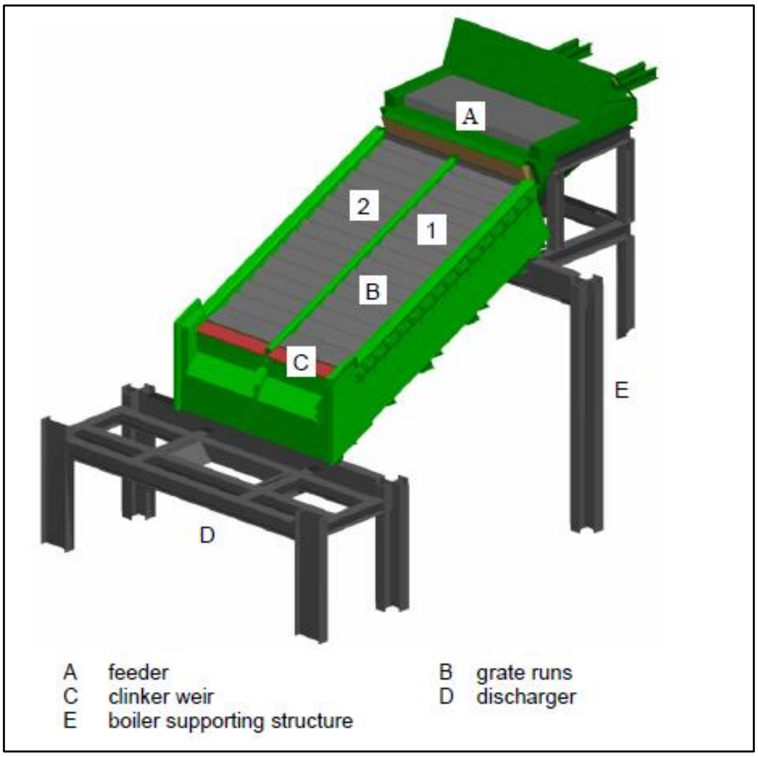


Figure 5:3: CNIM/MARTIN Reverse Acting Grate

5.1.13 The reverse-acting motion of the moving grate steps produces a closed layer of waste and/or bottom ash over the entire grate surface. As a result, the grate bars are ideally protected against thermal irradiation from the furnace. The average operating temperature of the grate bars even in the main combustion zone is only slightly above the set underfire air temperature. The grate surface consequently will not need to be cooled with water, not even when combusting waste with a high heating value. This will provide a high level of safety with respect to thermal overloading and contribute to a long service life, which depends almost exclusively on being able to withstand mechanical wear. Thermocouples for measuring the temperature of the grate bars will be installed in selected bars in the main combustion zone.

5.1.14 Mechanical wear and the influence of heat will cause changes in the total width of the grate run during operation. Adjusting bars in the grate surface and moving plates on the side elements of the grate runs will compensate for these changes. By exerting uniform pressure, they will facilitate precise guidance of the grate bars and a tight grate surface, also during long service periods. This will prevent uneven underfire air distribution and blockages caused by foreign objects entering the gap between the grate bars.

5.1.15 Whilst the grate bars will operate in a manner that is tightly-bound, there will be small amounts of fine ash particles that are able to pass through the grate bars. These grate siftings will be collected in hoppers underneath the grate. Beneath each of these hoppers there will be a grate siftings flap. The ash that falls through the feeder will be collected in the same manner. Each grate run will have a separate hopper for the feeder siftings under which the feeder siftings flap will be situated. The flaps for the feeder and grate siftings of each grate run will lead to a common siftings discharge duct through which the grate siftings will be pneumatically conveyed to the discharger connecting piece. The air admission flap will be at the air inlet. All flaps will be actuated by pneumatic cylinders. The flap position (open or closed) will be monitored by 2 limit switches which generate feedback signals.

5.1.16 The removal of ash from the grate runs will occur consecutively at intervals of approximately 5 minutes, and the siftings discharge air needed for this purpose will be drawn off from the underfire air. Since no supplementary air will be used, the air balance for combustion will remain unaffected. After the ash-discharge cycle has been completed for all grate runs, an idle time will be set for between 20 and 30 minutes, after which the ash-discharge cycle will begin again.

5.1.17 A discharger will be located at the lower end of the grate plates, for the collection of hot bottom ash via an ash pit. Here, complete quenching and cooling to approximately 80°C to 90°C will make it possible to safely remove the bottom ash without dust or odour nuisance. Water drains from the bottom ash in the discharger outlet chute, thereby reducing water loss in the discharger. The moisture retained by the bottom ash at the discharger outlet is low, and will be approximately 15 to 20 %.

5.1.18 Quench water is recirculated and will be made up using boiler blowdown and wash water generated on site. In this manner all water on site is reused and use of mains water will be minimised.

5.1.19 The regulation and supply of combustion air is one of the most important aspects of the operating techniques. The combustion air will be distributed as underfire air beneath the grate and injected into the furnace above the grate as overfire air via a series of nozzle rows, described below, and shown on the diagram in Figure 5***:4***:4 as follows.

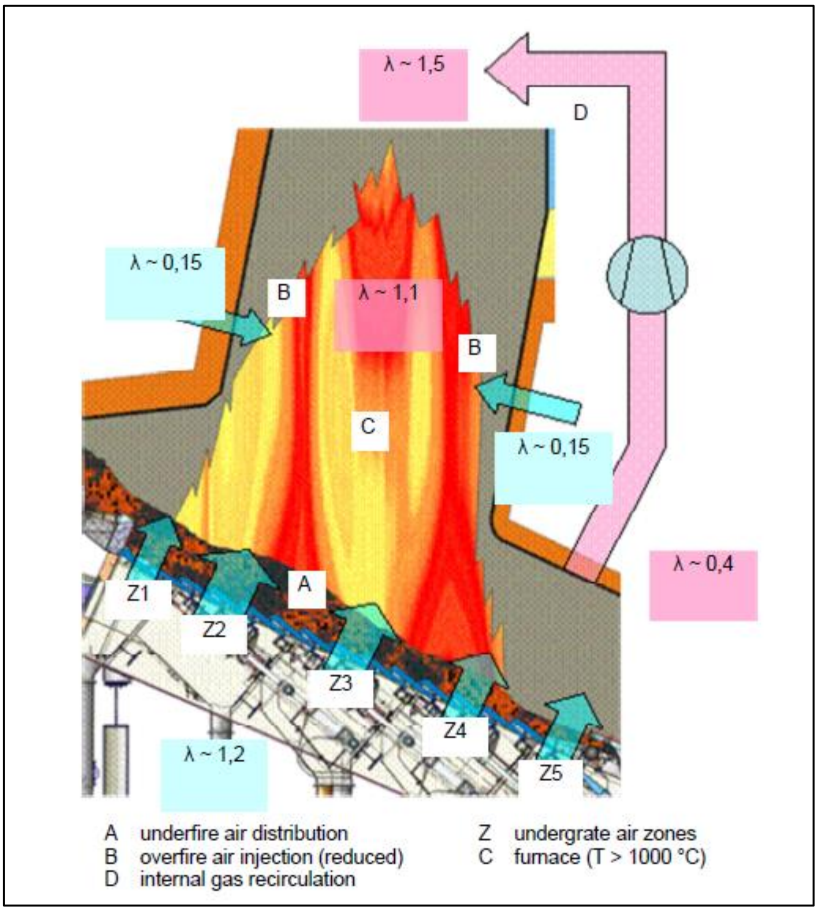


Figure 5:4: Combustion Air Supply

5.1.20 The preheated underfire air will be supplied in 5 separate air zones along each grate run. The air flow to each undergrate air zone will be measured and can be set individually, with the exception of zone 5, to which air is supplied from zone 4. The underfire air fan control system will keep the pressure in the underfire air plenums constant at approximately 40 hPa. In this way, the underfire air dampers can be used to set the required underfire air flow in each zone without influencing the remaining zones. The pressure difference between the underfire air plenum and the air zones beneath the grate will serve as a measure of the underfire air flow in the respective zone.

5.1.21 The aerodynamic resistance of the grate surface will be approximately 10 hPa and significantly higher than the air resistance of the fuel bed above it (usually about 1 -3 hPa). Therefore the air admission through the fuel bed will be uniform even if the waste is distributed unevenly on the grate.

5.1.22 Most of the still unburned gases released from the fuel bed will oxidize immediately at high temperatures when they mix with the residual underfire air in the furnace. This effect is enhanced by the overfire air which will be supplied over the entire furnace section. It will provide the oxygen required for complete oxidation and ensures thorough agitation of the gases.

5.1.23 There will be a 4-row stitching process for the arrangement of the overfire air nozzles. In this process, two parallel rows of nozzles will be arranged one above the other on the front and rear walls of the boiler. The rows of nozzles will be arranged opposite each other and staggered in relation to each other. As a result, a uniform temperature and flow profile, and optimal mixing of the gases in the furnace will be achieved. The residence time of the gases in the high temperature area will be increased, the gas burnout improved and the formation of nitrogen oxides in the furnace reduced, as described in detail below.

5.1.24 The reduction of NO_X and ammonia emissions is based on a combustion process which, in addition to the conventional supply of underfire and overfire air, involves the injection of secondary air via several staged air levels. The nozzles for the secondary air supply are arranged in opposite rows to ensure the furnace is completely permeated, thereby achieving thorough mixing of the flue gases and efficient secondary combustion.

5.1.25 This process achieves favourable combustion results, such as reduced excess O2 levels, reduced NOx emission levels, reduced NH_3 consumption, increased boiler efficiency, reduction in size of the boiler and downstream flue gas cleaning components.

5.1.26 The combustion control system will include:

- The IR camera measuring the heat flux on the grate surface;
- The steam flow;
- IR pyrometer determining the variation of the flue gas temperature;
- the fuel controller, which controls feeding of fuel to the grate;
- the O_2 controller, which determines / corrects the combustion air flow;
- the overfire air flow;
- overfire air distribution; and
- grate speed.

5.1.27 Changes in the flue gas temperature will be recorded by an infrared pyrometer in the second boiler pass, and changes in the heat release from the furnace will be identified promptly and reliably. This will result in a very short flow control response times and therefore temperature fluctuations in the furnace and the boiler and in steam flow fluctuations will be reduced to a minimum.

5.1.28 There will be an infrared camera system as a control to influence the underfire air distribution as a function of the position of the main combustion zone, the feeder speed and grate movement. An infrared camera will also record the intensity distribution of the thermal radiation on the fuel bed surface and will be used to obtain additional information from the combustion process to achieve optimal combustion results by operators in the control room.

5.1.29 The combustion air will be drawn from above the waste pit, so that odours and airborne dust are taken from the tipping hall into the incineration line. The air intake over the pit will be fitted with a grid and air velocity through the grid will be kept low (<4 m/s) in order to minimise clogging by paper, plastic sheets and other debris.

5.1.30 A forced draught air fan will be used to supply combustion and overfire air to the furnace. The fan will be of centrifugal type with axial air inlet. Combustion air will be pre-heated using steam from the first turbine bleed. Heated steam can also be taken from the boiler drum if required. Condensate from the air pre-heater will be redirected to the sub-cooling stage and then to the condensate tank.

6 STEAM GENERATION

6.1.1 Heat will be recovered from the flue gases by means of an integral water tube boiler. The boiler and associated equipment will be of the type and quality suitable for Commercial and Industrial (C&I) waste incineration plant, and will meet the steam requirements of the turbine generator as well as all other steam requirements of the plant.

6.1.2 The boiler specification will be of the natural circulation, vertical, one drum, bottom supported type, with 5 passes and water walls integral to the furnace, as follows:

- 1st pass: radiant combustion chamber, empty vertical pass;
- 2nd pass: vertical pass, with evaporator panels;
- 3rd pass: vertical pass, with evaporator and superheater bundles;
- 4th pass: vertical pass, with superheater and economiser bundles; and
- 5th pass: vertical pass, with economiser bundles.

6.1.3 There will also be an external economiser located downstream of the boiler.

6.1.4 The first three passes will be enclosed in water wall panels. These air tight walls will be composed of finned tubes welded lengthwise, with the first pass being protected by refractory up to the central screen header.

6.1.5 In order to optimise efficiency with particular reference to waste incineration, and to prevent fouling, erosion and corrosion, the operating techniques of the steam boiler will be governed by the following main criteria:

- A combustion chamber of correct width and adequate height;
- Low velocity of the flue gas in the combustion chamber in order to reduce ash carry-over;
- Long residence time;

- Refractory protection of combustion chamber water walls in the flame zone designed to achieve good heat transfer without high hot face temperatures;
- Low gas velocities and long residence time before entering the first convective surfaces;
- Large tube spacing in the convective banks;
- Convective superheater design for high flue gas temperature and steady steam temperature;
- Easy access for inspection and maintenance of all pressure parts;
- On-line cleaning systems based on water injection in the second pass; and
- Soot-blowers for superheaters.

6.1.6 A diagram showing a schematic of the boiler in relation to the combustion grate is shown in Figure 6:1 below.

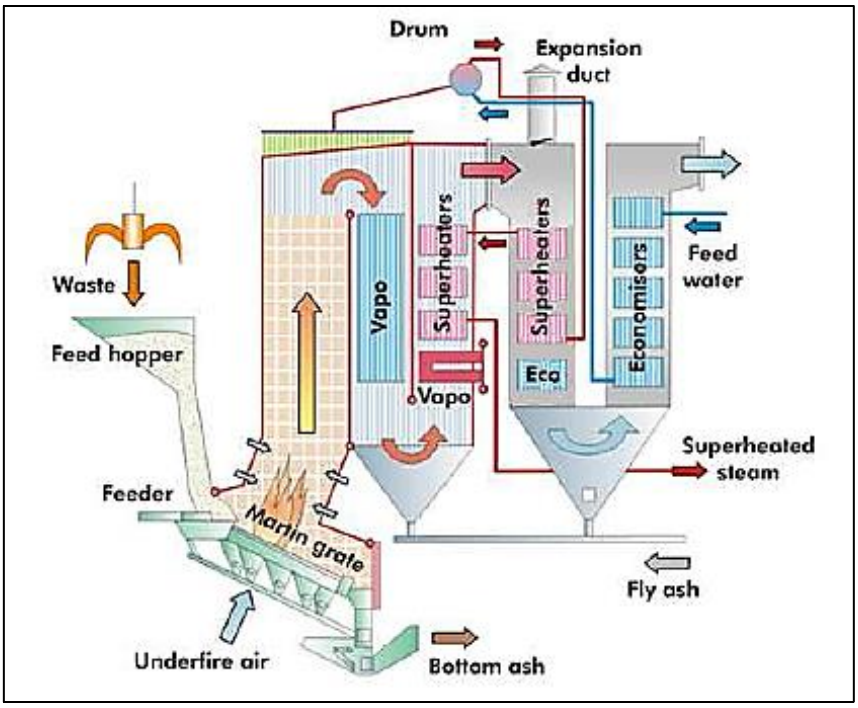


Figure 6:1: Typical Vertical Boiler Principle

6.1.7 In order to collect fly ash under the gas circuits, the boiler will be equipped with fabricated steel hoppers at the bottom of all passes. The hoppers in the high temperature section of the boiler will be refractory-lined/water cooled, and the hoppers in the low temperature section of the boiler are of casing type with external thermal insulation.

6.1.8 The boiler will be fitted with one main safety valve fitted on the drum, and sized to release a minimum of 75% of the boiler steam rate; and one safety valve fitted on the superheater at its outlet and sized for releasing a minimum of 25% of the boiler steam rate. This last safety valve will be set to open before the main safety valve fitted on the drum, to ensure a permanent flow through the superheater.

6.1.9 The combustion chamber will be provided with two auxiliary burners, designed to:

- Raise the temperature in the combustion chamber prior to starting up from cold and during shutting down of the plant;
- Ignite the refuse at the start-up of the plant following shut down periods; and
- Comply with the IED requirements for reducing flue gas emissions, i.e. whenever the temperature falls below 850°C a standby burner will operate automatically to maintain the temperature whilst there is waste on the grate.

6.1.10 One blowdown system will be supplied for the drainage and the blowdown of the boiler. This blowdown system will consist of one atmospheric blowdown tank which will receive all continuous and intermittent drains. Expanded steam from the blowdown tank will be vented to the atmosphere, and the liquid phase will be routed to and recovered in the bottom ash coolers.

7 POWER GENERATION

7.1.1 The Power Generation Plant and auxiliaries will include the following main components:

- Steam turbine and auxiliary equipment;
- Power generator;
- Air cooled condenser;
- Condensed steam heater(s);
- Boiler feed water system; and
- Miscellaneous equipment.

7.1.2 In summary, the power generation cycle description will be as follows. After the boiler has generated steam, this will be used by the steam turbine to produce electrical power. Bleeding steam will be used for internal consumers (e.g. the combustion air heater, de-aerator and condensate re-heater), whilst exhaust steam will be cooled down in the air-cooled condenser. Condensate will be fed by condensate pumps through a turbine gland steam condenser, ejector condenser, de-aerator gland steam condenser, condensate tank, condensate re-heater (flue gas cooler) and into a de-aerator tank. The re-heater will use steam to pre-heat water entering the boiler, improving efficiency and reducing heat loss. Two 100% centrifugal single stage condensate pumps (one in stand-by) will convey water to the deaerator tank ready for reuse in the boiler.

7.1.3 Water from the deaerator will be returned to the boiler via horizontal centrifugal feed water pumps. Feed water flow will be controlled by a feed water control valve. Demineralised water will be sent to the de-aerator to compensate for steam and water loss over the cycle.

7.1.4 The steam turbine will be used in full condensing mode and this design will enable continuous operation. After subtraction of the power required for internal use, the electrical net production will be supplied to the National Grid via a step-up transformer.

7.1.5 The turbine will be designed to accept the total steam flow produced by the boiler under any anticipated ambient conditions and will accept the full boiler operating range under the all possible combinations of acceptable waste types.

7.1.6 Upstream steam pressure will be regulated through the turbine by governor-controlled steam admission valves and the turbine is protected with a mechanical over speed trip device and an electronic over speed unit using speed sensors. Auxiliary equipment required to operate the turbine includes a gearbox and oil lubrication system.

7.1.7 Any loss of oil pressure will cause the stop valves to rapidly close and the governing valves to close to prevent damage to the turbine.

7.1.8 The power generator will consist of a synchronous 1,500 rpm 4 pole totally enclosed water-to-air cooled (TEWAC) machine excited by rotating diodes with no brushes or rings.

7.1.9 The air-cooled condenser which will be provided, is designed to condense the total amount of exhaust steam produced by the turbine and/or from the turbine bypass. The proposed steam condenser will be housed in a roof A-frame mounted on a steel structure, and will be air cooled. The proposed air-cooled solution will allow for maximum flexibility against variations in thermal load and/or ambient conditions.

7.1.10 Initially, the main boiler water feed for the process will be potable water from Yorkshire Water's network and this will be used to replenish the boiler water as needed. The boiler feed water will be produced by one common dual demineralisation plant, automatically controlled by the levels in the demineralised water tank. The tank will act as a buffer tank to ensure that demineralised water is continuously available, and store demineralised water during any planned shut-down and/or emptying operations. Boiler water conditioning will also include a combined unit where both phosphate and oxygen scavenging will take place.

7.1.11 Spent boiler water will be discharged and stored in the dedicated storage area of the wastewater pit. The water may then be used as make up water for the wastewater pit or otherwise will be tankered off site.

8 FLUE GAS CLEANING SYSTEM AND ASH DISPOSAL

8.1.1 This is a vitally important part of the operational process, in order to ensure flue gas emissions are controlled to prescribed limits and compliance with the IED is maintained.

Acid Gas Removal and Bag Filters

8.1.2 The initial flue gas cleaning plant will use a dry process and will comprise the following equipment elements:

- Reacting duct,
- Bag house filter,
- Induced draft fan, gas ducts and silencer,
- Quick lime storage and injection system,
- Hydrated lime injection from a big-bag, for peaks and pre-coating,
- Activated carbon storage and injection system,
- Residue hydration and re-activation and recirculation system,

- Final residue collecting and residues silo storage system; and
- 2 Analysers (1 + 1 redundant) for measurement of O2, H2O, pressure, temperature, flue gas flow, CO, Dust, TOC, HCl, SO_2, NO_X, NH_3 and N_2O.

8.1.3 A diagram of the flue gas cleaning system is shown in Figure 8:1.

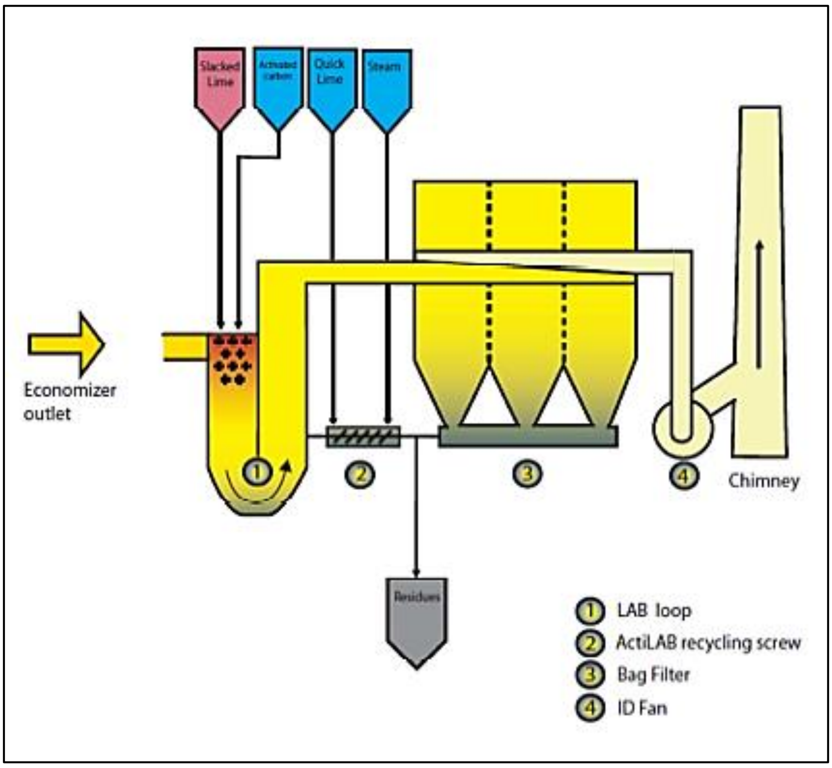


Figure 8:1: Flue Gas Cleaning System or VAPOLAB ® Process

8.1.4 The LabLoop® reaction duct will be used to optimise the mass transfer between the flue gases and the dry absorbents. It is designed to facilitate intensive mass transfer of the flue gases and dry absorbents. The reactor attributes include:

- High-performing separation of the pollutants contained in the flue gas under the actual operating conditions of the combustion plant;
- Reduction of the generated pollutant peaks by optimal reaction with absorbents;
- Increased operational flexibility; and
- Minimisation of the generated quantity of residues due to efficient use of raw materials.

8.1.5 High turbulence for the mixing process will be produced by the turbulent flow of the flue gases, and the active zone will be maintained by the regulated adding of reactivated recycled residues coming from the fabric filter, as well as by the injection of fresh quicklime and activated carbon.

8.1.6 Quick lime and activated carbon will be taken from their respective silos by mechanical extraction devices, and transported to the feeding point of a pneumatic/mechanical conveying pipe by means of speed-controlled dosing screws. Separate radial fans produce the required volume flow for each reagent and ensure the pneumatic conveying of the absorbent/air mixture to the injection point. Quick lime flow rates will be controlled by monitoring the upstream and downstream acid pollutant values, and the flue gas flow. Activated carbon injection will be controlled by monitoring the flue gas flow (or steam production). At the injection point they will be intensively mixed with the flue gases and entrained under continuous reaction with the flue gas pollutants. Non-used portions are recycled to the flue gas flow by way of the recycling and reactivation loop as described below.

8.1.7 The bag filter will be used for the major separation of particle pollutants from the flue gas. These pollutants mainly consist in entrained dust, dried reaction salts and used up absorbents. A diagram of the bag filter system is shown in Figure 8:2 below.

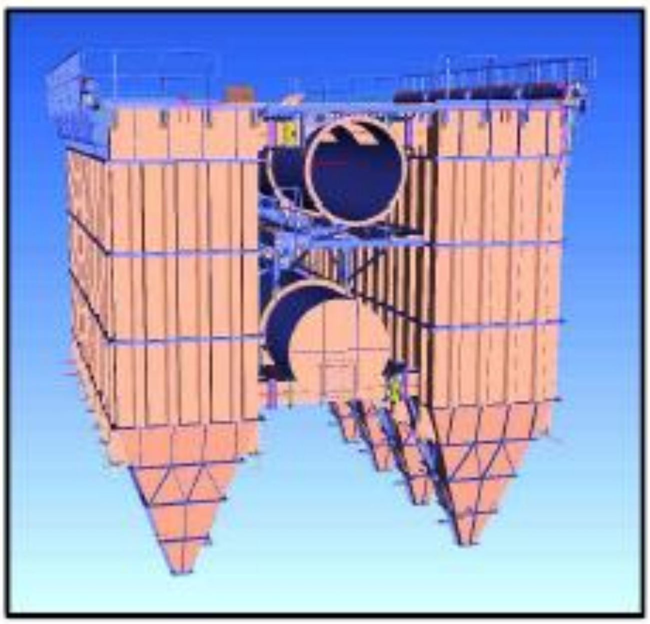


Figure 8:2: Typical View of CNIM/LAB Design Bag Filter

8.1.8 The main characteristics of the fabric filter are:

- 4 independent cells;
- On line air pulse cleaning of bags;
- P84/PTFE membrane bags, with corrosion protected carbon steel cages;
- 4 independent hoppers with high level detection, isolating gate valves, temperature measurement; and
- A pre-coating system using hydrated lime injection from a big-bag located at the bottom of the LabLoop®, used at the start-up of the line in order to protect the filter bags.

8.1.9 In order to prevent pressure drop due to clogging of the filter, the filter bags will be de-dusted through compressed air pulses in time intervals controlled automatically by a differential pressure-control. Other relevant process signals, such as actual flue gas volume flow and current inlet and outlet pollutant concentrations will be considered during the cleaning sequence. Compressed air pulses from the nozzles will be sent inside the filter bags, thus generating a pressure wave and leading to a short expansion of the filter bag. This phenomenon will cause the filter cake to be detached and to fall into the collection hoppers which are housed directly under the filter chamber. From the chambers, the residues will be extracted via conveyors and transported to either the residue silo or the re-circulation system.

8.1.10 Air pressure will be monitored before and after the bags as an indicator that they are functioning correctly.

8.1.11 The residues removed by the fabric filter will contain a certain portion of un-reacted lime. For reasons of efficiency, part of the residues exiting from the fabric filter will be recycled back to the reaction duct to utilise this residual lime content. This will be carried out using a chain conveyor to transport the residues from the bag hoppers to the re-activating system.

8.1.12 In order to purge the system of the used by-product, only part of the residue will be reused, and part will be transferred from the chain conveyor to the final residue storage silo via a pneumatic transport system.

8.1.13 Without treatment of the residues, only a part of the recycled excess of reagent will be available at the surface of the particles and can react with acid gases the reagents undergo reactivation. Reactivation results in increasing the part of the reagent available for reaction by producing calcium hydroxychloride (CaClOH). This is achieved through a diffusion process of hydroxide into the calcium chloride crust that covers the particles. The reactivated residue will then be recycled back into the LabLoop® reactor.

8.1.14 This type of re-circulation design allows automatic expulsion of part of the residues from the system, corresponding to the sum of fresh absorbents and fly ash taken in, without the need for implementing sophisticated techniques. Whilst at the same time preventing unnecessarily high absorbent consumption.

8.2 SNCR

8.2.1 NO_X gases will be removed from the flue gases by the use of a liquid reduction system. The system is described below and shown on the diagram as follows:

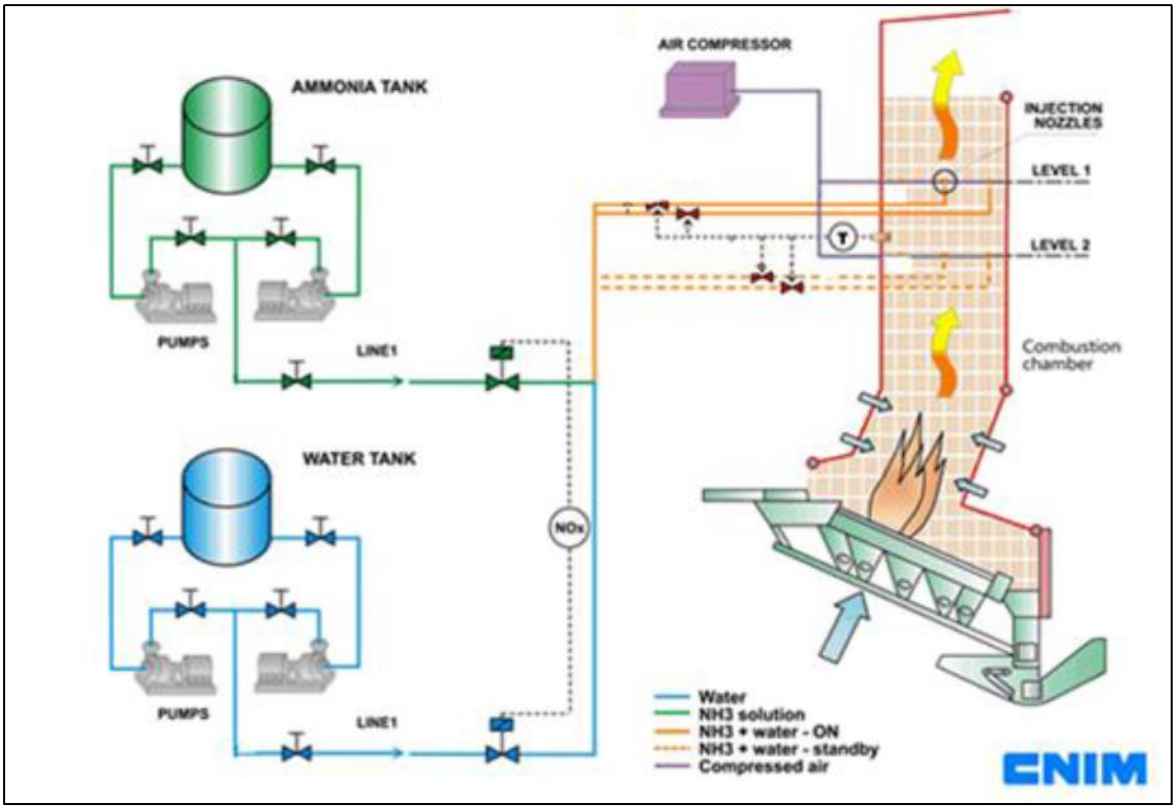


Figure 8:3: Ammonia Injection Schematic

8.2.2 NO_X reduction will be by SNCR (Selective Non-Catalytic Reduction) using ammonia as a reagent. Such systems are particularly well suited to medium sized combustions plants.

8.3 Stack

8.3.1 Final emission to air will be via the 60m stack. Air quality modelling has been completed to demonstrate that this stack will achieve sufficient dispersion of residual pollutants and ground level concentrations of these pollutants will be well within the environmental assessment levels, whether these are statutory limits under the Air Quality Regulations or recommended levels based on the Environment Agency's guidance.

8.3.2 The stack will include platforms for the location of the stack gas analysers, and monitoring ports to allow for any additional regulatory sampling of the stack gases. Further details are provided in the Monitoring Report.

8.4 Ash Disposal

8.4.1 The residues generated in the flue gas treatment plant will be a mixture of fly ash, dried reaction salts and remaining excess absorbents. They will be collected in the hoppers of the bag filter and conveyed to a final storage silo by a batch type (dense phase) pneumatic conveying system comprising a buffer tank, pneumatic conveying vessel, and conveying pipe.

8.4.2 The fly ash collected under the boiler, economisers and condensate preheater hoppers will be conveyed to the bottom ash discharger, and then to the bottom ash storage area by means of a vibrating conveyor and belt conveyors. This vibrating conveyor will be fitted with a 300mm grid which will remove oversize objects. The oversize objects will be stored in a $2m^3$ skip which can be handled by a forklift. The passing fraction of bottom ash will then be conveyed to the ash storage area by means of a succession of conveyors belts. A magnetic separator will allow the sorting of ferrous scrap from the bottom ash stream and this scrap will then be stored in a dedicated storage area.

9 CONTROL SYSTEMS

9.1.1 The plant will be designed to operate 24 hours a day, all year round, with the exception of planned stoppages for maintenance. The proposed Main Control and Supervision System will consist of a Distributed Digital Control System (DCS). In order to ensure the safety of all operators, electrical and electronic equipment will be provided with integral protective devices and trip/cut-out facilities in case of failure. It will also be designed to prevent operators from accidentally coming into contact with live parts of equipment.

9.1.2 The control systems which are particularly pertinent to environmental control and permitting will be described below in detail e.g. the atmospheric emissions monitoring station, and only brief summaries of other control systems e.g. electrical processing, administrative, and engineering will be described.

9.1.3 The flue gas cleaning system will be equipped with independent Programmable Logic Controllers (PLC) for some local functions, which are monitored by the Master Programmable Controller (MPC) of the plant. The MPC will provide automatic and selected manual control and operation of the system. Graphic displays, alarms and report generation will be derived from the MPC.

9.1.4 This will provide automatic adjustment to systems so that the plant remains within the optimum operating conditions. Alarms will alert site staff to any problems that could lead to abnormal emissions so that these can be resolved.

9.1.5 The atmospheric emissions monitoring station will be supplied with computer systems in order to perform the data storage and calculations concerning emissions and performances of the plant. This dedicated equipment will consist of 2 stations (PC type) fitted with 15" monitor, keyboard and pointing device, and 1 long term data storage device. This system will issue all reports requested by the regulating bodies with regards to pollutant emissions. All data will be published in the standard format required and then expressed in daily, weekly and monthly reports.

9.1.6 "As emission" values and associated parameters are necessary for the control of the overall process, and primary correction calculations will be made directly by the main control system (DCS). Additional calculations (averages on diverse time bases, peak values, etc.) will be made by the auxiliary station. All the information from the combustion and the flue gas treatment system will then be made available from the auxiliary station which will allow on-screen monitoring and printing of reports.

9.1.7 In terms of emissions measurements the following will be continuously monitored and recorded:

- Total dust;
- HCl (hydrogen chloride);
- CO (carbon monoxide);
- SO_2 (sulphur dioxide);
- NO_X (nitrogen oxides, NO & NO_2 expressed as NO_2);
- NH_3 (hydrated lime); and
- VOC (Volatile organic compounds expressed as TOC: Total Organic Carbon).

9.1.8 Associated parameters also subject to continuous monitoring will include:

- Oxygen (O_2);
- Water vapour (H_2O);
- CO_2 (carbon dioxide);
- Pressure;
- Temperature; and
- volume flow.

9.1.9 According to the selected equipment, some parameters will be measured directly or will be evaluated from another measurements which will allow subsequent calculation.

9.1.10 In addition, the monitoring control system will allow the data logging of the flue gas treatment system status (operation/fault condition information) as well as data logging and recording of some parameters issued from the incinerator / boiler unit, which are representative of the status of the process such as:

- Incinerator on/off;
- Combustion temperature (or "2 seconds" temperature);
- Oxygen content after incineration;
- Steam flow; and
- Auxiliary burners on/off.

9.1.11 The details of the proposed emissions monitoring control equipment are as follows:

9.2 Pressure and Differential Pressure

9.2.1 The transmitter will be of a SMART type with a power supply using dual-wired 10/36 Vcc, with an accuracy of +/- 0.25%.

9.3 Air/gas Flow

9.3.1 This will be measured by a Venturi nozzle with differential pressure transmitter for air and flue gas, and orifice plates with differential pressure transmitter for water and steam. When an extractive-type dust content analyser is used, the flue gas flow measurement will be carried out using a Pitot tube.

9.4 Temperature

9.4.1 The Primary element for T < 400 °C will be a resistance probe PT 100 type, and for T > 400 °C a thermocouple K type will be used. The Sensor and Thermowell material for T < 1000 °C will be stainless steel 316 L, and for T > 1000 °C refractory stainless steel (NS 30 or equivalent). The specification for the water & steam circuits will be drilled thermowells, and for the air & flue gas circuits welded thermowells will be used. The power supply will be dual-wired 10/36 Vcc (as for the pressure sensors), with an accuracy of +/-1 %.

9.5 Fluid Levels

9.5.1 Gauge pressure measurements will be carried out for tanks under atmospheric pressure, and differential pressure measurement for pressurised tanks, using capacity probes, hydrostatic pressure sensors, and ultrasonic transmitter or micro-wave measurements according to the fluid to be measured. The power supply will be 10/36 Vcc or 220 Vca.

9.6 Flue gas analysers

9.6.1 The combustion O_2 analyser will utilise a zirconium probe and have a 230 Vca, 50 Hz power supply. The dust content analyser will operate by light diffusion principals, and also have a 230 Vca, 50 Hz power supply.

9.6.2 The gas analysers will also have a similar power supply and be accurate up to +/-3% of full scale.

9.6.3 The method for the measurement of HCl, CO, SO_2 gases will be wet or dry gas extractive, or in-situ infrared spectroscopy. Similarly, NO_X and NH_3 will be measured using wet or dry gas extractive, or in-situ infrared spectroscopy or ultraviolet spectroscopy methods. The water content (% of H_2O) will be determined by IR spectroscopy measurement whether a wet gas extraction type multi-gas analyser or in-situ type multi-gas analyser is used.

9.6.4 There will be numerous control loops for the purpose of ensuring the proper functioning of the facility. These include boiler controls for steam, combustion, overfire and outlet flue gas controls; burner controls; steam and water circuit control loops; and condensate and de-aerator level controls.

9.6.5 For the purposes of environmental permitting it is appropriate to consider the flue gas acid neutralisation control loop in more detail. The purpose of this control is to lower the acid content to the desired level (target value) with regard to the regulatory framework, and to maintain an acceptable lime consumption (as low as possible to ensure minimum resource use). For this it is necessary to accurately control the reagent injection. The quantity of reagent to inject depends upon the quantity of acid in flue gas at the inlet and the residual target value at the outlet, as well as the necessary molar ratio (reagent/acid). The theoretical reagent flowrate set-point can then be calculated, which results in the quantity of acidity which must be neutralised. This set-point is compared to the actual flowrate in a PID type controller, the output of which determines the position of the reagent injection control valve.

9.6.6 As an additional control the actual HCl content in the flue gas outlet from the flue gas cleaning process will be monitored and will then be compared to its target value in another PID controller, the output of which will be used as a correction coefficient on the calculated reagent flow set-point.

9.6.7 There will be safety systems in place which will allow for the protection of operators and equipment against potential faults or malfunctions, and these will meet current recommendations and regulations in force. The safety systems will be based and designed on the "FAIL SAFE" principle i.e. in normal operation, all safety circuits are energised and in "closed contact" position. The fault or opening of any circuit will lead to a safe and stable position.

10 WATER REUSE, COMPRESSED AIR AND INSULATION SYSTEMS

10.1.1 For sustainable purposes, the proposed aims of the water flow cycle are to attain reduced water consumption and zero process waste water rejections. Potable water from Yorkshire Water will be used for process needs, for the sanitary system and fire water. Potable water will be supplied to the plant at the required minimum pressure of 5 bar and no intermediate storage tank / transfer pumps will be necessary.

10.1.2 In terms of process water waste water will be collected in a central tank for use in the bottom ash quench. Quench water will be collected within the ash bunker and recirculated for reuse. Clean roof water will be directed to the rain water pit, which will act as a backup supply for use in site processes and bottom ash quench.

10.1.3 The compressed air plant will provide general service air and instrument air for the whole incineration plant. The system will consist of a 2 x 75% flow arrangement for the compressors, based on the maximum flow rate normally encountered in operation. Service air will be filtered and dried. Instrument air will be dried, and oil removed using refrigeration and desiccant dryers including filtering element.

10.1.4 Thermal insulation will be of paramount importance for operational and safety reasons and will be provided on all directly accessible externally-insulated surfaces. The thickness of the insulation will be calculated based on an outside lagging face (cold side) temperature not exceeding 50°C. On non-directly accessible externally-insulated surfaces, the thickness of the insulation will be calculated based on an outside lagging face (cold side) temperature not exceeding 55°C. All insulated flat surfaces will be covered with galvanized steel or aluminium lagging not less than 0.75mm. Insulated piping will be covered with a flat galvanized steel or aluminium lagging not less than 0.4mm thick.

11 CONTROL OF AMENITY ISSUES

11.1 Odour

11.1.1 As described in section 2 above, the plant will be provided with an air extraction system which will direct odorous air from the waste reception hall and bunker to the incinerator for use as combustion air. The high temperatures within the furnace with breakdown odorous compounds with the resultant gas released via the 60m stack, ensuring good dispersion of any residual compounds.

11.1.2 The building will be designed to prevent uncontrolled ingress of air so that it can be maintained under negative pressure, preventing odour from escaping via doorways.

11.1.3 The main doors will be provided with fast acting roller shutter doors that will be opened only to allow access and egress of vehicles. The doors will be kept closed at all other times to maintain containment of odorous air.

11.1.4 All deliveries will be made in enclosed or covered vehicles and customers will be advised of this requirement.

11.1.5 Waste will be treated on a first in first out basis with all wastes being treated as soon as possible after arrival at the site. The waste reception hall will be kept tidy and will be cleaned as necessary to prevent any build-up of waste around the site.

11.1.6 All drains will be properly maintained to prevent blockages and overflows which might become a source of odour.

11.1.7 In the event of a shutdown of the main plant exceeding 3 days no waste will be received after this point on site but instead waste will be diverted to an alternative treatment facility. The doors will be kept closed to provide containment of odour.

11.1.8 An assessment will be made at the site boundary on a daily basis to ensure that there are no emissions of odour from the site. In the event of odour being detected the source will be investigated and suitable mitigation measures will be put in place. Further information is provided in the Odour Management Plan.

11.1.9 The results of odour monitoring, and any corrective actions undertaken in the event of odour being detected will be noted in the site log.

11.2 Litter

11.2.1 The control measures for litter will be as those for odour. That is, ensuring good containment within the building, receipt of waste in enclosed or covered vehicles and good housekeeping.

11.2.2 A daily inspection will be made around the site and any litter noted will be collected and returned to the waste reception bunker before the end of the working day.

11.3 Pests and Vermin

11.3.1 Vermin and pests may be attracted to the waste stored at the site, particularly where it contains a degradable content on which they can feed.

11.3.2 All waste delivery loads will be securely covered to prevent access for pests and vermin.

11.3.3 Ensuring good door management will help to limit access to the waste and exclude pests. In addition, good housekeeping, keeping the site generally clean and tidy, will minimise the build-up of any pockets of waste where vermin may nest or breed.

11.3.4 Good first in first out management of the waste will also minimise opportunities for pest populations to become established.

11.3.5 Any loads of waste noted to be infested by flies will be prioritised for treatment and will be loaded to the incinerator as soon as possible.

11.3.6 A pest control contractor will be retained and will be required to attend site should any signs of infestation be noted. Spraying or trapping will be carried out as advised by the qualified pest contractor.

11.3.7 The site is subject to daily inspections and any signs of flies, rats or other pests will be noted in the site log. A log will also be kept detailing when the pest contractor was contacted, when they attended and the treatment they used.

11.3.8 Due to the enclosed nature of the proposed waste processing at the site, the risk of nuisance caused by pests and vermin is considered to be low.

11.4 Dust

11.4.1 All unloading of waste will take place inside the building. Activities that might generate dust are therefore conducted within the area covered by the air extraction system and any dust will be drawn into the incinerator with combustion air.

11.4.2 Should dust levels become an issue waste may be damped down using the roof mounted sprinkler system. Dust on external site roads and hardstanding will be dampened using a bowser.

11.4.3 Bottom ash will be subject to cooling via a water quench and therefore will be damp and should not give rise to significant dust. Nevertheless, it will be stored inside a building providing containment.

11.4.4 Air pollution control residues (APCR) are transported via enclosed conveyors and stored in a silo. This and the silos used for lime and PAC are fitted with dust filters at the breathing vent to prevent fugitive emissions during filling and emptying.

11.4.5 Procedures are in place for the delivery of raw materials and the collection of APCR in order to prevent over filling or other spillage of powder.

11.4.6 The site roads will be swept as necessary to prevent a build-up of dust which might be disturbed by passing vehicles.

Appendix 1
Summary of Management System

Appendix 2
List of Waste Types

Appendix 3
Firing Diagram

Appendix 4
R1 Calculation

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ENERGY AND CLIMATE CHANGE
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ENDLESS ENERGY (KEIGHLEY) LIMITED

ENDLESS ENERGY FACILITY

ENERGY REPORT
(Version 2)

NOVEMBER 2020

wardell armstrong

CONTENTS

TABLES

APPENDICES

1 BASIC ENERGY REQUIREMENTS

1.1 Energy Consumption

1.1.1 Guidance for the Recovery and Disposal of Hazardous and Non Hazardous Waste (Environment Agency, October 2003)[1] and Guidance for the Incineration of Waste and Fuel Manufactured from or Including Waste (Environment Agency, July 2004)[2] requires operators to provide a breakdown of energy consumption and generation by source and the associated emissions.

1.1.2 Figures provided for the operation of the Endless Energy Facility show that it will treat 148,800 tonnes of waste per annum. The facility has a flexible processing capacity in order to operate continuously with low calorific value (LCV) waste from 8,000 to 14,000 KJ/Kg, which accommodates a broad range of waste types. The site will run for approximately 8,000 hours per year.

1.1.3 Energy output in terms of electricity produced by the plant to the electrical grid will be around 11.35MWe. The plant converts waste to energy via combustion. The heat that is generated as a result of burning waste generates steam within a boiler which drives a turbine connected to a generator. The site uses a reverse-acting moving grate in the combustion chamber; a proven technology that can be adjusted to ensure complete combustion of variable waste types and therefore provides good energy recovery from the waste itself.

1.1.4 The boiler and associated equipment will be of the type and quality suitable for a Commercial and Industrial (C&I) waste incineration plant and will meet the steam requirements of the turbine generator as well as all other steam requirements of the plant. Heat is used to pre-heat boiler water and combustion air, improving the efficiency of the plant.

1.1.5 Diesel oil may be required for start-up and shut down of the site and to maintain temperature where required. Auxiliary burners within the furnace are designed to:

- raise the temperature in the combustion chamber prior to starting up from cold and during shutting down of the plant;

[1] Sector Guidance Note S5.06
[2] Sector Guidance Note IPCC S5.01

- ignite the waste at the start-up of the plant following shut down periods; and
- comply with the IED requirements for control of flue gas emissions. This requires that whenever the temperature falls below 850°C after a flue gas residence time of 2 seconds a standby burner must operate automatically to maintain the temperature whilst there is waste on the grate.

1.1.6 Annual consumption of diesel oil for the installation as a whole is around 60 tonnes/year. During normal operations there is no additional energy input.

1.1.7 Table 1:1 identifies the estimated total energy consumption per annum, i.e. electricity and diesel oil use. The plant operates on a parasitic load (self-consumption) when the steam turbine is in operation.

1.1.8 Energy that is generated at the plant will be exported to the National Grid. Overall approximately 11.35MW of energy will be exported to the local electricity network by an underground cable. This is sufficient to power around 20,000 homes. The facility will produce electricity but will be CHP ready and will produce a heat supply if and when a local user becomes available.

Table 1:1 Estimated Annual Energy Consumption

Energy Source	Supply units	Energy consumption		Primary Energy Consumption MWh
		Delivered Units	Conversion Factor	
Electricity (from National Grid)	MWh	334.23	2.6[1]	869
Electricity (parasitic supply)	MWh	15,280	1[2]	15,280
Diesel Oil	Kg	60,000		600
Total	MWh	16,214.23		16,749

Notes
1. Factor for conversion of delivered units to primary energy consumed in accordance with section 2.7.1 of the Environment Agency's H2 guidance Energy Efficiency)
2. The electrical consumption of the plant is produced by the plant itself.

1.2 *Specific Energy Requirements*

1.2.1 The specific energy consumption (SEC) for the site is defined as MWh per tonne of waste received. This will enable comparison of the site's SEC to industry standards.

1.2.2 The calculation of the SEC, using data from Table 1, will be made over the duration of one year and will be calculated as follows:

$$SEC = \frac{\text{total primary energy consumption (kWh)}}{\text{total amount of waste received (tonnes)}}$$

1.2.3 The calculation of SEC will be completed on an annual basis and will be included within the annual site review. Table 1:2 shows a prediction of SEC for the first year of operation at the site. It is based on a maximum waste throughput of 148,800 tonnes per annum and a total energy consumption of 16,749 MWh per annum.

Table 1:2: Projected SEC for First Year of Operation			
Year	**Total Energy Consumption (MWh)**	**Total Waste Received (tonnes)**	**Projected SEC for year (MWh/Tonne)**
1	16,749	148,800	0.113

1.2.4 It is noted that over 91% of this energy is recovered from the waste itself and so consumption of imported energy is minimal (<9% of the total).

1.2.5 The facility will produce 106,080MWh of electricity per annum, which will be used on site and exported to grid.

2 ELECTRICITY GENERATION BENCHMARK

2.1.1 Guidance for the Incineration of Waste and Fuel Manufactured from or Including Waste (Environment Agency, July 2004) provides a benchmark value for the amount of electricity generated from waste. The Guidance states that where electricity only is generated, 5 to 8MW of electricity should be recoverable per 100,000 tonnes of waste material treated.

2.1.2 The site will process 148,800 tonnes per annum of residual, commercial and industrial wastes of a similar nature to unsorted municipal solid waste. A net rating of 11.35MWe based on this quantity of waste equates to an electricity generation value of 7.6MW per 100,000 tonnes of waste for benchmarking purposes, comfortably above the benchmark figure.

2.1.3 An R1 calculation has been completed and is included in the application. This shows that the site will achieve an R1 value of 0.74 and therefore recovers clean energy with sufficient efficiency to be classed as a recovery and not a disposal operation. The full R1 calculation is attached as Appendix 1.

2.1.4 This R1 calculation accounts for the generation of electricity only. A conservative position is provided, discounting heat supplied to third parties. A heat supply will be established at the facility, allowing for heat to be provided to a nearby data hotel. Despite discounting heat supply, the R1 calculation is shown to be above the required efficiency levels.

3 ENERGY EFFICIENCY MEASURES

3.1.1 An Energy Efficiency Plan will be prepared for the site, detailing how energy usage and consumption can be minimised. Measures that are detailed within the plan will be implemented within processes at the site. The plan will be reviewed at least every four years.

3.1.2 Energy efficiency techniques and advice are detailed to staff at inductions and training sessions. This will include simple housekeeping measures such as turning of lights when leaving a room and closing doors to retain heat.

3.1.3 Low energy bulbs will be used for lighting. Daylight and motion sensors may also be used to save energy.

3.1.4 In terms of the process, this is designed to achieve high levels of efficiency with close control over the combustion process. The waste feed is sealed to prevent the ingress of air and maintain optimal oxygen levels within the furnace to ensure complete combustion whilst maintaining efficiency.

3.1.5 The boiler incorporates on-line cleaning and all heat exchange surfaces will be kept clean to ensure optimum performance. Boiler water is conditioned using ion exchange, which uses less energy than membrane based systems.

3.1.6 Steam from the turbine bleeds is utilised to pre-heat water condensate, boiler water and combustion air, improving the efficiency of the process. Options are being explored to identify potential off-takers for the remaining heat.

3.1.7 Consistent flow of waste will be maintained during operations. Real time monitoring of waste and electricity demand will be undertaken in order to ensure that the plant is running efficiently.

3.1.8 Energy consumption at the site will be monitored in accordance with the EMS. Consumption will be reviewed annually to identify trends and any areas where energy efficiency can be improved. The electricity use will be metered to provide accurate figures.

3.1.9 Buildings will be thermally insulated to reduce heat loss and minimise heating requirements. The plant is provided with a high standard of insulation both to minimise the temperature of external surfaces, as a health and safety precaution, and also to retain heat within the system and minimise losses providing a high degree of energy efficiency.

3.1.10 Energy efficiency will be a consideration in the acquisition of new plant and equipment with low energy options being selected where possible. All plant and equipment will be serviced in accordance with manufacturers' requirements to ensure that energy efficiency is maintained.

Appendix 1

R1 Calculation

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