EPR PERMIT APPLICATION SUPPORT DOCUMENT

Grid Powr (UK) Ltd
Energy Production Facility

Prepared by:
Sol Environment Ltd

Date:
June 2023

Project Issue Number:
SOL_22_PO96_GP

VERSION CONTROL RECORD				
Contract/Proposal Number:		SOL_22_PO96_GP		
Authors Name:		Sophie Rainey		
Reviewers Signature:				
Version	Description of Status	Date	Reviewer Initials	Authors Initials
1	First Submission to Environment Agency	1st June 2023	SB	SR

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Glossary of Terms

Term	Definition
Advanced Conversion Technology (ACT)	A suite of technologies which have the capacity to convert solid waste materials into gas for the generation of renewable energy. Technologies include Pyrolysis, Gasification and Anaerobic Digestion. The technologies used to utilise renewable fuels or waste include: – Direct firing open cycle steam turbine systems, – Integrated gasification combined cycle turbine systems, – Integrated pyrolysis combined cycle turbine systems, – Anaerobically generated biogas fuel in reciprocating engine or gas turbine systems.
Advanced Thermal Treatment (ATT)	A subset of ACT that specifically includes sub-stoichiometric thermal treatment of waste to produce a combustible synthetic gas (syngas).
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
BTEX	BTEX is an acronym that stands for benzene, toluene, ethylbenzene, and xylenes.[1] These compounds are some of the volatile organic compounds (VOCs) found in petroleum derivatives such as petrol (gasoline). Toluene, ethylbenzene, and xylenes have harmful effects on the central nervous system.
By-product	A by-product is a secondary product derived from a manufacturing process or chemical reaction. It is not the primary product or service being produced.
CHP	Combined Heat and Power Plant (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process.
CHPQA	The CHPQA (Quality Assurance for Combined Heat and Power) programme is carried out on behalf of the Department for Business, Energy and Industrial

	Strategy, in consultation with the Scottish Executive, the National Assembly for Wales, and the Northern Ireland Department of Enterprise, Trade and Investment.
DEFRA	Department for Environment, Food and Rural Affairs.
Dioxin	Dioxins and dioxin-like compounds, a diverse range of chemical compounds which are known to exhibit "dioxin-like" toxicity. In chemistry, a dioxin is a heterocyclic 6-membered ring, where 2 carbon atoms have been replaced by oxygen atoms.
Eutrophication	Eutrophication or more precisely hypertrophication, is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilisers or sewage, to an aquatic system
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
Gasification	Gasification is a process that converts organic or fossil based carbonaceous materials into carbon monoxide, hydrogen, methane and carbon dioxide. This is achieved by reacting the material at high temperatures (>700°C), without combustion, with a controlled amount of oxygen and/or steam.
HVAC	HVAC (heating, ventilation, and air conditioning) is the technology of indoor and vehicular environmental comfort.
ISO14001	ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NOx	Nitrogen oxides.
O_3	Ozone.
PAH	Polycyclic aromatic hydrocarbons (PAHs), also known as poly-aromatic hydrocarbons or polynuclear aromatic hydrocarbons, are potent atmospheric pollutants that consist of fused aromatic rings and do not contain heteroatoms or carry substituents. Naphthalene is the simplest example of a PAH. PAHs occur in oil, coal, and tar deposits, and are produced as by-products of fuel burning (whether fossil fuel or biomass).

	As a pollutant, they are of concern because some compounds have been identified as carcinogenic, mutagenic, and teratogenic.
Percentile	The percentage of results below a given value.
PLC	A Programmable Logic Controller, PLC or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
PPB parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.
PPM parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Pyrolysis	Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
RDF	Refuse-derived fuel (RDF) or solid recovered fuel/ specified recovered fuel (SRF) is a fuel produced by shredding and dehydrating solid waste (MSW) with a Waste converter technology. RDF consists largely of combustible components of municipal waste such as plastics and biodegradable waste.
Renewable Energy	Renewable energy is generally defined as energy that comes from resources which are continually replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy is also defined under the Renewable Energy Directive as comprising energy from the biomass fraction of waste.
ROC	Renewable Obligation Certificates
SCADA	SCADA (supervisory control and data acquisition) is a type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes.
SCR	Selective catalytic reduction (SCR) is a means of converting nitrogen oxides, also referred to as NOx with the aid of a catalyst into diatomic nitrogen, N_2, and water, H_2O. A gaseous reductant, typically anhydrous ammonia, aqueous ammonia or urea, is added to a stream of flue or exhaust gas and is adsorbed onto a catalyst.
SRF	SRF can be distinguished from RDF in the fact that it is produced to reach a standard such as CEN/343 ANAS.

Synthesis Gas (Syngas)	Syngas, or synthesis gas, is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, methane and very often some carbon dioxide. The name comes from its use as intermediates in creating synthetic natural gas (SNG) and for producing ammonia or methanol.
µg/m^3 micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
VSD	Adjustable speed drive (ASD) or variable-speed drive (VSD) describes equipment used to control the speed of machinery. Many industrial processes such as assembly lines must operate at different speeds for different products. Where process conditions demand adjustment of flow from a pump or fan, varying the speed of the drive may save energy compared with other techniques for flow control.

NON TECHNICAL SUMMARY

Grid Powr (UK) Ltd (the '*Applicant*' or the *'Operator'*) is making a New Bespoke Installation Permit Application for the proposed operation of a newly constructed renewable energy generation facility at their site on land off the Houghton Main Colliery Roundabout, Park Spring Road, Houghton Main, Barnsley.

The facility ('the Site') is located at Park Spring Road, Houghton Main, Barnsley, S72 7GX. National Grid Reference: SE 41640 06444.

The proposed development is a renewable energy generation facility which has been designed to recover energy from Refuse Derived Fuel (RDF) feedstocks using combustion and gasification, specifically for the production of electricity. The facility is an Advanced Thermal Treatment (ATT) process that will produce a combustible synthesis gas in a close coupled combustion process, which is then used to raise steam and generate electricity, through steam cycle turbine generation.

The Advanced Thermal Treatment (ATT) plant is designed to use Refuse Derived Fuel (RDF) feedstocks to produce heat to raise steam in a conventional tube boiler for utilisation in a steam turbine for the production of renewable electricity with a gross electrical output of up to 16MWe.

The Installation has been designed to process a maximum of 145,000 tonnes of pre-prepared Refuse Derived Fuel (RDF) per annum.

The treatment process will be permitted by the Environment Agency as a Waste Co-Incineration Activity and will be operated in accordance with the Environmental Permitting Regulations 2018 and Chapter IV of the Industrial Emissions Directive (IED).

The proposed process meets the definition of an Installation as defined by Section 5.1 *'Incineration and Co-Incineration of Waste'* paragraph A(1)(b) namely:

'The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.'

General Overview

Refuse Derived Fuel (RDF) will be delivered directly to the Fuel Reception Hall. HGV's will unload in the internal offloading area and a visual inspection will take place. The delivered RDF feedstocks will then be transferred directly to the pre-processing equipment which consists of two shredders, two magnetic separators and two eddy-current separators. Once pre-processed the RDF will then be transferred to one of two bunkers for storage prior to loading via crane into the hybrid combustion system.

The site will have two gasification and combustion lines each with an independent fuel feed system. The fuel feed system will deliver the waste into the system where the waste will be gasified to produce a synthetic gas (syngas). The syngas is then combusted for the purposes of raising superheated steam through a steam boiler plant.

The superheated steam then passes to a Steam Turbine and Generator for the production of renewable electricity with a gross electrical output of up to 16MWe.

Exhaust steam from the turbine is then sent to an air cooled condenser (ACC) to be condensed and returned to the system.

Detailed Computational-Fluid-Dynamic modelling (CFD) of the gasification and combustion process will be carried out to demonstrate syngas production and complete combustion of the fuels under varying conditions and also to guarantee the 2 seconds minimum syngas combustion time above 850°C as compliance with IED.

Flue gas cleaning and pollution control consists of Selective Non-Catalytic Reduction (SNCR) through ammonia hydroxide injection within the combustion chambers, Selective Catalytic Reduction (SCR) through ammonia hydroxide injection into the flue gas after the bag filtration unit, sodium bicarbonate injection for acid gas neutralisation and activated carbon powder injection for absorption and removal of heavy metals, dioxins, VOCs and other harmful substances.

Emissions to Air

There will be a single wind shield stack (45m) comprising two (one per process line) flues (A1 and A2) for the discharge of cleaned flue-gas to atmosphere.

All combustion products / flue gases are passed through multiple gas clean up stages and abatement stages resulting in all emissions to atmosphere being comfortably within the stipulated Emission Limit Values (ELVs) for Chapter IV IED activities and the Waste Incineration BREF limits.

Odour

Due to the design of the building structure and the fully enclosed RDF handling activities, there is very little potential for offsite odour emissions and impacts to arise from the site.

Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed. The unloading of waste will take less than 5 minutes per HGV.

To avoid any odour emissions from the building, the building is kept at slight negative pressure. An air extraction system will be in place resulting in odourous air within the building being thermally destroyed by the combustion system.

Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the surface water drainage system (W1).

Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of 4m^3/hr of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant.

All domestic foul effluent arisings will also be discharged via sewer.

All emissions to sewer will be monitored in line with the sites effluent discharge consent once granted.

In the event of a significant site fire, the facility has been designed to fully contain any firewater run-off. In the event of a fire within the bunkers, any water from the suppression system will be contained within the bunkers. In the event of a fire within the waste offloading area, the slab and floor areas are designed such that all firewater will be contained within the building. The building will have a bunding system to stop any potentially contaminated firewater escaping which will be finalised during detailed design. The firewater collected will be tankered off site for disposal.

Emissions to Land

There will be no emissions to land arising from the Installation.

Waste Management

There are two principle types of solid by-products produced from the operation of the combustion facility. These are:

- Bottom Ash; and
- APC Residue (Air Pollution Control (APC) residues).

The by-products will be collected in suitable sealed containers and exported off site for reprocessing / disposal.

Impact

The air emissions from the proposed development have been modelled using the UK Atmospheric Dispersion Modelling System (ADMS) dispersion model.

The air quality impact assessment considered the air impact to all identified residential, sensitive habitat and ecological receptors.

It is the conclusion of the modelling that predicted maximum off-site concentrations are assessed as 'not significant' or well below the relevant air quality standards for all pollutants considered.

The habitat assessment considered the impact of airborne concentrations of the oxides of nitrogen, sulphur dioxide, ammonia and hydrogen fluoride. Predicted concentrations were compared to relevant critical levels. In addition, the impact of nutrient nitrogen deposition and acidification were assessed with deposition fluxes compared to the most stringent critical loads for the habitats present at each designated site. Where the impacts could not be screened out (i.e. long term exposure is greater than 1% or short term exposure is greater than 10% of the relevant critical levels/loads) an interpretation of the likelihood of effects on the habitat sites has been provided by the project ecologist.

All of the air emissions from the Installation have been risk assessed against their potential impact on human health. The results of the assessment are that the proposed installation will not present any risk to human health.

1. INTRODUCTION

This document has been prepared on behalf Grid Powr (UK) Ltd (GP or the Applicant hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environmental Permit Application Forms B2 and B3 issued by the Environment Agency (EA).

The Applicant is making this application for a Bespoke Part A(1) Installation Permit Application under The Environmental Permitting (England and Wales) (Amendment)Regulations 2018 for the proposed operation of a renewable energy generation facility incorporating Advanced Thermal Treatment.

The facility ('the Site') is located at Park Spring Road, Houghton Main, Barnsley, S72 7GX. National Grid Reference: SE 41640 06444.

The proposed development is a renewable energy generation facility which has been designed to recover energy from Refuse Derived Fuel (RDF) feedstocks using combustion and gasification, specifically for the production of electricity. The facility is an Advanced Thermal Treatment (ATT) process that will produce a combustible synthesis gas in a close coupled combustion process, which is then used to raise steam and generate electricity, through steam cycle turbine generation.

The Advanced Thermal Treatment (ATT) plant is designed to use Refuse Derived Fuel (RDF) feedstocks to produce heat to raise steam in a conventional tube boiler for utilisation in a steam turbine for the production of renewable electricity with a gross electrical output of up to 16MWe.

The Installation has been designed to process a maximum of 145,000 tonnes of pre-prepared Refuse Derived Fuel (RDF) and Solid Recovered Fuel (SRF) per annum.

The main features of the proposed Installation, as described in this document are as follows:

- *Fuel Reception Hall:* For the delivery and reception of RDF feedstocks;
- *RDF Pre-processing:* For the screening and shredding of the fuel feedstocks to reduce the particle size and remove oversize from the RDF stream;
- *Two-stage Hybrid Combustion System:* Comprising two gasification and combustion lines for the thermal conversion and combustion of syngas from the fuel feedstocks;
- *Steam Turbine Generator:* Comprising a steam turbine and generator for the conversion of steam into electricity within a steam turbine; and
- *Gas Cleaning and Pollution Abatement Plant:* Consisting of Selective Non-Catalytic Reduction (SNCR) through ammonia hydroxide injection within the combustion chambers, Selective Catalytic Reduction (SCR) through ammonia hydroxide injection into the flue gas after the bag filtration unit, sodium bicarbonate injection for acid gas neutralisation and activated carbon

powder injection for absorption and removal of heavy metals, dioxins, VOCs and other harmful substances.

The Installation will make an important contribution to regional waste management and local renewable energy generation and will provide a single treatment facility for RDF materials that would otherwise be destined for landfill, incineration or foreign export.

The close coupled combustion process meets the definition of a Listed Activity as defined by Schedule 1 of the Environmental Permitting Regulations 2018.

Therefore, the proposed facility meets the definition of an Installation as defined by Section 5.1 *'Incineration and Co-Incineration of Waste'* paragraph A(1)(b) namely:

'The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.'

The remainder of this application support document is structured accordingly:

- Section 2: Provides a detailed planning history of the site and associated activities;
- Section 3: Provides specific details associated with the New Bespoke Installation Permit Application;
- Section 4: Provides specific nature and detailed description of the emissions to air, water emissions and waste associated with the Installation;
- Section 5: Provides details of all environmental monitoring associated with the Installation;
- Section 6: Provides a BAT description of the proposed technology and provides a comparison against the applicable guidance and emission limit values for the Installation; and
- Section 7: Provides an Environmental Impact and Assessment of the Installation against the requirements of the Habitats Directive.

All technical appendices associated with the Installation are included within the technical annexes and comprise the following:

- Annex A: Figures;
- Annex B: Technical Information;

- Annex C: Environmental Risk Assessment;
- Annex D: Air Quality Assessment and HHRA;
- Annex E: Noise Impact Assessment;
- Annex F: Site Condition Report;
- Annex G: EMS Summary;
- Annex H: Accident Management Plan;
- Annex I: Fire Prevention Plan;
- Annex J: Odour Management Plan;
- Annex K: CHP Assessment;
- Annex L: Global Warming Potential (GWP);
- Annex M: Planning Permission.

The location of the Installation is provided overleaf in Figure 1.1.

The site layout and Installation Boundary is provided in Figure 1.2.

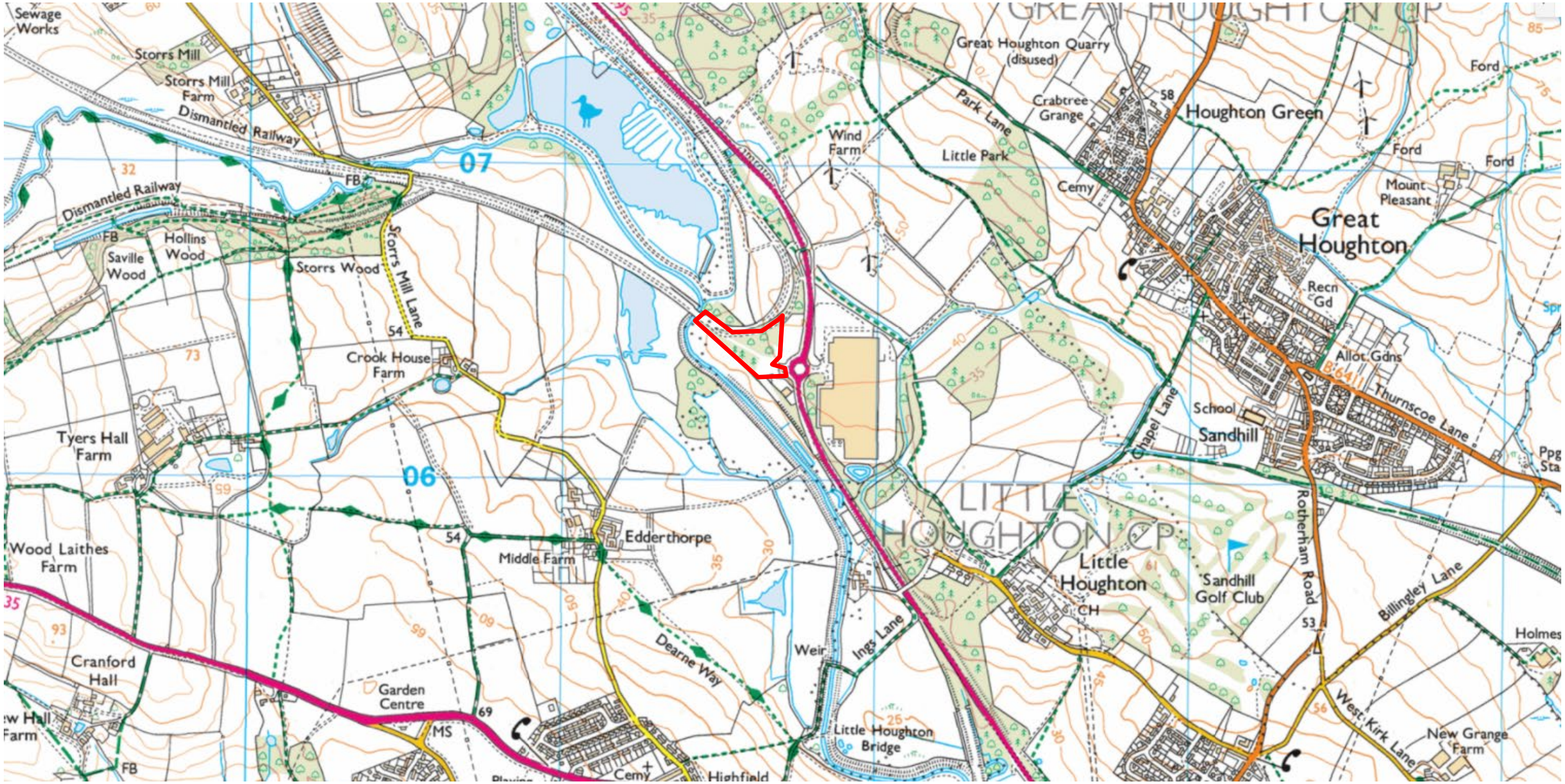

Figure 1.1: Site Location (OS licence Ref: 100062750)

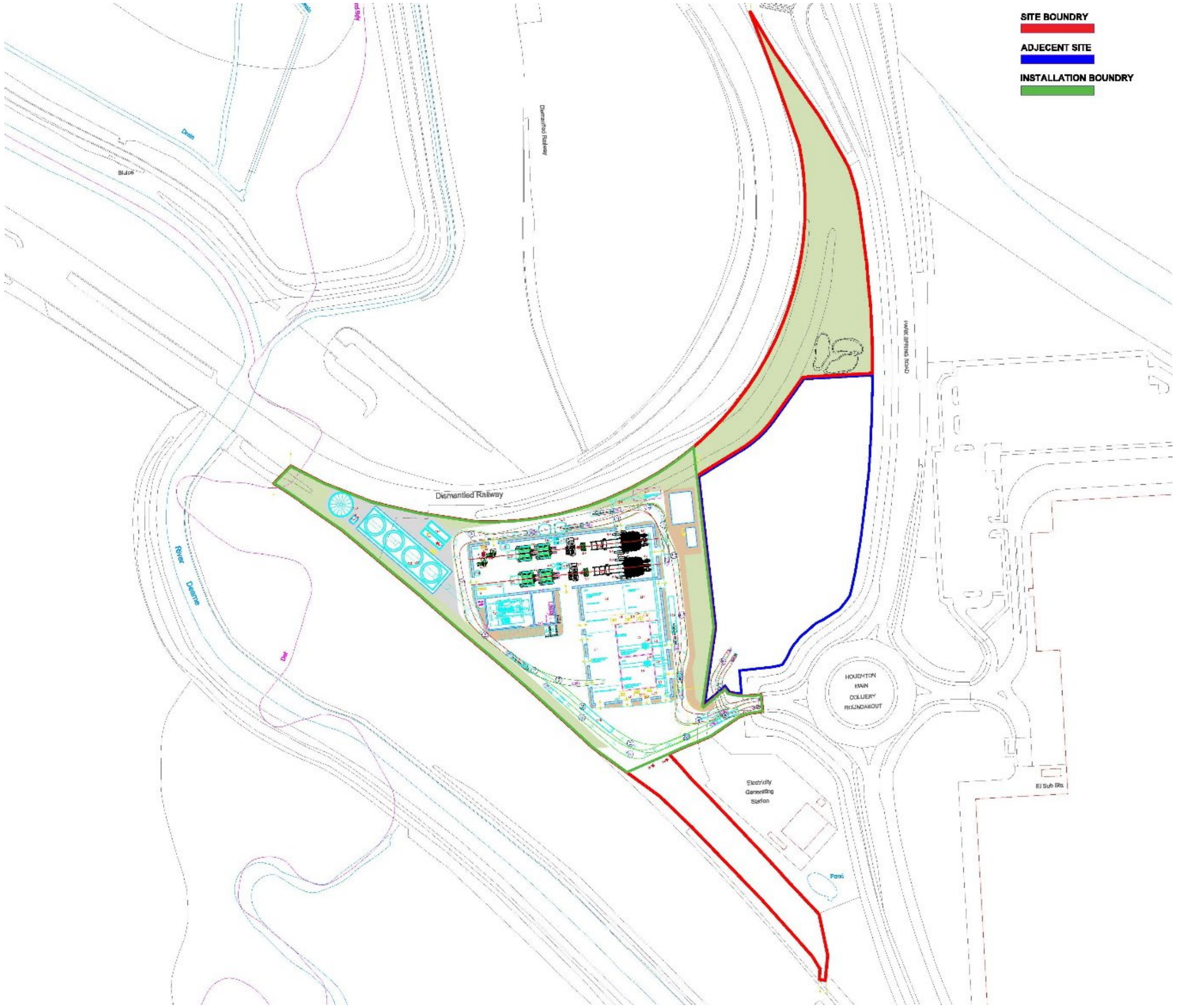

Figure 1.2: Installation Boundary and Site Layout (labelled version shown in Annex A – Site Plans)

2. PLANNING STATUS

The site benefits from existing planning determined by Barnsley Metropolitan Borough. The main application was successfully granted on 29th June 2015 with two subsequent variations to conditions applications made in 2019. A further non-material amendment to the planning application was granted in 2023 relating to the partial lowering of a roof section of the main boiler hall.

The 2015 Planning Permission has been included within *Annex E – Planning Permission* and the details pertaining to all known planning permissions are provided in Table 2.1 below.

Table 2.1: Planning History

Reference	Description	Status	Date Granted
2019/0941	Variation of Condition 1 of application 2018/1437 to allow alterations to the design, scale and layout of the Renewable Energy Park	Granted	14/11/2019
2018/1437	Variation of conditions (4, 17 ,18 ,19 and 20) of application 2015/0137 Erection of a Renewable Energy Park to allow for Refuse Derived Fuel (RDF) and waste wood to be used for energy recovery, to increase the capacity limit and daily traffic movements along with amended routing of delivery vehicles and to extend construction hours.	Granted	17/04/2019
2015/0137	Erection of a Renewable Energy Park comprising of a Timber Resource Recovery Centre and associated infrastructure.	Granted	29/06/2015

3. PROPOSED ACTIVITIES

3.1 Type of Permit

The Applicant is making an application for a Bespoke Installation Permit for the proposed operation of a waste to energy plant utilising Advanced Thermal Treatment in Barnsley.

The Installation will typically accept a maximum of 145,000 tonnes of prepared Refuse Derived Fuel (RDF) which will be thermally treated through a two-line hybrid combustion plant to produce synthesis gas for combustion and the production of steam to produce renewable electricity with a gross electrical output of up to 16MWe.

The use of Advanced Thermal Treatment and the generation of heat and power meets the definition of an *'Co-incineration Plant'* as defined by Chapter 5 *'Waste Management'* of Schedule 1 of the Environmental Permitting Regulations.

The Installation has been designed to accept non-hazardous RDF in accordance with stringent site waste acceptance procedures and agreed specification. All waste will be contracted and supplied to meet the specification provided in Table 3.2. All incoming waste feedstocks will be subject to a suite of pre-acceptance, acceptance and inspection procedures. Any non-conforming wastes will be rejected, separated and quarantined.

The applicant is making an application for an Environmental Permit to carry out the following listed activities:

Table 3.1: IED Activities			
Activity listed in EP Regulations 2013	Description of Specified Activity	Limits of Specified Activity	Specified Waste Management Operation
Section 5.1 'Incineration and Co-incineration of Waste' paragraph A(1)(b)	The incineration and co-incineration of non-hazardous waste using Advanced Thermal Treatment.	The reception, storage and combustion of non-hazardous RDF feedstocks to produce steam for the generation of renewable electricity. Installation includes all ancillary activities including emissions abatement and electrical generation.	R1: Use principally as a fuel or other means to generate electricity. R13: Storage of waste pending the operations numbered R1
Directly Associated Activities			
Electricity Generation	Generation of up to 16MWe electrical power	From receipt of steam to export of electricity for	-

	using a steam turbine from energy recovered from the flue gas.	either on-site use or export to the grid.	
Back-up Diesel Generator	For providing emergency electrical power to the plant in the event of supply interruption.	From receipt of fuel to generation of electricity for on-site use and emission of exhaust gas.	

The technical guidance notes used in the preparation of this application document are:

- Waste Incineration BREF;
- EPR – The Incineration of Waste (reference EPR 5.01); and
- Environment Agency Guidance on Environmental Permits.

The main issues identified within these guidance documents and the relevant Best Available Techniques have been built into the site operation procedures that will form the management systems and working plans for the site.

3.2 Installation Boundary

All proposed operations will be contained within the wider site ownership boundary. A figure showing the proposed building configuration and Installation boundary has been provided in Section 1, Figure 1.2.

A Site Condition Report that provides a baseline conceptual model for the site has been completed and included within *Annex F – Site Condition Report* of this document.

The Site Condition Report neither indicates that the existing site presents a significant contamination risk, nor does it identify any aspect of the new Installation that presents a potential risk to the environment.

All aspects of the new Installation have been designed in accordance to the Environment Agency's Pollution Prevention Guidance and Horizontal Guidance Notes.

3.3 Infrastructure and Design

The facility is to be newly constructed in its entirety including all drainage, foundation works, steel structure and structural slabs, intermediate floors, stairs, external clad walls, roof system, glazing and external doors.

The facility will consist of the following:

- Fuel Reception Hall;
- Fuel Handling System;
- 2 x Hybrid Gasification and Combustion Units (heating, drying and two stage combustion);

- Flue Gas Cleaning System comprising SNCR, SCR, reagent injection and bag filtration;
- Steam Boiler with Economiser;
- Turbine and Generator Set with Air Cooled Condenser;
- Ash Handling and Storage Systems;
- A 45m high exhaust stack;
- Continuous Emissions Monitoring Systems; and
- Water Treatment Plant.

Site Drainage

There will be no direct process emissions to controlled water arising from the Installation.

All activities on site take place within the main building. There is no external storage or processing that takes place external to the main building.

The building provides both secondary and tertiary containment. Any spillages, leaks or incidents arising within the building will be effectively contained and captured within the footprint of the main building.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the existing surface water drainage system (W1).

Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of $4m^3$/hr of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant.

All domestic foul effluent arisings will also be discharged via sewer.

All emissions to sewer will be monitored in line with the sites effluent discharge consent once granted.

Above ground drainage shall be designed in accordance with BS EN 12056.

In the event of a significant site fire, the facility has been designed to fully contain any firewater run-off. In the event of a fire within the bunkers, any water from the suppression system will be contained within the bunkers. In the event of a fire within the waste offloading area, the slab and floor areas are designed such that all firewater will be contained within the building. The building will have a bunding system to stop any potentially contaminated firewater escaping which will be finalised during detailed design. The firewater collected will be tankered off site for disposal.

Tanks and Bunds

All storage tanks will be installed with secondary containment and be designed to comply with the necessary standards and pollution prevention guidance.

All storage tanks associated with the process are detailed within Table 3.4.

Roadways and External Areas
An internal roadway system has been designed to give safe access to all areas of the site.

Segregated pedestrian walkways and car parking areas have been provided to allow for safe access and egress of all personnel at site.

3.4 Description of the Process

The Applicant has designed an energy generation plant that utilises a twin line combustion plant to produce a combustible synthesis gas from RDF feedstocks which will be used to raise steam and generate energy.

The principle components of the process comprise the following:

- *Waste Acceptance and Reception:* Refuse Derived Fuel (RDF) will be delivered directly to the Fuel Reception Hall. HGV's will unload in the internal tipping area and a visual inspection will take place. The delivered RDF feedstocks will then be transferred either directly to the pre-processing plant or to one of two fuel bunkers. The RDF will be stored within the temporary storage area for no longer than 1 day before being transferred to the pre-processing plant.

- *Mechanical Polishing Plant:* The inspected RDF feedstocks will then be transferred directly to the pre-processing equipment which consists of two shredders, two magnetic separators and two eddy-current separators. Once pre-processed the RDF will then be transferred to one of two bunkers for storage prior to loading via crane into the hybrid combustion system.

- *Hybrid Combustion System*: The site will have two gasification and combustion lines each with an independent fuel feed system. The fuel feed system will deliver the waste into the combustion system where the waste will be gasified to produce a synthetic gas (syngas). The syngas is then combusted for the purposes of raising superheated steam through a steam boiler plant.

- *Electricity Generation:* The superheated steam then passes to a Steam Turbine and Generator for the production of renewable electricity with a gross electrical output of up to 16MWe.

- *Flue-Gas Cleaning:* Flue gas cleaning and pollution control consists of Selective Non-Catalytic Reduction (SNCR) through ammonia hydroxide injection within the combustion chambers, sodium bicarbonate injection for acid gas neutralisation and activated carbon powder injection for absorption and removal of heavy metals, dioxins, VOCs and other harmful substances. The resulting flues gases are subsequently filtered through a modular gas filtration system and passed through a Selective Catalytic Reduction (SCR) to facilitate further NOx and ammonia slip reduction.

More detailed equipment specifications have been included within Section 3. A simplified process layout is provided in Figure 3.1 below.

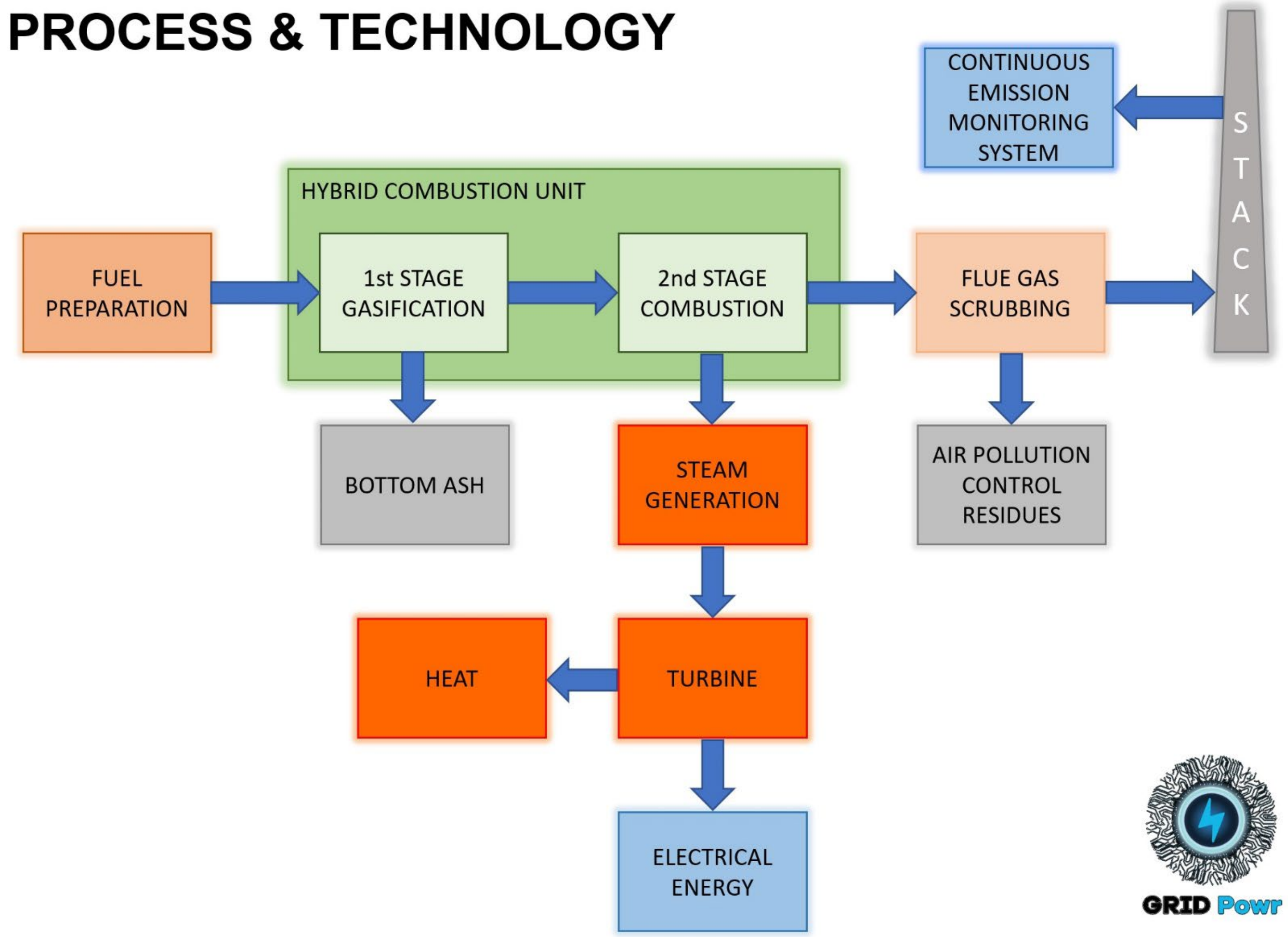

Figure 3.1: Simplified Process Schematic

3.5 Raw Materials

Waste Feedstocks

The Installation will typically accept a maximum of 145,000 tonnes of pre-prepared Refuse Derived Fuel per annum.

Prior to processing, all wastes accepted on site will be subjected to stringent waste acceptance criteria in accordance with the site environmental management plan and associated procedures.

Table 3.2 below describes the feedstock specification as well as the maximum range.

Table 3.2: RDF Fuel Specification

Parameter	Unit	Ranges or Upper Limits (on an as received basis)
Net Calorific Value	MJ/kg	12 (8 – 15)
Sulphur Content	% w/w	<0.8
Chlorine Content	% w/w	<1.2
Nitrogen	% w/w	<1.5
Sodium and Potassium	mg/Kg	600
Zinc	ppm	<300
Lead	ppm	<200
Moisture Content	% w/w	15 – 40
Bulk Density (loose / uncompacted)	kg/m^3	130 – 400
Particle Size	mm	Solid in pieces with diameter between 1mm and 300mm in all dimensions
Ash Content	% w/w	<30
Dust (<5mm)	% w/w	<5

A detailed list of European Waste Catalogue (EWC) codes of wastes that will be accepted by the Installation is provided in Table 3.3 overleaf.

Table 3.3: Proposed Feedstock EWC Codes and Types	
Waste Code	Description
19	WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
20	MUNICIPAL WASTE AND SIMILAR MATERIALS FROM COMMERCE AND INDUSTRY
20 03	**other municipal wastes**
20 03 01	mixed municipal waste

Notwithstanding the EWC's codes stipulated in Table 3.3 above, RDF shall not be accepted at the site which has any of the following characteristics:

- Hazardous wastes;
- Consisting solely or mainly of dusts, powders, loose fibres or liquids;
- Defined as Infectious;
- Drummed waste; or
- Malodourous wastes.

Process Consumables

Table 3.4: Raw Materials Summary			
Material	Nature of storage	Location	Fate
Refuse Derived Fuel	Fuel used to generate synthesis gas Typically, 130,000 tonnes per annum at a calorific value of 12 MJ/kg Maximum, 145,000 tonnes per annum at a calorific value of 9.5 MJ/kg	Stored within the Fuel Reception Hall	Thermally converted to ash
Diesel	Used for the auxiliary burners / generator Stored in an external 90m^3 tank and an internal 1,000 litre tank which is automatically refuelled from the 90m^3 tank	External	Used as start up and support fuel
Lubrication, Hydraulic and Turbine Oils	Internal Bunded oil tank Approximately ~1,000 litre tank	Internal	Used within main plant
Ammonia (24.5%)	Stored in internal bunded tank (2 x 50m^3) Approximately 1,235 tonnes per annum	Internal	Reacts with flue gas and discharged to atmosphere
Sodium Bicarbonate	Internal bunded silo (2 x 80m^3) Approximately 1,955 tonnes per annum	Internal	Reacts with acid gases and discharged as APC residue. All APC residue will be transferred off site and reprocessed.
Activated Carbon	Internal bunded silo (2 x 70m^3) Approximately 100 tonnes per annum	Internal	Discharged as APC residue. All APC residue will be transferred off site and reprocessed.
Boiler Chemicals	Internal 1m^3 IBC's • Chemical oxygen scavenger (as NALCO 4221) – 4 x 1 m^3 • Condensate corrosion inhibitor (as NALCO 72310) – 4 x 1 m^3 • Boiler internal treatment (as NALCO 72215) 4 x 1 m^3	Internal	Used within the boiler plant
Water Treatment Chemicals	Internal bunded storage tanks <5m^3. Proprietary item	Internal	Used within water treatment system and ultimately discharged to surface water drainage system.

Table 3.4: Raw Materials Summary			
Material	Nature of storage	Location	Fate
CEMS Calibration Gases	Stored within 50l cylinder	Gas Compound	Used within CEMS equipment
Maintenance Fluids (grease, oil etc)	Handheld items	Maintenance area	Used for general maintenance activities

3.6 RDF Reception and Pre-Processing

All vehicles will enter the site and report to the weighbridge at the site entrance to weigh and record the delivered RDF in accordance with the sites waste acceptance procedures. All incoming and outgoing HGV delivery vehicles will be recorded via the weighbridge.

All vehicles will be directed from the weighbridge to the Fuel Reception Hall. Entry to the Fuel Reception Hall is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the offloading area. The doors are fitted with integrated air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed. The unloading of waste will take less than 5 minutes per HGV.

Waste will initially be stored in the vehicle offloading area prior to transfer to the pre-processing area. The offloading area has the following dimensions 30m long and 16.5m wide and RDF will be stored at a maximum of 2m high (990m^3). Waste will be stored in 3 separate piles within this area in line with the 3 vehicle delivery doors.

All waste inspections will take place in accordance with the sites waste acceptance procedures.

The RDF feedstocks will then be transferred directly to the pre-processing equipment which consists of two shredders, two magnetic separators and two eddy-current separators. Once pre-processed the RDF will then be transferred to one of two bunkers for storage prior to loading via crane into the hybrid combustion system. Each bunker can store 2,600m^3 and has been designed for 3 days of operation at the plant's full capacity.

All waste will be stored in accordance with the site Fire Prevention Plan which is provided within *Annex I – Fire Prevention Plan.*

To avoid any odour emissions from the building, the building is kept at slight negative pressure. Air from within the building is extracted into the intake of the primary combustion air fans and any odorous compounds thermally destroyed.

3.7 Fuel Transfer

From the storage bunkers, RDF is transferred to the hoppers of the fuel feeding units which are positioned above the two hybrid combustion chambers. The screw feeding units provide a continuous and steady fuel transport into the combustion chambers. The continuous screw feeding system provides a uniform two stage combustion of fuel and thereby minimises the extreme values of CO and TOC emissions.

Feeding of the RDF feedstocks into the primary chamber begins once the temperature inside the secondary chamber is above 850^{o}C. Auxiliary fuel (diesel) burners will be used during start up to ensure this temperature is reached and sustained. If the temperature falls below 850°C or if emissions exceed the emission limit values, the waste feeding system will stop.

The two fuel bunkers will be fitted with an automatically and manually controlled crane. The crane will transport fuel from the fuel bunkers into the intermediate storage which will serve as a fuel buffer during dosing.

3.8 Fuel Feeding Units

Each combustion and gasification line has three fuel feeding units consisting of two screw feeders (six screw feeders in total). Above each pair of screws, a larger but shorter dividing screw is placed at 90° angle, which distributes the fuel equally between the two pairs of feeding screws depending on the level of the fuel in each hopper. Above the dividing screw a cellular lock is installed, which shuts down the fuel transportation system in case of a system failure.

Each fuel feeding screw is equipped with a double safety system to prevent heat and gas transfer back into the fuel feed system. All feed systems are fitted with fire and heat detection coupled to the plant safety control systems. In case of an increased temperature of the housing, an electromagnetic valve is activated first. If the fire is not successfully extinguished the thermostatic valve also opens. A manual barrier flap is installed for stopping the fire from spreading into the fuel storage.

Fuel dosing into the primary chamber begins after the temperature in the secondary chamber has reached 850°C as required by the Industrial Emissions Directive. If the temperature in the secondary chamber cannot be sustained for a longer period of time (even with the help of the auxiliary burners), the fuel dosing is stopped.

3.9 Hybrid Combustion Unit – Heating, Drying and Two Stage Combustion

The two-stage combustion process converts carbonaceous materials contained within the fuel feedstocks, into a synthesis gas predominantly comprising methane (CH_4), carbon monoxide (CO) and hydrogen (H_2). The thermal conversion to syngas takes place in the primary chamber by thermally treating the fuel at high temperatures in a reduced (sub-stoichiometric) atmosphere with a controlled amount of oxygen (air).

In the primary chamber a temperature of 500–850°C is required. Sub-stoichiometric conditions must prevail within the chamber in order to provide the environment for the two-stage combustion process. The quantity of primary air must be carefully controlled and regulated in order to provide optimal conditions for drying and gasification of the fuel.

In the secondary chamber (thermal reactor) careful supply of the secondary air in the mixing zone generates an optimum mixture of air and syngas. In the subsequent zone this mixture is completely oxidised, where complete combustion is ensured by correct mixing procedure and by supplement of the tertiary air. Diesel burners will be installed for preheating of the secondary chamber during start-up and for sustaining the minimum required temperature as required by IED.

The Gird Powr designed combustion system utilises a reciprocating grate system. It is designed with an inclination of 35/15° and is divided into three sections. In the first section fuel is heated and dried with the help of recirculated flue gases, which increase the temperature of the fuel and prepare it for first stage of combustion. On the second section of the grate fuel is ignited and gasified with syngas being produced due to sub-stoichiometric conditions.

The syngas is mostly composed of H_2, CO and small amount of unoxidised hydrocarbons, plus water vapor, N_2 and other elements found in the air or fuel. This results in the syngas having a high calorific value and allows subsequent oxidation to take place in the secondary chamber. The last section of the grate is where a burn-out and complete oxidation of the solid fuel takes place and thus minimising the TOC content of the residue.

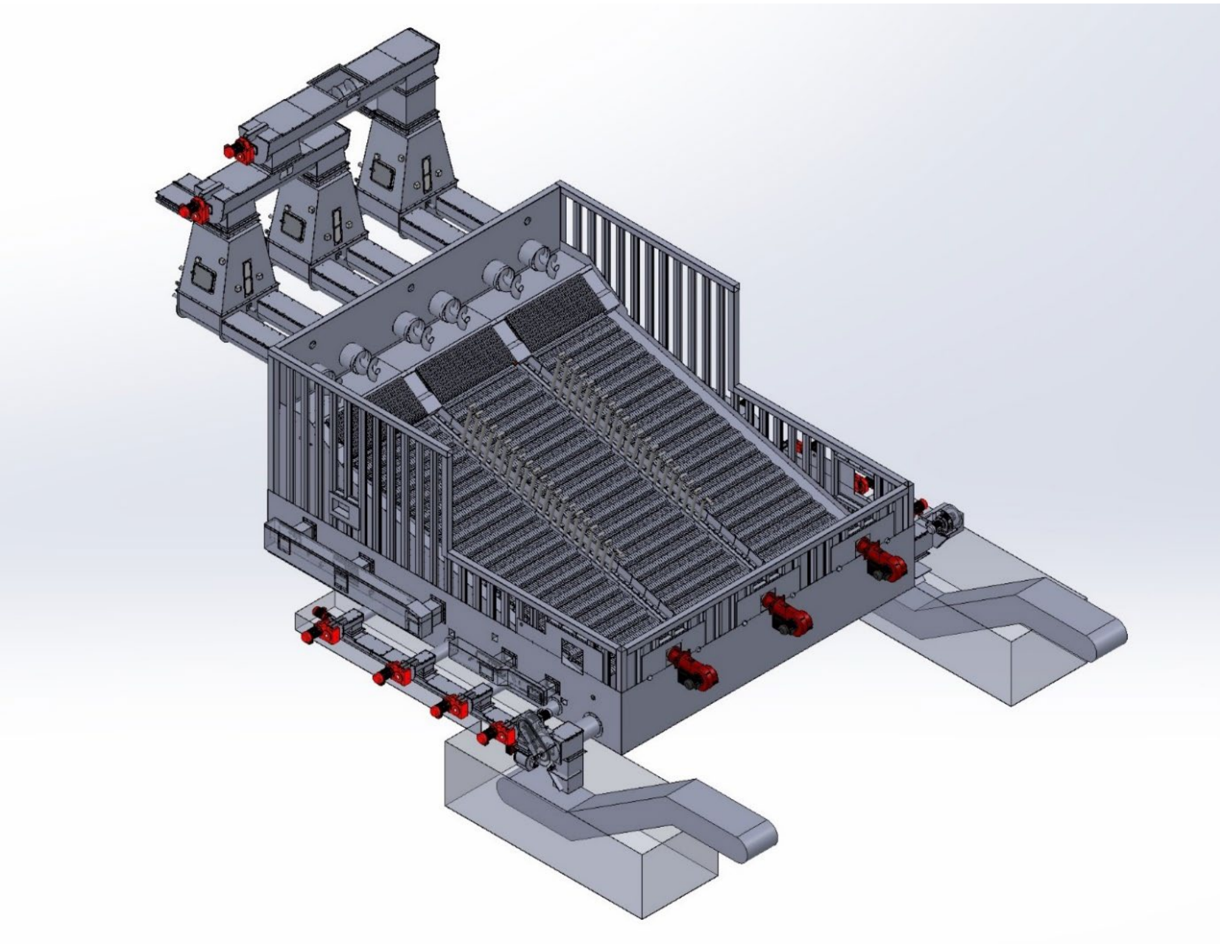

Figure 3.2: Hybrid Combustion Unit

The primary chamber is internally coated with high-temperature resistant refractory. The outside of the chamber consists of water-cooled membrane walls. The grate is constructed of a chrome-based alloy allowing thermal and chemical resistance. The cooling of the grate is achieved by blowing primary air and recirculated flue gas across to surface.

At the bottom of the chamber is a hydraulically operated step grate, designed to push the fuel forward into the last ash trough equipped with a water-cooled screw. Speed of the step grate is adjusted according to the fuel combustion algorithms. Moving of the grate is programmed in order to achieve optimum dwell time of the fuel inside the combustion unit ensuring high efficiency.

At the end of the chamber a water cooled screw-type ash transporter is installed, which is used for the transport and cooling of the resultant ash. Ash is then stored within an ash container prior to transfer off site.

Primary air is supplied by variable-speed drive fans into the sections below the grates and the side walls of the primary chamber. To prevent excessive temperatures in the primary chamber the recirculation of flue gases is utilised.

3.10 Steam Boiler

The boiler system has been specially designed to process the hot gases produced from the gasification and combustion of RDF waste and produces high pressure superheated steam. The design of the boiler consists of a natural circulation water tube boiler with steam superheating.

The boiler plant consists of:

- Feedwater tank with deaerator;
- Feedwater pumps;
- Boiler water conditioning system;
- Economiser;
- Drum;
- Membrane walls;
- Evaporator packages;
- Superheater packages (SH 1, SH 2 and SH3) with intermediate coolers;
- Internal and external boiler piping;
- Water and steam quality monitoring system;
- Safety, measurement and control equipment;
- Fly ash cleaning system (hammering and soot blowers);
- Deashing system; and
- Flash steam system.

In the feedwater deaerator, water is heated to 105°C with low pressure steam to remove gases from the feedwater. In the feedwater tank, pH correction and oxygen scavenger are dosed. Feedwater pumps pump the water through the economiser, where it is preheated.

The boiler piping distributes the water to the membrane walls and evaporator where saturated steam is produced. A mixture of steam and water is separated in the drum and the steam transferred to the superheaters for intermediate cooling for temperature regulation.

Table 3:5: Indicative BAT Requirements for the Combustion Systems and Boilers	
Minimise dioxin production by boiler design and operation	
Avoidance of slow rates of combustion gas cooling between 450 and 200°C.	• A system has been designed to ensure that flue gas is rapidly cooled through the critical de novo synthesis temperature (around 170°C); • CFD will be undertaken to confirm that there are no pockets of stagnant or low velocity gas; • Boiler passes are progressively decreased in volume so that the gas velocity increases through the boiler; and • The design of the boiler ensures that boundary layers of slow moving gas are prevented.
Prevention of boiler fouling	The boiler has been designed with the following control methods to prevent fouling: • Uniform waste feeding and combustion rates; • Supply of uniform and homogeneous waste feedstocks; • High degree of control over combustion air; and • On-line cleaning (steam or compressed air soot blowing) and off-line cleaning.
NOx reduction techniques may also help to minimise dioxin emissions.	NOx reduction is achieved through the use of SNCR, SCR and flue gas recirculation. All NOx limits are within BAT ELV's.
Minimising releases to water from boilers	
Reducing boiler blow down	• Boiler blowdown will be collected in the boiler blowdown tank and is used for ash wetting to prevent dust production. This prevents the use of main water.
Reduction in water treatment and de-ionisation plant effluent.	• Streams are mixed together and treated in the Waste Water Treatment Plant; and • The waste water system blowdown is then reused within the system.
Treatment of wash water and cleaning solutions.	• Any waste water will be collected in the effluent collection tank.

3.11 Turbine and Generator Set

High pressure (HP) superheated steam is transferred from the boiler to the turbine. The thermal energy of the steam is converted into mechanical energy so that the turbine drives the generator. The construction of the turbine ensures very high electrical efficiency.

Air Cooled Condensers

Exhaust steam from the turbine is transferred to air cooled condenser to be condensed and returned back to the system.

Electrical Generation

The electricity produced by the steam turbine generator will be transferred onto the Local Distribution Network.

3.12 Flue Gas Treatment

The flue gas generated by the process will enter a cleaning system. The flue gas treatment stages consist of the following:

- DeNOx system:
    - Recirculation of flue gases;
    - Selective Non-Catalytic Reduction (SNCR) through ammonia hydroxide injection within the combustion chamber;
    - Selective Catalytic Reduction (SCR) through ammonia hydroxide injection into the flue gas after the bag filtration unit.
- Dry flue gas scrubbing using sodium bicarbonate and activated carbon;
- Bag filters for reducing dust particulate quantity in flue gases;
- ID Fan;
- 45m high multi flue Stack (A1 and A2); and
- Continuous Flue Gas Monitoring system to monitor all dust and gas emissions.

The plant has been designed to ensure compliance with the New Plant Waste Incineration BREF Guidance Emission Limit Vales (ELVs).

DeNOx System

Achieving the new plant BREF Emission Limit Values is achieved with the primary control measures of controlled two stage combustion and use of Selective Non Catalytic Reduction (SNCR) technology with injection of ammonia hydroxide into the hot flue gasses.

Further NOx control and ammonia slip reduction is achieved using Selective Catalytic Reduction (SCR) technology with injection of ammonia hydroxide into the flue gases after the bag filtration system.

Acid Gas Removal

Prior to the bag filters, sodium bicarbonate is injected to enable to neutralisation of SO_2, HCl and HF acids in the flue gas. The advantage of dry flue gas scrubbing is that there is no waste water from the process.

Sodium bicarbonate is metered and injected into flue gas duct, where it reacts with and neutralises acid gases such as HCl, HF and SO_2. Activated carbon is also injected into flue gases in order to remove any residual PCCD / DF, PAH, PCB and Hg (heavy metals).

Bag Filters

Flue gases are cleaned by a dry flue gas filtration unit consisting of bag filters with automatic pneumatic blow-down cleaning.

Flue gases enter the filter from the side chamber where large particles are eliminated. Afterwards gases pass through the material of the filter where small particles are trapped. The filter bags are supported by the filter cage, which prevents them from deforming due to pressure difference. Dust is collected on the outside of the filter from where it is removed by compressed air (4-6 bar) blown down from above and through the filters. Dust is collected at the bottom of the filter chamber.

ID Fan

The ID-fan is placed between the bag filter and the stack. The ID-fan serves two purposes:

- Maintaining the desired pressure level in the gasifier and boiler; and
- Overcoming the pressure drop generated in the ducts, the silencer and the bag filtration system.

Stack (A1 and A2)

There will be a single wind shield stack (45m) comprising two (one per process line) flues (A1 and A2) for the discharge of cleaned flue-gas to atmosphere.

All emissions from the stack will be monitored using a fully compliant MCERTS accredited Continuous Emissions Monitoring System (CEMS) which meets the requirements of BS EN 15259.

The CEMS will be IED complaint and monitor HCl, NOx, NH_3, O_2, SO_2, VOC, particulates, H_2O, temperature, pressure and flow. TOC will be analysed by a Flame Ionisation Detector. HF will be calculated through the measurement of HCl as a surrogate.

3.13 Controls and Environmental Management System

The site shall be operated in accordance with corporate standards and procedures as part of a wider Environmental Management System. The system will be designed to meet the requirements of ISO14001:2015.

All aspects of the operation will be managed in accordance with a formal Environmental Management and Working Plan. The plan will define all activities throughout the lifecycle of the treatment process (i.e. pre-acceptance, acceptance, reception).

The Environmental Management and Working Plan will be structured to meet the requirements of the Environmental Permitting Regulations and associated pollution prevention guidance.

The EMS will be designed to ensure:

- The identification of all foreseeable environmental impacts and risk that the Operators activities pose to the environment.
- Prevention or minimisation of any identified risks to practical minimum.
- Legal Compliance assurance.
- Identification of risks of pollution including those arising from operations, maintenance, accidents, incidents, non-conformances and complaints, and how these will be minimised.

- Activities at the site will be managed in accordance with the management system, which will be subject to continuous review, audit and improvement. Specific detailed management system reviews will take place if there is a significant change to the activities, following an accident or if a non-compliance is found.
- Furthermore, the whole management system will be subject to annual external audit by competent third parties.
- The key aspects of the EMS for the site will include:
  - Preventative maintenance;
  - Operator requirements;
  - Training and Competence;
  - Emergency response and incident management; and
  - Monitoring, measurement and reporting.

The environment management system and procedures will be written to ensure that the environmental risk and impact of the normal running of the site activities are documented and minimised.

The EMS will be fully developed, implemented and in operation at the time of plant commissioning and permit issue and a copy of the management system will be kept at a convenient location on site. Please find a copy of the EMS Summary provided within *Annex G – EMS Summary.*

Site Maintenance
All maintenance activities on site will be carried out in accordance with the manufacturers' recommendations and will be integrated within the company's environmental management system.

The key aspects of the maintenance management programme will include:

- A programme of Planned Preventative Maintenance (PPM) is undertaken to ensure ongoing management and replacement of key plant and equipment rather than waiting for the equipment to fail and the maintenance of any critical environmental equipment.
- The inspection and maintenance schedules that the manufacturer recommends are adhered to, including any period of recommended shut-down.
- Predictive maintenance (e.g. assessment of vibration from bearings in motors) is carried out to prevent any catastrophic breakdown.
- Real time data collection and plant condition monitoring.

The detailed management system operated by the site will include procedures for ensuring that adequate maintenance is undertaken at the site.

The maintenance programme will ensure that all equipment or infrastructure that is deemed essential in the prevention of pollution to the environment (e.g. hard-standing, bunds, abatement plant etc.) or the prevention of local nuisance impacts (e.g. noise abatement equipment etc.) is maintained and kept in good operating condition.

All maintenance activities for critical pollution control equipment (abatement etc.) will form a key part of the certified EMS that will be established prior to the commencement of operations at site.

During planned periods of maintenance, if any of the following situations arise, waste will cease to be charged until normal operations can be restored:

- Continuous monitoring shows that emissions are exceeding any ELVs due to failure of the abatement systems or CEMS are out of service for a total of 4 hours;
- The cumulative duration of the periods of abnormal operation over 1 calendar year has reached 60 hours; or
- The continuous emission monitors are unavailable.

The planned period of abnormal operation will end at the earliest of the following:

- When the failed equipment is repaired and brought back into normal operation;
- When the operator initiates a shutdown of the combustion activity;
- When a period of four hours has elapsed from the start of the period of abnormal operation; or
- When, in any calendar year, an aggregate of 60 hours has been reached for planned periods of abnormal operation.

3.14 Operator Competence

The facility will be fully automated to the point that all process activities will be PLC controlled and DCS monitored. The installation will have on-line monitoring which can be administered remotely to ensure the process is optimised and operating correctly.

Notwithstanding the above, the site will be staffed at all times by the Operations team. The primary role of day staff is to ensure and oversee plant loading operations, fuel transfers and management.

Additional activities will include general site housekeeping and administration activities. Additional staff attending the site will be visiting engineers from the equipment manufacturers who are adequately trained to perform their duties at site. Grid Powr will maintain written operation instructions for all plant and monitoring equipment present on site.

All personnel working at the facility will be trained in the necessary sections of the EMS and any associated Procedures. All staff working for and on the behalf of the site will be suitably trained and competent (e.g. professional maintenance engineers, electricians, equipment operators etc.).

The Operations Team will employ on a full time basis a site manager / technically competent person who holds the necessary qualifications.

No operations (pre-conditional or otherwise) that involve the acceptance, handling or processing of any wastes will take place without a technically competent person being employed by the Operator.

Operational Times
The site will be operated on a continuous 24/7 basis.

Deliveries with the transfer of waste to and from the site shall be carried out in accordance with the schedule below:

- Monday – Friday: 07:00 – 19:00;
- Saturday and Sunday: 08:00 – 18:00.

In addition to the above core hours, the facility will also need to be available to receive waste in emergencies and in the event of unforeseen delays.

Additional activities will include general site housekeeping and administration activities. The site will maintain written operation instructions for all plant and monitoring equipment present on site.

All personnel working at the facility will be trained in the necessary sections of the Working Plan and associated Procedures.

3.15 Site Security

The site will consist of the relevant security measures including:

- A perimeter fence which will be inspected periodically to ensure that the site security has not been compromised;
- CCTV monitoring of the external and internal areas of the Installation;
- External on-line monitoring and administration of the process from a remote location;
- All personnel and vehicles entering the site are strictly controlled and managed; and
- No vehicles or personnel will be allowed access to the facility without prior authorisation.

3.16 Accidents and Emergencies

Fire Protection Strategy

The fire protection strategy for the Installation includes the following fire mitigation and suppression measures:

- An automatic fire detection and alarm system will be installed;
- An automatic suppression system will be installed;
- A suitable number of manual break-glass call points will be installed;
- Appropriate first aid fire-fighting equipment will be provided throughout the site;
- Planning inspection, maintenance and testing procedures will be established and used to ensure that all fire protection systems can be operated effectively. A component person will regularly test and inspect all fire safety equipment, installations and systems; and
- Fire extinguishers throughout the plant and in the control and electrical room areas.

All escape routes will be designed as per the building regulations and Fire and Service Rescue Acts.

Fire Prevention Plan

The site has developed a Fire Prevention Plan that complies with the Environment Agency Guidance *'Fire prevention plans: environmental permits'.*

The Fire Prevention Plan relates to the internal storage of all fuel product and provides the necessary information on site infrastructure, storage locations, storage practices, monitoring equipment and emergency response procedures.

The Fire Prevention Plan is included as part of *Annex I – Fire Prevention Plan.*

Accident Management Plan

The Applicant has developed a draft Accident Management Plan based around the specific risks associated with the site operations.

The key aspects of the Sites Accident Management Plan are:

- Reviewed by the Site Management annually and as soon as practicable after an accident.
- Considers hazards presented by:
  - Emergency shut-down procedures;
  - Actions in case of fire/explosion;
  - Actions in case of fire/emergencies;
  - Contaminated firewater;
  - Failure of any equipment;
  - Failure of abatement plant;
  - Spillages and uncontrolled release;
  - Plant or equipment failure (e.g. over-pressure of vessels and pipework, blocked drains);
  - Vandalism; and
  - Flooding.
- Identify events or failures that could damage the environment.
- Assesses the likelihood and the potential environmental consequences from accidents at the site.
- Proposes action to minimise the potential causes and consequences of accidents.

In the event of an accident, the EA will be immediately informed and necessary measures to limit the environmental impact of the accident will be carried out, as well as measures to prevent further possible accidents.

The draft Accident Management Plan has been included in *Annex H – Accident Management Plan.*

Specific emergency response procedures will be developed by the Operator in conjunction with the plant manufacturer. These procedures will be completed prior to operations commencing at the site.

Incident Reporting

The reporting of incidents and non-conformities will form a key component of the companies Environmental Management System. Identified non-conformities under the system include, but are not limited to the following:

- Uncontrolled leaks and spillages of any materials with the potential to cause pollution to the environment (hydraulic fluid / oils, unabated dust emission to atmosphere);
- Non-compliance to any permitted condition or consent limit (emissions excursions, missing of reporting deadlines, breach of any permitted consent limits);
- Internal Audit findings (legal non-compliances, EMS procedural breaches, system non-compliances);
- External and Internal Complaints; and
- Whenever a plant malfunction, breakdown or failure, or any near miss occurs.

The company's EMS will undergo periodic external audit and review to ensure that both compliance and continuous improvement is achieved. The EMS requires that all identified incidents and non-conformities will be investigated and closed out.

All plant and equipment will be PLC controlled, monitored and alarmed using an advanced DCS system, thus ensuring that continuous plant diagnostics can be facilitated.

Furthermore, the site management system will have documented procedures and registers to:

- Ensure that any members of the public/residents are alerted and informed if a significant plant issue arises (fire, explosion etc);
- Record, report and investigate any internal or external complaints to ensure that any necessary measures are taken to prevent, or where that is not possible to minimise, the causes; and
- Inform any members of the public about the nature of the site, key contacts and sources of further information.

4. EMISSIONS & THEIR ABATEMENT

4.1 Emissions to Air

Point-source Emissions to Air

All point source emissions from the plant are detailed in the table below. This table provides details of the predicted emissions parameters, concentrations and source.

All concentrations from the plant will be in line with the BREF emission limits for new plant except for NOx and NH_3 where more stringent emission limits of 100 mg/Nm^3 and 5 mg/Nm^3 have been adopted, respectively. Please refer to Table 4.1 for more information.

Table 4.1: Stack Technical Data

Parameter	Single Stream	Two Streams Combined
Stack height (m)	45	45
Flue exit diameter (m)	1.20	1.70
Temperature of release (ºC)	170	170
Moisture content (%v/v)	14.63	14.63
Oxygen content (%v/v dry)	7.06	7.06
Actual flow rate (Am^3/s)	18.87	37.74
Normalised flow rate (Nm^3/s) (a)	13.88	27.76
Emission velocity at flue exit (m/s)	16.7	16.7
Emission Concentration (mg/Nm^3) (a)	**Emission Concentration (mg/Nm^3) (a)**	**Combined Emission Rate (g/s)**
$PM_{10}/PM_{2.5}$	5	0.14
TOC	10	0.28
HCl	6	0.17
HF	1	0.028
CO	50	1.4
SO_2	30	0.83
NOx	100	2.8
NH_3	5	0.14
Group I (Cd, Tl)	0.02	5.6×10^{-4}
Group II (Hg)	0.02	5.6×10^{-4}
Group III (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.3	0.0083
Dioxins and Furans	0.06 ng/Nm^3	1.7×10^{-9}
PAHs (as B[a]P)	9×10^{-5}	2.5×10^{-6}
PCBs	3.6×10^{-9}	1.0×10^{-10}

(a) Normalised to 273K, 1 atmosphere, dry and 11% O_2

Detailed emission modelling to full IED requirements has been carried out as part of this Application.

All details are provided within the *Annex D – Air Quality Assessment and HHRA.*

The following table summarises the BAT justifications regarding the emissions from site.

Table 4.2 BAT Justification for Emissions to Air	
Indicative BAT	**Justification**
Emissions identification and benchmark comparison	The emissions benchmarks in the Sector Guidance Note can be met.
Vent & chimney height dispersion capacity and assessment of emitted substances fate in the environment	An impact assessment has been carried out and is referenced in Section 7 of this document.
Visible particulate plumes	Controlled by the particulate abatement system (bag filter system).
Visible condensed water plumes	There will be no visible plume from the facility under a majority of climatic conditions.
Particulate matter	Controlled by the particulate abatement system (bag filter system).
NOx - Primary Measures	
Fuel selection	Gas Oil / Diesel used for start-up burners
Combustion chamber design	This is compliant with IED and represents BAT.
Air control – primary and secondary	Automated air control at the point of final combustion – dilution air valve
Temperature control	Temperature control is a key aspect of the control system, as is a uniform temperature gradient.
NOx – Secondary measures	
Flue gas recirculation	This will be used and is considered BAT.
SNCR	SNCR will be used and is considered BAT.
SCR	SCR will also be used and is considered BAT
Acid gases and halogens	
Primary acid gas measures	The waste feed will exclude hazardous waste and will not contain significantly chlorinated or halogenated components. Each supplier is governed by the fuel specification and supply contract.
Secondary acid gas measures	Sodium bicarbonate and PAC injection will be used in order to control acid gases.
Alkaline reagent selection	Sodium bicarbonate has been chosen because it is easier to handle and is more efficient than lime.
Acid gas control: cost/benefit study	As this installation is a newly built facility, all measures employed are BAT, for this reason a cost benefit study on the merits of primary and secondary measures is not required. Careful consideration has been made during

	the design stage of this project to ensure that releases of acid gases and halogens are well managed by appropriate primary and secondary measures.
Carbon Dioxide	All measures to increase energy efficiency will also reduce CO_2 emissions.
Carbon monoxide and VOCs	CO is not significantly influenced by the conventionally employed abatement techniques. Reduction of both CO and VOCs is achieved by control of conditions in the combustor.
Dioxins and Furans	The primary method of reducing the emissions of dioxins is by careful control of the conditions in the combustor. Boiler residence time is controlled to minimise de novo formation. PAC injection will remove dioxins and furans from the gas phase, followed by bag filters which will provide efficient particulate abatement.
Metals	PAC gives reliable and effective heavy metal (e.g. mercury) reductions, and for the majority of metals particulate abatement is the main means of ensuring that releases are minimised.

4.2 Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the surface water drainage system (W1).

In the event of a significant site fire, the facility has been designed to fully contain any firewater run-off. In the event of a fire within the bunkers, any water from the suppression system will be contained within the bunkers. In the event of a fire within the waste offloading area, the slab and floor areas are designed such that all firewater will be contained within the building. The building will have a bunding system to stop any potentially contaminated firewater escaping which will be finalised during detailed design. The firewater collected will be tankered off site for disposal.

The Site Drainage System is shown in *Annex A – Figures*.

4.3 Emissions to Sewer

Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of $4m^3/hr$ of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant.

All domestic foul effluent arisings will also be discharged via sewer.

All emissions to sewer will be monitored in line with the sites effluent discharge consent once granted.

Table 4.3 below summarises the BAT justification for emissions to water and emissions to groundwater.

Table 4.3 BAT Justification for Emissions to Water	
Indicative BAT	**Justification**
Water use	Water use will be minimised and recycled where possible.
Contamination identification and fate analysis	Sampling, monitoring and analysis will be carried out, once the installation is operational, in agreement with the Agency.
Filtration	No further filtration necessary.
Off-site treatment	No off-site treatment.
Benchmark comparison - Control of emissions to meet EQS and WID requirements	IED Chapter IV requirements do not apply.
BAT Justification for Emissions to Groundwater	
Identification of List I substances	n/a
Identification of List II substances	n/a
Prior Investigation	Please refer to *Annex F – Site Condition Report*
Surveillance	n/a

4.4 Emissions to Land

There will be no emissions to land arising from the Installation.

4.5 Odour

Due to the design of the building structure and the fully enclosed processing activities, there is very little potential for offsite odour emissions and impacts to arise from the site. Furthermore, the fundamental design of the facility has a hierarchy of odour control and abatement measures to ensure that the potential for odour impacts are eliminated.

Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed.

To avoid any odour emissions from the building, the building is kept at slight negative pressure. An air extraction system will be in place resulting in odourous air within the building being thermally oxidised and destroyed by the combustion system.

The process itself has no significant potential for odours as the combustion system thermally oxidises any odorous compounds.

No odorous wastes will be accepted onto site and therefore the potential for offsite odour impacts is considered negligible.

Although it is considered that there is very little potential for odour emissions from site due to the control measures described above, an Odour Management Plan has been produced as part of the sites Environmental Management System. Please refer to *Annex J – Odour Management Plan* for more information.

Table 4.4: Odour Management Summary		
Tier	Reference	Description
1	Inventory Control	The Installation will process a maximum of 145,000 tonnes per annum of RDF. The site will be operated such that there is never more than 3 days' inventory awaiting processing and will be managed in a manner that prevents wastes being accepted into the site in the event that the site is inoperable. All wastes accepted on site will be required to be pre-declared and be deemed acceptable by the site manager prior to the transportation and delivery to site. All waste accepted on site will be inspected on arrival

		to ensure compliance with the agreed *'Waste Declaration Form'* and do not have any malodourous properties. Waste Acceptance and inventory controls will be covered in the sites waste acceptance procedures. The delivery and reception of waste is a fully enclosed process and will not produce any odour emissions.
2	Enclosed Building	Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed.
3	Controlled Extraction System	To avoid any odour emissions from the Fuel Reception Hall, the building is kept at slight negative pressure. An air extraction system will be in place resulting in odourous air within the building being thermally destroyed by the combustion system.

Although no odour from the plant is anticipated, odour shall be monitored daily at points around the site boundary and observations shall be noted in the site diary and/or on a daily monitoring document.

In the unlikely event that there is any discernible odour detected at the site boundary and the odour is judged to be 'moderate' (i.e. odour Intensity Rank 3), then the Site Manager will be notified immediately, and the olfactory survey will continue to attempt to determine the source and extent of the odour plume, as follows:

- A suitable location downwind of the site and potentially sensitive receptor at which the odour plume is unlikely to extend will be selected for assessment;
- Survey will continue toward the facility until a site-related odour is perceived; and
- Assessment points perpendicular to the plume axis and equidistant from the site will then be monitored, subject to access requirements.

The main aim of monitoring will be to test if any odours emitted from the site will be causing the nearest receptors nuisance. In scenarios where nuisance is being caused then operations will be suspended until the conditions improve. The Site Manager may deem it necessary to find the precise source of the odour and attempt to eliminate it or neutralise it immediately.

The following table shows the BAT justification for odour prevention on site.

Table 4.5: BAT Justification for Odour

Indicative BAT	Justification
Containment.	Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the

Table 4.5: BAT Justification for Odour	
Indicative BAT	**Justification**
The Operator should maintain the containment and manage the operations to prevent its release at all times.	floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed.
Assessment and Management	
For existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance.	N/A – not an existing installation.
For new installations, or for significant changes, the releases should be modelled and it is expected that the Operator will achieve the highest level of protection that is achievable with BAT from the outset.	Dispersion modelling has been undertaken for combustion gases from the facility. No assessment for dust is considered necessary as RDF materials are not inherently dusty and stored internally within the Fuel Reception Hall. Odour is considered low risk and is controlled by the onsite measures therefore no odour modelling is considered necessary however an odour management plan has been produced.
Where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made.	N/A
Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in the view of the Regulator, to increase the odour impact at receptors, the Operator should take appropriate and timely action, as agreed with the Regulator, to prevent further annoyance (these agreed actions will be defined either in the Permit or in an odour management statement).	N/A
Where odour generating activities take place in the open, (or potentially odorous materials are stored outside) a high level of management control and use of best practice will be expected.	N/A – no odour generating activities are taking place outside.
Where an installation releases odour but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that the Operator will work towards achieving the standards described in this Note, but the timescales allowed to achieve this might be adjusted according to the perceived risk.	N/A
Specific Odour control techniques:	
Enclosing odorous areas (applicable to all).	All appropriate areas will be enclosed.

Table 4.5: BAT Justification for Odour	
Indicative BAT	**Justification**
Enclosing odorous waste all the way to the furnace (ACI, CWI).	All appropriate areas will be enclosed.
Confining waste to designated areas (all).	Designated areas designed into the layout.
Ensuring that putrescible waste is incinerated within an appropriate timescale (MWI, CWI, ACI, SSI).	Storage times on site are minimised. No putrescible wastes will be processed on site.
Refrigeration of such waste which is to be stored for longer than an appropriate timescale (CWI, ACI).	N/A
Regular cleaning and (for putrescible wastes) disinfection of waste handling areas (all).	All areas will be regularly cleaned.
Design of areas to facilitate cleaning (all).	Facility is new and designed to ease cleaning.
Ensuring that the transport of waste and ash is in covered vehicles, where appropriate (all).	All vehicles will be covered.
Ensuring good dispersion at all times from any release points (all).	Release points have been designed aided by modelling to ensure adequate dispersion. The location and height have been optimised.
Preventing anaerobic conditions by aeration, turning of waste and short timescales (SSI, MWI).	Storage times are minimal hence this is not anticipated to be an issue.
Chlorination of waters being returned to STW or in storage (SSI) drawing air from odorous areas at a rate which will ensure that odour is captured (all) and treating such extracted air prior to release to destroy the odours - see below.	N/A
The use of these techniques should obviate the need for odour masking or counteractants.	No masking agents or counteractants have been specified at the plant.
Treatment of Odour	
The use of odorous air e.g. air from the waste handling area or air displaced from tanks, as furnace air is an ideal way of treating odours. The quantity of contaminated air that can be handled this way is obviously limited by the needs of the furnace. A disadvantage is the need to consider provision for odour control when the incinerator is not operating.	Odorous air is not anticipated to be a problem. Air from the Fuel Reception Hall is sucked into the combustion air system.
Biofilters.	Biofilters will neither be used nor required.
Scrubbing for odour control.	Scrubbing for odour control will not be required.
Carbon filters.	Carbon filters will not be required for odour control.
For a new plant it would normally be the case that the imposition of conditions achieving BAT also secures that no significant pollution (including odour) is caused.	The proposed plant has no potential for significant odour pollution.

4.6 Noise Impacts

The design of the Installation has taken into account the potential impacts on the environmental and neighbouring receptors with regards to noise. The plant and building have been designed to abate and control noise, odour and fugitive emissions. The building is fully enclosed and nominally air tight.

The processing plant and associated equipment has been designed in accordance with best practice and to ensure that internal noise does not present an issue to the employees at the site under the Control of Noise at Work Regulations and to ensure that noise breakout does not lead to noise nuisance at the identified sensitive receptors.

A noise assessment in accordance with statutory noise guidance has been carried out, including detailed modelling shown in *Annex E – Noise Impact Assessment.*

The report concludes that the total, aggregate environmental noise impact arising from the proposed operation of the plant, in full compliance with the plant noise specification as presented within the report, results in a “low” noise impact at the worst affected noise sensitive receptors, all as assessed in accordance with British Standard BS4142: 2014+A1: 2019. The assessment also indicates that the requirements of Planning Condition 12 of the 2018 Planning Consent (Planning Application number: 2018/1437) are capable of being met.

Table 4.6 below shows the BAT justification for noise prevention on site.

Table 4.6: BAT Justification for Noise

Indicative BAT	Justification
Maintenance • Plant • Equipment • Fans • Bearings • Vents • Building Fabric • Other	Appropriate preventative maintenance will be provided for the various elements of the installation. This will ensure no deterioration of plant or equipment that would give rise to increases in noise.
Control Techniques and comparison with BAT indicative thresholds	Control techniques will be in line with BAT. The noisiest equipment is housed in acoustic enclosures and / or within separate appropriately signed and controlled acoustic housings.
Reasonable Cause for Annoyance – Sensitive Receptors/Complaints?	The facility will not give rise to reasonable cause for annoyance. In the unlikely event that complaints are received measures described in the integrated management system will be put in place.

Table 4.6: BAT Justification for Noise	
Indicative BAT	Justification
Noise Survey	A noise assessment in accordance with statutory noise guidance has been carried out, including detailed modelling shown in *Annex E – Noise Impact Assessment.*

4.7 Fugitive Emissions

The plant has been designed to ensure that all odour, vapour and fugitive emissions are contained. An air extraction system will be in place for odour and dust control within the Fuel Reception Hall.

Table 4.7 shows the BAT justification for preventing fugitive emissions from the proposed development.

Table 4.7: BAT Justification for Fugitive Emissions	
Indicative BAT	Justification
Dust controls	
Covering of skips and vessels	There will be no open skips or vessels at the facility which could give rise to fugitive emissions.
Avoidance of outdoor or uncovered stockpiles (where possible)	There will be no outdoor or uncovered stockpiles which could give rise to fugitive emissions.
Where dust creation is unavoidable, use of sprays, binders, stockpile management techniques, windbreaks and so on	N/A
Regular wheel and road cleaning (avoiding transfer of pollution to water and wind blow)	Due to the nature of the operations, problems with wheel contamination are not expected to be significant. All areas of the site will have hardstanding.
Closed conveyors, pneumatic or screw conveying (noting the higher energy needs), minimising drops. Filters on the conveyors to clean the transport air prior to release	Feed systems are simple and enclosed.
Regular housekeeping	The site staff will be fully trained and regularly audited through the EMS to ensure that housekeeping measures are appropriate to the nature and scale of the activities and that there is minimum possibility of uncontrolled emissions.
The recycling of by-products	All waste will be removed from site by covered vehicles.
Enclosed containers or sealed bags used for smaller quantities of fine materials	No materials will be stored outside. Small volumes of materials for maintenance etc. shall be stored in appropriate containers, sealed so as to prevent fugitive emissions.
Mobile and stationary vacuum cleaning	Mobile and stationary vacuum cleaning will be used if necessary.

Table 4.7: BAT Justification for Fugitive Emissions	
Indicative BAT	**Justification**
Closed storage with automatic handling system	All storage is closed and transferred using an automated handling system.
Sealed charging system	The charging system is fully enclosed.
VOC control measures	N/A

4.8 Waste Generation and Management

Types and Amounts of Waste

The close coupled combustion process will not inherently produce significant quantities of waste.

The main solid by-products produced from the operation of the combustion facility will be:

- Bottom Ash; and
- APC Residue (Air Pollution Control (APC) residues).

Bottom ash from the system will be handled by a water cooled screw-type ash transporter used for the transport and cooling of the ash. Ash is then stored within an ash container prior to transfer off site.

APC residue is removed from the bag filtration unit and collected within a closed silo prior to transport off site.

Table 4.8 below shows a tabular summary of site wastes.

Table 4.8: Waste Summary					
Waste	**EWC Code**	**Approx. Quant (tonnes/yr)**	**Source**	**R / D Code**	**Environmental Fate**
Bottom Ash	10 01 15	16,600	Gasifier	R5 (Off site recycling)	Reused as a re-cycled aggregate
Fly Ash (Air Pollution Control (APC) residues)	19 01 05*	2,500	Gas Clean-up Equipment	R5 (Off site recycling)	Exported off site to an appropriate waste disposal facility

All waste produced at the site will be sampled and analysed. Additional samples will be taken if the disposal or recovery route changes or it is suspected that the nature or composition of the waste has changed such that it may no longer be appropriate for its environmental fate.

Throughput of Waste

The facility principally utilises non-reactive non-hazardous solid waste as a means to generate a synthetic gas which is combusted to recover energy.

All wastes will be sourced from commercial and industrial sources and will be Refuse Derived Fuel (RDF) that can form a fuel that meets with the plant's specification.

The Installation has been designed to process a maximum of 145,000 tonnes per annum of non-hazardous RDF.

Under 11B of the Waste Framework Directive, the Installation activities fall under the generic description D1.

Waste Storage

The design of the installation has taken into account the potential impacts on the environmental and neighbouring receptors.

All incoming fuel feedstocks will be stored within the Fuel Reception Hall. All other waste materials, will be clearly identified, sealed and stored internally within a secured area protected by secondary containment.

Table 4.9 summarises the BAT justification for the proposed storage on site.

Table 4.9: BAT Justification for Storage on Site	
Indicative BAT	**Justification**
Subsurface structures	N/A
Appropriate surfacing and containment or drainage facilities for all operational areas, taking into consideration collection capacities, surface thicknesses, strength/reinforcement; falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures; • have an inspection and maintenance programme for impervious surfaces and containment facilities; • unless the risk is negligible, have improvement plans in place where operational areas have not been equipped with: – an impervious surface – spill containment kerbs – sealed construction joints – connection to a sealed drainage system	Surfacing has been designed in accordance with the design standards for similar installations. There is no open ground in the process area. All joints are sealed. The surfacing is designed to ensure that it is of the appropriate strength, reinforcement and thickness to withstand the heavy traffic which will pass over it during operations. The installation will have an extensive maintenance programme in place which will include provision for the inspection of all appropriate plant and structures. The detailed inspection of the impervious surfaces and containment will be in line with the construction engineer's recommendations. Routine inspections will be undertaken on a daily basis by site personnel as part of the daily site checks.

Table 4.9: BAT Justification for Storage on Site	
Indicative BAT	**Justification**
	Since this is a new installation BAT will be demonstrated from commencement of operations.
Above-ground tanks	Above ground bulk storage tanks containing liquids will be appropriately constructed to ensure they are impermeable. Supervised deliveries will ensure that the risk of contamination of surface water is negligible. All tanks and facilities containing potentially contaminative substances will be installed with secondary containment and be designed to comply with the necessary standards and guidance requirements.
Storage areas (IBCs, drums, bags etc.) Storage areas should be located away from watercourses and sensitive boundaries, (e.g. those with public access) and should be protected against vandalism. Storage areas should have appropriate signs and notices and be clearly marked-out, and all containers and packages should be clearly labelled. Where spillage of any stored substance could be harmful to the environment, the area should be appropriately kerbed or bunded. The maximum storage capacity of storage areas should be stated and not exceeded, and the maximum storage period for containers should be specified and adhered to. • Appropriate storage facilities should be provided for substances with special requirements (e.g. flammable, sensitive to heat or light) and formal arrangements should be in hand to keep separate packages containing incompatible substances (both “pure” and waste). • Containers should be stored with lids, caps and valves secured and in place - and this also applies to emptied containers. • All stocks of containers, drums and small packages should be regularly inspected (at least weekly). • Procedures should be in place to deal with damaged or leaking containers.	All non-bulk storage (IBCs etc.), where used, shall be stored within the fully contained building. In the event of a release it is not possible for the materials to enter the surface water drainage system.

5. ENVIRONMENTAL MONITORING

5.1 Emissions to Air

All emissions to atmosphere (as identified within Table 4.1) will arise from the main combustion plant stack.

The plant will have continuous emissions monitors (CEMS) located on the exhaust flues of the combustion plant (Emission Point A1 and A2).

The CEMS system will monitor the stack emissions and provide data reporting. The system features a single-point extraction and includes monitors for CO, O_2, NOx, SO_2, ammonia slip and dust.

The CEMS will be IED compliant and continuously monitor, HCl, NO, NO_2, N_2O, NOx, NH_3, O_2, SO_2, VOC, particulates, H_2O, temperature, pressure and flow. TOC will be analysed by a Flame Ionisation Detector. HF will be assessed through the surrogate monitoring of HCl.

The dust monitor provides added flow, stack pressure and temperature. All analysers are provided with remote control, calibration and maintenance.

The continuous monitoring equipment will operate on a 24-hour basis and will include the facility for on-line monitoring of the gas concentrations and provide for any out-of-tolerance indications to be monitored by remote staff.

All CEMS equipment and associated platforms and sampling ports installed on site will meet the requirements of BS EN 15259 Air quality – Measurement of Stationary Source Emissions and Environment Agency Technical Guidance Note M2. All CEMS equipment shall be MCERTS approved.

Procedures will be created for monitoring undertaken at the site. These procedures will conform to M1 and M2 guidance and those required by the operator monitoring and assessment scheme and are incorporated into the sites EMS system.

The CEMS will be used such that:

- The values of the 96% confidence intervals of a single measured result at the daily ELV shall not exceed the following percentages:
  - Carbon Monoxide – 10%
  - Sulphur Dioxide – 20%
  - Oxides of Nitrogen (NO and NO_2) – 20%
  - Particulate Matter – 30%
  - Total Organic Carbon – 30%
  - Hydrogen Chloride – 40%

- Valid half-hourly average values or 10-minute averages shall be determined within the effective operating time from the measured values;
- Where is it necessary to calibrate or maintain the monitor resulting in data not being available for a complete half hour period, the half-hourly average or 10-minute average shall in any case be considered valid if measurements are available for a minimum of 20 minutes or 7 minutes during the half-hour or 10-minute period respectively;
- Daily average values shall be determined as the average of all valid half-hourly average or 10-minute average values within a calendar day; and
- No more than ten daily average values per year shall be determined not to be valid.

5.2 Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the surface water drainage system (W1). As this is uncontaminated runoff only, no monitoring will be required.

5.3 Emissions to Sewer

Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of $4m^3$/hr of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant.

All domestic foul effluent arisings will also be discharged via sewer.

All emissions to sewer will be monitored in line with the sites effluent discharge consent once granted.

5.4 Emissions to Land

There are no process emissions to land arising from the process. No monitoring is required.

5.5 Monitoring Frequency

The process will be subject to a range of process monitoring which has been designed to comply with the requirements of the EA M1, M2 and IED Guidance.

Table 5.1 Monitoring Frequency

Emission Point	Parameter	Monitoring Frequency	Methodology
A1 and A2	• Oxides of nitrogen (NO and NO_2 expressed as NO_2) • Nitrous oxide (N_2O) • Particulate Matter • Hydrogen Chloride • Carbon Monoxide • Sulphur Dioxide	• Continuous daily average and ½ hour average for all parameters	MCERTS certified CEMS equipment

	• Ammonia • Total Organic Carbon		
A1 and A2	• Cadmium and thallium and their compounds (total) • Mercury and its compounds • Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total) • Hydrogen Fluoride • Dioxin / Furans • Dioxin like PCB's • Specific Individual PAH's	• Periodic as detailed within permit	EA Monitoring Guidance M1/M2 compliant extractive sampling
W1	N/A	N/A	N/A
S1	TBC	TBC	TBC

Records will be kept of all monitoring carried out at site. The records will be made as soon as practicable and will be retained for at least 6 years from the date the records were made. More information regarding the environmental monitoring and record keeping will be detailed within the sites EMS.

6. BAT APPRAISAL

6.1 Technology Appraisal

There is a number of potentially suitable Energy from Waste (EfW) technologies which have been considered for the application Site. Although all of the technologies reviewed are capable of treating refuse derived fuels, a majority have been rejected on ground of environmental impact, operational cost or efficiency.

Advanced Thermal Treatment (ATT) has a number of potential advantages over traditional incineration processes, mainly due to the following factors:

- It is viable at smaller unit sizes, enabling the development of facilities ancillary to existing waste management operations; and
- There is much less visual impact, as ATT processes tend to be smaller and therefore require shorter exhaust stacks (45m compared to 60 – 100m for conventional incinerators) and lower boiler house buildings (20m as opposed to 30 – 45m).

As a consequence of ATT technologies only being suited to homogeneous fuel feeds (i.e. less dirty fuels), less flue gas treatment is required. Hence, fewer raw materials are used resulting in the production of fewer residues.

A summary of the advantages and disadvantages of the available combustion technologies is included in Table 6.1.

The processes proposed for this facility have been selected against detailed criteria which are based on the application of BAT, both to the particular process operation and to the combined process as a whole.

The objectives for the process were established as follows:

- To provide an advanced thermal treatment facility (ATT) that can produce energy from waste using combustion and gasification;
- To achieve significantly lower levels of emissions when compared with conventional energy from waste (EfW) technologies;
- To achieve a high degree of plant availability and reliability;
- To offer a cost effective and financially low risk solution for the generation of renewable power; and
- To utilise conventional unit operation techniques and technologies which meet the above aims and are established as BAT.

The design principles for the process were therefore defined as follows:

- To provide equipment with a suitable level of robustness and redundancy for the process duty and the inherent risk associated with that duty;

- To utilise conventional technologies to avoid the business and reliability risks associated with syngas clean up techniques for gas engine (compression or spark ignition) and gas turbine appliances which are not yet commercially proven or widely available;
- To utilise primary NOx control (low NOx combustion) combined with flue gas recirculation and SNCR / SCR Injection;
- To achieve excellent acid gas removal utilising dry or semi-dry injection (high acid gas removal efficiency); and
- Further ammonia slip reduction is achieved through the incorporation of SCR catalysts.

The combustion system comprises of two stages that incorporates a reciprocating grate system that is operated under sub-stoichiometric conditions. This design of combustion is generally accepted as being the most robust and least sensitive to variations in feedstock homogeneity. Similarly moving grate incineration technologies are a well accepted, robust and proven means of thermally treating waste and as such the hybrid design does not have the complexity of some fluidised bed or pressurised gasification systems.

Despite the combustion system involving gasification, the process is more akin to moving grate combustion and cannot be compared to conventional fluidised bed, updraft or downdraft gasification processes.

Table 6.1: BAT Comparison for Combustion Technologies

BAT Criteria	Moving Grate (MG) Combustion	Fluidised Bed Combustion	ATT	
			Gasification	Pyrolysis
Emissions	Abated emissions meet IED, lower levels are achieved by many plants.	Lower temperature leads to low NOx levels, but abatement will still be required to guarantee IED.	Abated emissions meet IED, and lower levels are achievable.	Abated emissions meet IED, and lower levels are achievable.
Waste	Untreated (or partially treated) municipal waste is main application.	Only suitable for reasonably homogenous material. May be used for waste that has been sufficiently treated.	Highly homogenous feedstock required. Opportunity to link to waste management facility and allow increased recycling.	Homogenous feedstock required. Opportunity to link to waste management facility and allow increased recycling.
Residue Generation	Produces bottom ash (<3% carbon) and air pollution control (APC) residues.	Produces larger volumes of residues for disposal.	Raw material consumption is lower than conventional incineration options and hence residue production is lower. Produces bottom ash (<5% TOC/3% LOI) and APC residues.	Raw material consumption is lower than conventional incineration options and hence residue production is lower. Produces carbon char and APC residues. Char can then be gasified or directly combusted to create process heat.
Odour	Odour management typically avoids nuisance.	Odour management typically avoids nuisance.	Odour management typically avoids nuisance. Due to pre-treated feedstock less likely to be odour producing than untreated municipal waste.	Odour management typically avoids nuisance. Due to pre-treatment feedstock less likely to be odour producing than untreated municipal waste.
Raw Materials	Depends on flue gas treatment option selected.	Higher due to fluidisation sand requirements.	Selection of appropriate flue gas treatment minimises raw material consumption. Typically, less than conventional incineration options.	Selection of appropriate flue gas treatment minimises raw material consumption. Typically, less than conventional incineration options.

Table 6.1: BAT Comparison for Combustion Technologies

BAT Criteria	Moving Grate (MG) Combustion	Fluidised Bed Combustion	ATT	
			Gasification	Pyrolysis
Noise	With appropriate abatement noise can successfully be controlled.	Similar to MG, although pre-treatment plant may cause additional noise requiring abatement.	With appropriate abatement noise can successfully be controlled.	With appropriate abatement noise can successfully be controlled.
Accidents	Proven technology with a large number of operational facilities. Similar accident potential as for other incineration options, mainly related to loss of storage of FGT reagents, supplementary fuel and residues.	Some operational experience, with mixed performance. Similar accident potential as for other incineration options, mainly related to loss of storage of FGT reagents, supplementary fuel and residues.	Operated on a smaller scale to conventional incineration options. Increased accident potential from storage of oxygen and pressurised oxygen delivery systems*.	Operated on a smaller scale to conventional incineration options. Not considered to have any greater accident potential as other incineration options. Gas containment and storage issues (similar to AD) associated with storage of pyro gas.

Combustion Plant and Prime Mover

An external combustion system such as a steam cycle can operate with a relatively dirty combustion gas (tars and oils in vapour phase) and does not require significant syngas clean up to operate.

Internal combustion systems, such as a gas turbine or a spark ignition gas engine, provide higher levels of thermal efficiency, but require highly cleaned, conditioned and stable syngas in order for them to operate reliably.

Such gas conditioning requires the removal of condensable tars and oils as well as the removal of water vapour and particulate. These residues are typically hazardous and require further treatment and processing for final disposal.

Table 6.2 shows a BAT comparison for three different combustion options for the plant.

Table 6.2: BAT Comparison for Electrical Generation

BAT Criteria	Steam Cycle	Gas Turbine	Spark Ignition Gas Engine
Efficiency	Up to 29% process efficiency – the addition of low grade heat recovery can improve this	Can be 40% but requires fuel preparation – combined cycle (i.e. heat recovery to a steam turbine) will improve this efficiency further.	Gas engine typically operate in the region of 37-40% electrical generation efficiency. Gas engines produce a reliable and consistent low and medium grade heat that can be used for process heating and/or export.
Feedstock	Less preparation required – steam cycle plant can reliably operate on low quality, low CV gas.	Much higher CV and stable gas required, indicating that higher quality feedstock and gas processing is required. All tars, moisture and particulate will be removed, indicating that higher degrees of fuel preparation required	As per gas turbine
Flexibility	Highly flexible: Steam can be raised by many gas combinations and or auxiliary firing if required	The flexibility is contingent with level of gas clean up and conditioning. A high level of fuel feedstock preparation is required to ensure stable gas formation and reliable clean up.	Less flexible with feedstock
Design	Well proven	Proven in a number of cases, however no plant has operated a long term commercial basis using RDF/SRF from MSW	As gas turbine, but not commercially proven on SRF from MSW
Reliability	Excellent with maintenance	Reliable, but very sensitive to gas composition.	Reliable but sensitive to gas composition

Flue Gas Clean-up Technologies

The syngas cleanup requirements for combustion systems are relatively minimal due to the combustion of the syngas at relatively high temperatures. Tars and oils remain in the vapour phase and add to the gas energy content which is recovered in the staged combustion and steam cycle phases.

Acid gas removal is achieved by the use of a dry scrubbing system, utilising a sodium bicarbonate based reagent.

Dry scrubbing techniques compare favourably with wet scrubbers and generally achieve the best acid gas removal efficiencies. They also eliminate any water effluent treatment requirements and allows for use with other reagents such as activated carbon for the absorption and removal of heavy metals, dioxins, VOC and other harmful substances.

Dry Flue Gas Treatment (FGT) has become the predominant solution for modern flue gas facilities. The basic FGT consists of a filtration unit combined with an injection of dry sorbent. The actual acid gas neutralisation takes place in the duct and on the surface of the filter bags.

Benefits of dry FGT over wet scrubbing systems include;

- Low Investment Cost;
- Simplicity of design and operation;
- Proven ability to meet stringent emission limits;
- Small physical footprint;
- Lower parasitic loads;
- Flexible operation with regards to temperature and capacity; and
- Easy stabilisation of dry residues.

The technique that has been selected for the acid gas treatment is a dry scrubbing system utilising a sodium bicarbonate based reagent.

Sodium Bicarbonate has been chosen the grounds that it is the most efficient reagent for acid gas abatement purposes.

Lime, despite being a cheaper commodity requires larger storage and handling equipment and also presents a caustic hazard to operators. Sodium bicarbonate has therefore been selected.

Table 6.3 shows a BAT comparison for sodium bicarbonate and lime.

Table 6.3: BAT Comparison for Sodium Bicarbonate and Lime

BAT Criteria	Sodium Bicarbonate	Lime
Storage	Easy to handle Safe reagent	Can be difficult to handle, especially in the presence of humidity. Will be stored within hoppers.
Reagent Preparation	Can be a ready to use reagent – a pre-milled, ready to inject reagent is available	A ready to use reagent
Availability	More expensive than lime	Readily available
Temperature	Is injected at temperatures higher than 140°C up to 400°C+.	Operates in a temperature window of 140 – 160°C.

Table 6.3: BAT Comparison for Sodium Bicarbonate and Lime

BAT Criteria	Sodium Bicarbonate	Lime
Efficiency	Very high efficiency	Medium to high efficiency (assuming high surface area lime is used)
Recirculation	Due to high efficiency only goes once through the system – no need for recirculation	A residue recycle loop can be incorporated into the design to increase removal efficiency
Use in Scrubbing systems	Proven in dry systems	Can be used in wet, dry or semi-dry systems
Residue Handling	Residues are easy to handle. They contain NaCl, Na2SO4 and Na2CO3 stable sodium salts	Lime residues are hazardous and need to be contained.
Operating Costs **(Reagent cost plus disposal cost)**	Raw material costs of Sodium Bicarbonate are high and the security of supply is uncertain. Residue production is lower per tonne of reagent. Overall there are no cost advantages over Lime	Lime is readily available and cost effective. Residue production per tonne of lime is high, so disposal costs are higher. Overall there are no cost advantages over Sodium Bicarbonate

The Installation will also have a bag filtration system which is designed to have the capacity to remove dust particles within anticipated emission limit values of the Industrial Emission Directive.

6.2 The Industrial Emissions Directive (IED) and Best Available Technology (BAT) Compliance

Chapter VI of the IED describes all aspects of management and operation of a process as well as the environmental impact but allows for the Member State to vary the requirements of the IED where there is good reason. Please refer to Table 6.4 that provides a detailed review against the IED requirements.

The Waste Incineration BREF was issued in December 2018 and requires all waste incineration plants to meet the necessary BAT conclusions. Please refer to Table 6.5 below that provides a detailed review against the BAT conclusions.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
Article 41 – 45	NA
Article 46 Control of Emissions (1) Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Significant ground level pollution will not arise as a result of this installation. Section 4 and 7 of this application discuss this in detail. Atmospheric Dispersion Modelling and Human Health Risk Assessment have been completed by the applicant.
(2) Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex. If in a waste co-incineration plant more than 40 % of the resulting heat release comes from hazardous waste, or the plant co-incinerates untreated mixed municipal waste, the emission limit values set out in Part 3 of Annex VI shall apply.	All Chapter IV IED Emission Limit Values will be met by the Installation.
(3) Discharges to the aquatic environment of waste water resulting from the cleaning of waste gases shall be limited as far as practicable and the concentrations of polluting substances shall not exceed the emission limit values set out in Part 5 of Annex VI.	There are no waste water discharges resulting from the gas cleaning process. The exhaust gases will be cleaned using dry processes, namely flue gas recirculation, sodium bicarbonate / activated carbon injection and bag filters. There will be no aqueous gas cleaning effluents.
(4) The Emission Limit Values shall apply at the point where waste waters from the cleaning of waste gases are discharged from the waste incineration plant or waste co-incineration plant. When waste waters from the cleaning of waste gases are treated outside the waste incineration plant or waste co-incineration plant at a treatment plant intended only for the treatment of this sort of waste water, the emission limit values set out in Part 5 of Annex VI shall be applied at the point where the waste waters leave the treatment plant. Where the waste water from the cleaning of waste gases is treated collectively with other sources of waste water, either on site or off site, the operator shall make the appropriate mass balance calculations,	N/A There are no waste water discharges resulting from the gas cleaning process. The exhaust gases will be cleaned using dry processes, namely flue gas recirculation, sodium bicarbonate / activated carbon injection and bag filters. There will be no aqueous gas cleaning effluents.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
using the results of the measurements set out in point 2 of Part 6 of Annex VI in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of waste gases. Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set out in Part 5 of Annex VI.	
(5) Waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater. Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.	There will be an environmental management system (EMS) in place to include procedures to manage waste delivery and reception. Hazardous waste will not be accepted at the Installation. Feedstock will be delivered to the renewable energy facility within a fully enclosed building / conveyor system. Roadways, floor and surfaces will be designed and constructed so as to prevent any emissions to groundwater, surface water and soil. All waste handling activities and the main process will take place inside the process building. There are no external processes on site. All fire water will be contained within the building and tankered away to a suitable water treatment facility. The site surface water drainage systems will pass through an oil separator prior to discharge off site.
(6) Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded. The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours.	The plant will be operated with a single CEMS unit per stream which will be linked into the controls system. In the unlikely event of CEMS failure, a full replacement back-up CEMS will be available on site.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	**Justification**
The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	
Article 47 Breakdown In the case of a breakdown, the operator shall reduce or closedown operations as soon as practicable until normal operations can be restored.	Each gasification and combustion line has an independent fuel feed system. The feed system for the process is automated and in the event of temperature loss or departure from operating conditions the process will automatically shut down in a controlled manner.
Article 48 Monitoring of Emissions (1) Member States shall ensure that the monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Monitoring will meet all the requirements of Article 48. The plant is designed to have continuous emissions monitors (CEMS) located on the exhaust stack of the combustion plant (Emission Point A1 and A2). The CEMS will be IED compliant.
(2) The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	The plant will be operated with a single CEMS unit per stream which will be linked into the controls system. In the unlikely event of CEMS failure, a full replacement back-up CEMS will be available on site. Please see section 5.1 for more details.
(3) The competent authority shall determine the location of the sampling or measurement points to be used for monitoring of emissions.	The exact positions of all sampling points will be agreed with the Environment Agency prior to commencement of operation however will be compliant with BS EN 15259.
(4) All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Reporting format will be agreed with the Environment Agency prior to commencement of operation and will reflect the requirements of the permit. CEMS will be backed up by non-continuous check monitoring to comply with the IED.
(5) As soon as appropriate measurement techniques are available within the Union, the Commission shall, by means of delegated acts in accordance with Article 76 and subject to the conditions laid down in Articles 77 and 78, set the date from	Should such a technique become available, it will be adopted as required.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
which continuous measurements of emissions into the air of heavy metals and dioxins and furans are to be carried out.	
Article 49 Compliance with the Emission Limit Values The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	The plant has been designed to comply with the specific ELV's stipulated the Waste Incineration BREF which are more stringent then Part 8 of Annex VI of the IED. The reference conditions in the exhaust gas will be Temperature 273 K; Pressure 101.3 kPa, 11% oxygen; Dry Gas.
Article 50 Operating Conditions (1) Waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3 % or their loss on ignition is less than 5 % of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used.	The waste streams will be treated so the recoverable organic fraction will be removed by upstream processing. Bottom ash will therefore comply with the 3% TOC / 5% LOI limits. Testing will be undertaken quarterly for the first year and annually thereafter to demonstrate this. The design, which incorporates a combustion chamber, ensures that the minimum temperature of 850°C is met at the final point of combustion whenever waste is being fed, and the residence time of combustion gases at or above this temperature is more than 2 seconds. This will be demonstrated by CFD modelling. The EMS will include procedures for the checking of waste composition and removal of contaminants.
(2). Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850°C for at least two seconds. Waste co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised in a controlled	The waste incinerator has been designed to meet the requirements of IED.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850 °C for at least two seconds. If hazardous waste with a content of more than 1% of halogenated organic substances, expressed as chlorine, is incinerated or co-incinerated, the temperature required to comply with the first and second subparagraphs shall be at least 1100°C. In waste incineration plants, the temperatures set out in the first and third subparagraphs shall be measured near the inner wall of the combustion chamber. The competent authority may authorise the measurements at another representative point of the combustion chamber.	
(3) Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels, liquefied gas or natural gas.	The site will be complete with 2 x 1.5 MW burners for start up and 2 x 2.2 MW support burners to ensure that combustion temperature reaches 850°C prior to waste introduction. Note: this is 850°C at the final point of combustion of the syngas i.e. in the secondary chamber of the combustor. The auxiliary burners will be using diesel.
(4). Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached; (b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained;	Each gasification and combustion line has an independent fuel feed system. Fuel is transferred from the two fuel bunkers into intermediate storage which will serve as a fuel buffer during dosing. This is an automated system. The feed system will have automatic shutdown to prevent waste feed if the temperature in the combustor at the final point of combustion is <850°C, or if emission limit values, obtained via the CEMS, look to be breached.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	
Article 51 Authorisation to change operating conditions	No requests to change operating conditions will be required.
Article 52 Delivery and reception of waste (1) The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health.	All waste will be received directly into a purpose designed building. All pollution abatement and prevention methodologies are detailed in this main application document.
(2) The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	The site will only receive non-hazardous refuse derived fuels. The range of waste codes from the List of Wastes (England) Regulations 2005 that will constitute this prepared fuel is included in Section 3.5 of the application. This will be weighed at the weighbridge. Unsuitable material and material that is hazardous, or contains unwanted materials, will not be accepted.
(3) Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, the operator shall collect available information about the waste for the purpose of verifying compliance with the permit requirements specified in Article 45(2).	No hazardous waste will be accepted into the plant. All wastes will be non-hazardous RDF only.
(4) Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, at least the following procedures shall be carried out by the operator:	No hazardous waste will be accepted into the plant. All wastes will be non-hazardous RDF only.

Table 6.4: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTSAND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
Article 53 Residues (1) Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	The process has been designed around a specified electrical power generation capacity. It is a new installation so a waste minimisation audit is yet to be carried out. This will be done in compliance with the permit condition specified.
(2) Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment.	Bottom ash from the system will be handled by a water cooled screw-type ash transporter used for the transport and cooling of the ash. Ash is then stored within an ash container prior to transfer off site. APC residue is removed from the bag filtration unit and collected within a closed silo prior to transport off site.
(3) Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	Chemical analysis will be undertaken regularly.

Other requirements (former WID compliance requirement not specifically stated under the IED) Technical Competence **Former WID Article 6 (8)** The management of the incineration or the co-incineration plant shall be in the hands of a natural person who is competent to manage the plant.	The operator will employ on a full time basis a site manager / technically competent person who holds the necessary qualifications. The operator will also meet all the other requirements of operator competence as stipulated in the Environmental Permitting Regulations. There will be named individuals with the relevant qualifications to supervise the operation of this renewable energy facility.
Former WID Article 11 (3) The residence time as well as the minimum temperature and the oxygen content of the exhaust gases shall be subject to appropriate verification, at least once when the incineration or co-incineration plant is brought into service and under the most unfavourable operating conditions anticipated.	During the plant's first year of operation we would seek to discuss with the Agency the need for a validation study to measure residence times through the combustor at above 850°C. Oxygen, moisture and temperature measurements will be made via the CEMS as well as spot sampling and analysis.
Former WID Article 11 (4) The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. In this case the emissions of HF shall be subject to periodic measurements as laid down in paragraph 2(c).	HF will be assessed through surrogate monitoring of HCl.
Former WID Article 11 (5) The continuous measurement of the water vapour content shall not be required if the sampled exhaust gas is dried before the emissions are analysed.	Water vapour is continuously monitored to correct emissions for dry gas conditions.
Former WID Article 11 (6) Periodic measurements as laid down in paragraph 2(c) of HCl, HF and SO2 instead of continuous measuring may be authorised in the permit by the competent authority in incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values.	CEMS will be provided for continuous HCl and SO_2 measurement, allowing calculation of HF through surrogate monitoring of HCl.
Former WID Article 11 (7) The reduction of the frequency of the periodic measurements for heavy metals from twice a year to once every two years and for dioxins and furans from twice a year to once every year may be authorised in the permit by the competent authority provided that the emissions resulting from co-incineration or incineration are below 50 % of the emission limit values determined according to Annex II or Annex V respectively and provided that criteria for the	After one year of operation sampling and measurement of heavy metals will be reduced from twice a year to once every two years as well as sampling and measurement for dioxins and furans will be reduced from twice a year to once a year, once it is demonstrated that the emissions are shown to be 50% of those stated in Annex V.

requirements to be met, developed in accordance with the procedure laid down in Article 17, are available. These criteria shall at least be based on the provisions of the second subparagraph, points (a) and (d). Until 1 January 2005 the reduction of the frequency may be authorised even if no such criteria are available provided that: L 332/100 EN Official Journal of the European Communities 28.12.2000 (a) the waste to be co-incinerated or incinerated consists only of certain sorted combustible fractions of non-hazardous waste not suitable for recycling and presenting certain characteristics, and which is further specified on the basis of the assessment referred to in subparagraph (d); (b) national quality criteria, which have been reported to the Commission, are available for these wastes; (c) co-incineration and incineration of these wastes is in line with the relevant waste management plans referred to in Article 7 of Directive 75/442/EEC; (d) the operator can prove to the competent authority that the emissions are under all circumstances significantly below the emission limit values set out in Annex II or Annex V for heavy metals, dioxins and furans; this assessment shall be based on information on the quality of the waste concerned and measurements of the emissions of the said pollutants; (e) the quality criteria and the new period for the periodic measurements are specified in the permit; and (f) all decisions on the frequency of measurements referred to in this paragraph, supplemented with information on the amount and quality of the waste concerned, shall be communicated on a yearly basis to the Commission.	
Former WID Article 13 (3) The incineration plant or co-incineration plant or incineration line shall under no circumstances continue to incinerate waste for a period of more than four hours uninterrupted where emission limit values are exceeded; moreover, the cumulative duration of operation in such conditions over one year shall be less than 60 hours. The 60-hour duration applies to those lines of the entire plant which are linked to one single flue gas cleaning device.	The plant will be operated with CEMS which will be linked into the controls system. In the unlikely event of CEMS failure, backup CEMS will be available on site.

Former WID Article 13 (4) The total dust content of the emissions into the air of an incineration plant shall under no circumstances exceed 150 mg/m^3 expressed as a half-hourly average; moreover, the air emission limit values for CO and TOC shall not be exceeded. All other conditions referred to in Article 6 shall be complied with.	The applicant does not request the abnormal emission limit value for particulates available under Article 13(4). In the unlikely event of CEMS failure on one of the streams, backup CEMS will be available on site.

Table 6.5: Waste Incineration BREF Compliance

BAT Reference	BAT Conclusion	Justification
BAT 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates the features provided within the BREF document.	Grid Powr will have an Environmental Management System in place that incorporates the features provided within the BREF document.
BAT 2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.	The gross electrical efficiency of the plant is 26.31%.
BAT 3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in the Guidance.	Emissions to air will be monitored by CEMS as described in the permit application. In addition, in accordance with the BREF Guidance: • Flue-gas from the incineration of waste will be continuously monitored for flow, oxygen content, temperature, pressure and water vapour content; and • Combustion chamber will be continuously monitored for temperature. There will be no emissions to water from flue gas cleaning as the proposed system uses dry techniques. There is no bottom ash treatment carried out on site. Boiler blow down will be used for ash wetting to prevent dust production.
BAT 4	BAT is to monitor channeled emissions to air with at least the frequency given below and in accordance with EN standards. If the EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	CEMS will monitor the relevant emissions to air detailed within the guidance. The waste accepted on site will have a low mercury content, therefore periodic monitoring is considered appropriate. Periodic testing of the fuel will provide confirmation of substance levels which are not continuously monitored.

BAT 5	BAT is to appropriately monitor channeled emissions to air from the incineration plant during OTNOC	Emissions to air will be monitored appropriately during abnormal emissions.
BAT 6	BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	There will be no emissions to water from flue gas cleaning as the proposed system uses dry techniques. There is no bottom ash treatment carried out on site.
BAT 7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency given below and in accordance with EN standards.	TOC's will be monitored once every three months in accordance with the guidance.
BAT 8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	n/a – no hazardous waste is incinerated.
BAT 9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) given below, and, where relevant, also techniques (d), (e) and (f).	The sites EMS will be complete with details on the following: • The waste that can be processed on site; • Pre-acceptance procedures; • Waste acceptance procedures; • A waste tracking system and inventory; and • Waste segregation.
BAT 10	In order to improve the overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	n/a – there is no bottom ash treatment plant on site.

BAT 11	In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9 c) including, depending on the risk posed by the incoming waste, the elements given in the guidance.	The waste acceptance procedure will include the monitoring of waste deliveries for: • Weighing of the waste deliveries; • Visual inspection; and • Periodic sampling of waste deliveries and analysis of key properties/substances (e.g. calorific value, content of halogens and metals/metalloids). Due to the type of waste and the UK radioactive substances regulation minimising the risk of radioactive material accidently arriving at the site radioactivity detection will not be provided.
BAT 12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given in the guidance.	Waste reception, waste handling and the storage of waste will take place internally within the relevant internal storage areas on impermeable surfaces with sealed drainage. No waste will be accepted on site unless the site has adequate waste storage capacity. This will be achieved by: • The maximum waste storage capacity being clearly established on site; and • Regular monitoring of the waste stored on site against the maximum allowed storage capacity.
BAT 13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given in the guidance.	n/a – no clinical waste is accepted on site.
BAT 14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags	Refuse Derived Fuel (RDF) will be delivered directly to the Fuel Reception Hall. HGV's will unload in the internal tipping area and a visual inspection will take

	and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given in the Guidance.	place. The delivered RDF feedstocks will then be transferred directly to the pre-processing equipment which consists of two shredders, two magnetic separators and two eddy-current separators. Once pre-processed the RDF will then be transferred to one of two bunkers for storage prior to loading via crane into the hybrid combustion system. The crane system ensures sufficient blending and mixing of the waste. The plant will be controlled by an advanced DCS control system which will optimise and control the process with special attention at gasification and combustion, abatement, flue gas treatment and monitoring.
BAT 15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings, e.g. through the advanced control system (see description in Section 5.2.1), as and when needed and practicable, based on the characterisation and control of the waste (see BAT 11).	The plant will be controlled by an advanced DCS control system which will optimise and control the process with special attention at gasification and combustion, abatement, flue gas treatment and monitoring.
BAT 16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	Procedures will be in place to limit shut-down and start-up operations as far as practically possible.
BAT 17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability	The flue gas cleaning system and water treatment plant are appropriately designed for the facility, will be operated within the design range and maintained to ensure optimal availability.

BAT 18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the environmental management system (see BAT 1) that includes all of the elements within the guidance.	An abnormal operation risk based management plan will be produced as part of the EMS in accordance with the guidance.
BAT 19	In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	A steam boiler will be used on site and is considered BAT. The resultant steam is then passed to a steam turbine and generator set which produces electricity.
BAT 20	In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given in the guidance.	In accordance with the guidance, the following techniques are used to increase energy efficiency: • Reduction of the flue-gas flow; • Minimisation of heat losses; • Optimisation of the boiler design; and • High steam conditions.
BAT 21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to: • store solid and bulk pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled subatmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion; • store liquid wastes in tanks under appropriate controlled pressure and duct the tank vents to the combustion air feed or to another suitable abatement system;	An air extraction system will be in place resulting in odourous air within the building / bunkers being thermally destroyed by the combustion system. In the event of a shutdown where no incineration capacity is available, no more waste deliveries will be accepted on site. If any waste stored on site exceeds the maximum storage times on site, the waste will be removed off site. This is considered BAT for the site.

	• control the risk of odour during complete shutdown periods when no incineration capacity is available, e.g. by ▪ sending the vented or extracted air to an alternative abatement system, e.g. a wet scrubber, a fixed adsorption bed; ▪ minimising the amount of waste in storage, e.g. by interrupting, reducing or transferring waste deliveries, as a part of waste stream management (see BAT 9); ▪ storing waste in properly sealed bales.	
BAT 22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	n/a – no gaseous and liquid wastes are processed on site.
BAT 23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the environmental management system (see BAT 1) the following diffuse dust emissions management features: • identification of the most relevant diffuse dust emission sources (e.g. using EN 15445); • definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.	n/a – there is no treatment of slags and bottom ashes on site.
BAT 24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given in the guidance.	n/a – there is no treatment of slags and bottom ashes on site.

BAT 25	In order to reduce channeled emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given in the guidance.	Particulate is controlled by the bag filter system. Activated carbon (dry sorbent injection) is used which gives reliable and effective heavy metal (e.g. mercury) reductions, and for the majority of metals particulate abatement is the main means of ensuring that releases are minimised. This is considered BAT for the plant and the BAT-AEL's will be met.
BAT 26	In order to reduce channeled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 f), BAT is to treat the extracted air with a bag filter (see Section 5.2.2).	n/a – there is no treatment of slags and bottom ashes on site.
BAT 27	In order to reduce channeled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given below.	Acid gas removal is achieved by the use of a dry scrubbing system, utilising a sodium bicarbonate based reagent. This is considered BAT for the plant.
BAT 28	In order to reduce channeled peak emissions of HCl, HF and SO2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given in the guidance.	Reagent dosage will be automated based on continuous monitoring. This is considered BAT for the plant and the BAT-AEL's will be met. Recirculation of reagents is not necessary due to the reagents used being of a high surface area.
BAT 29	In order to reduce channeled NOX emissions to air while limiting the emissions of CO and N2O from the incineration of waste and the emissions of NH3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given in the guidance.	The NOx that is formed during the combustion process is abated using a Selective Non-Catalytic Reaction (SNCR) system, a Selective Catalytic Reaction (SCR) system and flue gas recirculation. This is considered BAT for the plant and the BAT-AEL's will be met.
BAT 30	In order to reduce channeled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given in the guidance.	The primary method of reducing the emissions of dioxins is by careful control of the conditions in the combustor. Boiler residence time is controlled to minimise de novo formation. PAC injection will remove dioxins and furans from the gas phase, followed by bag filters which will provide efficient particulate abatement. In addition, in line with BAT the following techniques will be used:

		• Optimisation of the incineration process; • Control of the waste feed; • On-line and off-line boiler cleaning; • Rapid flue-gas cooling; and • Dry Sorbent Injection. This is considered BAT for the plant and the BAT-AEL's will be met.
BAT 31	In order to reduce channeled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques given in the guidance..	Activated carbon (dry sorbent injection) is used which gives reliable and effective heavy metal (e.g. mercury) reductions, and for the majority of metals particulate abatement is the main means of ensuring that releases are minimised. In line with BAT the following noted techniques are used. This is considered BAT for the plant and the BAT-AEL's will be met.
BAT 32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics	Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the surface water drainage system (W1). Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of $4m^3/hr$ of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant. All domestic foul effluent arisings will also be discharged via sewer. Water streams are collected and treated separately and this is considered BAT for this site.
BAT 33	In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given in the guidance.	A dry scrubbing system is proposed for flue gas cleaning which does not generate waste water.

BAT 34	In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.	A dry scrubbing system is proposed for flue gas cleaning which does not generate waste water. There is no treatment of slags and bottom ashes on site. Bottom ash from the combustion system will be handled by a screw-type ash transporter used for the transport and cooling of the ash. Ash is then stored within an ash container prior to transfer off site.
BAT 35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	Bottom ash and APC Residue (Air Pollution Control (APC) residues) are handled separately.
BAT 36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	n/a – there is no treatment of slags and bottom ashes on site.
BAT 37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques in the guidance.	A noise impact assessment has been carried out as part of the permit application which demonstrates that the noise impacts from site will have an insignificant effect on existing residential receptors due to the appropriate design, mitigation and intervening distances to the nearest residential receptors. All operational measures provided within the guidance will be carried out with noise attenuation being used where necessary. In line with BAT the following techniques will be used on site: • Appropriate location of equipment and buildings; • Operational measures; • Low-noise equipment; • Noise Attenuation; and • Noise-control equipment / infrastructure.

BAT

The following BAT demonstration is based on the EPR 5.01 The Incineration of Waste. The BAT demonstration is summarised in the following tables. These detail all of the indicative BAT requirements insofar as they apply to this process.

Table 6.6: BAT Justification

Indicative Requirement	BAT justification
Incoming waste and raw materials management	
Waste code	The proposed technology uses non-hazardous refuse derived fuel. The waste codes from the List of Wastes (England) Regulations 2005 are identified in Table 3.3.
Pre-treatment	Before entering the gasifier, the feedstock will be pre-processed.
EMS	Grid Powr will operate to an environmental management system (ISO14001) which will ensure that procedures are in place for fuel input and raw material management. All necessary operating procedures will be in place and documented and stored within the company EMS. Grid Powr will aim for certification of the renewable energy facility to ISO14001 within the first year of operation.
Odour control – internal storage	Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed. To avoid any odour emissions, the building is kept at slight negative pressure. An air extraction system will be in place resulting in odourous air within the building being thermally destroyed by the combustion system. During periods of planned shutdown, the feedstock within the storage system will be run down prior to the shutdown. All doors will remain closed as far as practicable. Fuel stores will only start to be increased again slightly in advance of the planned recommencement date. If there are extended periods of unplanned shutdowns deliveries will be diverted to other suitably permitted facilities. For longer unplanned shutdowns the feedstock will be removed from site.
Fire fighting	The feedstock is not volatile or easily combustible. An automatic fire detection and suppression system will be installed on site. All fire water will enter the drainage system and be contained within the building. All fire water will then be tankered away to a suitable water treatment facility. A Fire Prevention Plan is included in *Annex I – Fire Prevention Plan*. The Fire Prevention Plan relates to the internal storage of all fuel product and provides the necessary information on site infrastructure, storage locations, storage practices, monitoring equipment and emergency response procedures.

Table 6.6: BAT Justification

Indicative Requirement	BAT justification
Storage of fuel and treatment chemicals	Treatment chemicals will be stored in drums, tanks or bags (whichever are required for the quantity needed to be held in storage). These will be stored in the building and on hardstanding, within bunded areas that can contain 110% of the largest drum or 25% of the total storage capacity, whichever is the greater.
Preventing rainwater contamination	There are no external processes on site. Surface water run-off from the site roads will enter the existing surface water drainage system.
Incoming waste covered	Incoming waste will be delivered in covered vehicles with walking floor trailers and discharged internally with the Fuel Reception Hall.
Litter avoidance	It is not anticipated that litter will be a problem. If litter does arise a litter patrol will be initiated at the end of each working day.
Maximisation of homogeneity of feed	Homogeneity of the waste is achieved by pre-treatment. A fuel specification is in place which stipulates the parameters that must be achieved.
Inspection and removal	The waste acceptance procedures will include the validation of a load against the pre-acceptance documentation. Loads may be inspected at the weighbridge and during unloading. A waste rejection procedure will be in place for unsuitable loads / part loads / items within a load.
Feed transfer	Each gasification and combustion line has an independent fuel feed system. RDF is transferred to a fuel feeding system to allow continuous feed into the gasifier. This is an automated system. The control system automatically controls the feed of feedstock to the gasifier. Waste will be stored on site for a maximum of 3 days for scenarios such as a long weekends, resulting in the continuous operation of the combustion system without major load reduction.
Control of dust emissions	The waste will neither be dry or friable (i.e. the moisture content will be sufficiently high so to avoid excessive dust) therefore dust generation is unlikely. The waste is also delivered and stored within an enclosed building and enclosed conveyors so dust generation is further minimised. Bag filters are used to reduce dust emissions from the main process. Ash residues will be stored in enclosed vessels and removed from the facility in enclosed vehicles.
Odour prevention. Storage time within the buffer store	Entry to the waste reception area is via electrically controlled fast acting roller shutter doors. Vehicles will enter backwards and discharge the waste onto the floor of the waste reception hall. The doors are complete with air curtains to prevent any odourous emissions escaping during the unloading of waste. Once unloaded the vehicles will exit the building and the roller shutter doors are closed. To avoid any odour emissions, the building is kept at slight negative pressure. An air extraction system will be in place resulting in odourous air within the building being thermally destroyed by the combustion system. The process

Table 6.6: BAT Justification	
Indicative Requirement	BAT justification
	itself has no significant potential for odours as the combustion system thermally oxidises any odorous compounds. During short-term shutdowns the storage areas will be kept closed and the stocks of feedstock will be reduced. During long-term shutdowns in addition to the previous actions, no incoming waste will be accepted. The Applicant will operate to an environmental management system (EMS) that includes procedures relating to all reception and handling areas.
Waste Charging	
Automatic waste feed prevention system	Each gasification and combustion line has an independent fuel feed system. The installation is provided with a control system that automatically controls the feed of waste to the combustion system. At start-up waste cannot be fed to the gasifiers until the combustor reaches the required operating conditions. The feed system for the gasifier process is automated and in the event of temperature loss or departure from operating conditions the process will automatically shut down in a controlled manner.
Furnace interlock	The waste feed system is interlocked with the gasifier vessel conditions to prevent feed taking place when synthesis gas combustion is inadequate or other parameters are not within limits.
Airtight charging design, with interlock for chute or hopper	The transfer of waste to the gasifier is controlled. Each gasification and combustion line has an independent fuel feed system. The waste will be transferred via a conveyor system into the gasifier metering bins. This is then continuously fed into the gasifier. The conveyors also ensure that the fuel is compressed and air free to allow controlled gasification and combustion to take place. In the event of the gasifier deviating from its normal operating conditions, the control system will automatically alter the waste feed rate to the gasifier to ensure optimum conditions are achieved.
Charging rate and firing diagram, throughput rate, optimised combustion, waste residence time	Please refer to the firing diagram provided within *Annex B – Technical Information.*
Pyrolysis and Gasification	The close coupled combustion system has been designed for purpose. The feedstock is non-hazardous refuse derived fuels. The fuel handling systems are by conveyor and are designed with this material in mind. The fuel is continuously fed into the system via conveyors which ensure that the fuel is compressed and air free to allow controlled combustion to take place.
Feed of RDF	Before entering the gasifier, the feedstock will be transferred through the pre-processing plant.
Furnace Requirements	The syngas is combusted at temperatures typically between 850 to 1,000°C.

Table 6.6: BAT Justification	
Indicative Requirement	BAT justification
	CFD modelling of the combustor will be undertaken to demonstrate that residence times are above 850°C in excess of 2 seconds. Following commissioning of this installation, the results will be validated. No waste that contains a significant chlorinated or otherwise halogenated component is accepted. This is to ensure that halogen content cannot exceed 1% (as chlorine). The combustion process is controlled on temperature and remains above 6% O_2 at all times.
Validation of combustion conditions	CFD modelling of the combustor will be undertaken to demonstrate that residence times above 850°C in excess of 2 seconds. This will inform the design of the combustor. Testing using plug flow methodologies will be undertaken by the operator as part of the commissioning process.
Measuring oxygen levels	Measurement of oxygen is taken by extractive measurement in the stack as part of the emissions monitoring package to allow sample data to be converted to standard conditions.
Combustion Control	There are numerous temperature measuring positions throughout the thermal process which ensure correct combustion conditions at all times including at the point of final combustion.
Dump stacks and by-passes	There will not be any dump stacks or by-passes during normal operation at the installation.
Flue gas recirculation	Secondary NOx control will be employed using recirculated flue gas to minimise NOx formation.
Cooling systems	Cooling will be provided by an air-cooled condenser. The purpose of the condenser is to condense the steam by dissipating low grade heat to the atmosphere. The condensate recovered is returned to the deaerator and makes up the majority of the boiler feed water. There will be no cooling towers required, therefore, there will be no use of biocides in any cooling water systems and no release to land.
Boiler design	The boiler design has been chosen to prevent as far as possible the formation of dioxins and furans. The boiler, connecting duct work and economiser sections are designed to minimise the residence time of gases. This is in order to minimise the formation of dioxins and furans by de-Novo synthesis.
Environmental Performance Indicators	Key process performance indicators will be devised in discussion with the Agency prior to commencement of operation of the facility.

6.3 Resource Efficiency and Climate Change

Basic Energy Efficiency Measures

The plant and ancillaries have been designed to operate with a high level of energy efficiency. Key energy efficiency measures that have been included within the design of the plant are as follows:

- All plant and equipment will be individually monitored and controlled using a DCS monitoring system and PLC controls, optimised for efficiency of operation;
- All heat generated by the combustion plant will be recovered and used for the generation of electricity;
- All aspects of the combustion plant are controlled in real time to ensure maximum thermal efficiency and operational control;
- All plant energy data will be monitored and recorded and targeted to ensure optimal plant performance; and
- As part of the company's environmental management system, targets will be set regarding the increased thermal efficiency of the plant and the potential export of heat to neighbouring facilities.

Development of KPI's

The Operator will establish Key Performance Indicators (KPIs) when site electricity generation figures are available. The composition of the waste materials in the process will not vary greatly over the life of the plant. Should any site equipment or technology be replaced, efforts will be made to replace the unit with one which is more energy efficient, if available.

The Operator will create KPIs based on monitoring data from how much energy is used to run the site and whether this can be reduced. Within six months of operating the Applicant will produce a report detailing the energy uses at the site and where energy use improvements, if any, can be made.

Basic Design Principles

The Installation has been designed to ensure that all potential electrical energy is generated and supplied to the grid. A summary of the basic measures has been provided below:

- Wherever possible the plant utilises the waste heat to generate steam, which is used to generate electricity;
- All parasitic loads of the plant will be provided by the generated electricity, and hence the net energy imports are required to power and operate the plant;
- All pipelines and thermal processes are lagged and insulated to ensure that heat loss is minimised and prevented;
- The steam turbine specified for the plant has a high electrical and thermal efficiency;
- All ancillary plant (fans and motors) have been specified with high efficiency electrical motors and variable speed drives;
- The plant is controlled by PLC and optimised to ensure maximum efficiency and minimal operation of ancillary components where required;
- The Installation uses high efficiency electrical generation technology (i.e. steam turbine).
- Waste heat will be used for internal uses where possible i.e. preheating combustion air etc;
- The overall energy efficiency of the plant has been designed around to achieve 26.3% efficiency which is in line with the efficiency target stipulated for incineration processes; and
- The plant will be maintained at steady capacity to avoid downtime.

Raw Materials and Water Usage

- The plant has been designed to ensure that all residues are reused or recycled where possible; and
- The net water use meets the sector average (250 – 1100kg per tonne of material processed).

Avoidance, Recovery and Disposal of Waste

- All feedstock delivered to the site will be subject to an acceptance and pre-acceptance process that should ensure that the potential for inappropriate feedstock delivery is minimised;
- The site has a detailed inspection process to avoid unsuitable wastes to be introduced to the process; and
- The safe storage of rejected loads has been provided within and procedures will be in place for dealing with such loads to ensure that they are safely stored and dispatched for onward disposal. The storage times will be minimised.

An Energy Balance has been provided within *Annex B – Technical Information.*

6.4 CHP-Ready Assessment

The plant has been configured to maximise power generation and can be configured for CHP mode operation. The turbine has the capacity to operate in a CHP mode and steam could be diverted to heat exchangers if required (CHP-ready).

Please refer to *Annex K – CHP Assessment* for more information.

6.5 BAT Comparison

An assessment of the applicable indicative BAT requirements (as stated by EPR Guidance Note 5.01 Incineration) for the sector has been carried out. The following indicative BAT measures are considered to be met by the process.

Operations

- Very high levels of housekeeping will be employed throughout the site;
- All vehicles will be loaded and unloaded under cover and on sealed concrete hardstanding and engineered containment;
- All RDF feedstocks will be stored within the sealed building;
- The building will be maintained under negative pressure;
- Segregated water systems have been incorporated into the design of the plant to minimise the contamination of rainwater; and
- All building doors will be self-closing.

Waste Charging

- All feedstock into the hybrid combustion system will be on automatic feed systems to prevent waste feed at start-up:
    - Until the required temperature has been reached;

  - Whenever the required temperature is not maintained; and
  - Whenever the continuous monitors show that any emission limit value is exceeded due to disturbances or failures of the purification devices.
- Waste charging will be interlocked with gasifier conditions so that charging cannot take place when:
  - The temperatures and air-flows are inadequate;
  - Any flue gas cleaning bypasses are open;
  - Where the continuous monitors show that the emission limit values are being exceeds for a period of time in excess of the limits set within IED; or
  - Monitoring results required to demonstrate compliance with emission limit values are unavailable.
- The charging process has been designed to be sealed and all pressure controls have been designed to avoid escape of fumes or excess air flows; and
- The charging rates will be maintained at the optimum feedstock design rate depending on the calorific value. Nominal design rate is 7.75 tonnes per hour per line (total of 15.5 tonnes per hour).

Legislative Requirements

- The gases resulting from the close coupled combustion process will be maintained at above 850ºC for at least 2 seconds;
- The combustion temperature and residence time and the oxygen content of the stack gases have been validated under the most unfavourable operational conditions;
- Ash produced by the plant will comply with the IED/WID 3% TOC requirements; and
- The installation will not give rise to significant ground level air pollution as demonstrated by Section 7 '*Environmental Impact'.*

Emissions to Air

- A bag filtration system will be used to provide reliable abatement of particulate matter to below $5mg/m^3$;
- Filters with multiple compartments will be used, which can be individually isolated in case of individual bag failures. There will be sufficient of these to allow adequate performance to be maintained when filter bags fail, i.e. design will incorporate capacity for meeting emission limits during online maintenance;
- The plant is fitted with SNCR (Urea Injection) and SCR (Catalysts) to control and abate NOx formation;
- The gas is cooled quickly to avoid de novo synthesis of dioxin between 450ºC and 200ºC; and
- All indicative IED / WI BREF ELV's will be met.

Odour Emissions

Odour will be minimised through the following measures:

- Containing waste to designated areas;
- Ensuring that no putrescible waste is processed at the plant;

- Regular cleaning of waste handling areas;
- The design of all waste handling areas facilitates cleaning; and
- Drawing air from feedstock areas at a rate which will ensure that any odour present is captured.

7. IMPACT TO THE ENVIRONMENT

7.1 Impacts to Air

An assessment has been carried out to determine the potential air quality impacts associated with the proposed hybrid combustion plant.

Scope of the Assessment

The scope of the assessment has been determined in the following way:

- review of air quality data for the area surrounding the Site, including data from the Defra Air Quality Information Resource (UK-AIR);
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and
- review and modelling of emissions data which have been used as input to the UK Atmospheric Dispersion Modelling System (ADMS) dispersion model.

The assessment for the facility comprises a review of emission parameters for the development and dispersion modelling to predict ground-level concentrations of pollutants at sensitive human and habitat receptor locations.

Predicted ground level concentrations are compared with relevant air quality objectives for the protection of health and critical levels / loads for the protection of sensitive ecosystems and vegetation

This modelling presented within *Annex D – Air Quality Assessment and HHRA.*

7.2 Sensitive Human Health Receptors

Specific receptors have been identified where people are likely to be regularly exposed for prolonged periods of time (e.g. residential areas). The location of the discrete sensitive receptors is presented in Table 7.1 below.

Table 7.1: Human Health Receptors

ID	Receptor	Type	Easting	Northing
R1	Little Houghton	Residential	442235	405718
R2	The Water Mill	Residential	441958	405678
R3	Sandhill Primary School	School	443179	406216
R4	Great Houghton	Residential	442838	406685
R5	Park Lane	Residential	442645	407020
R6	Ridgeway House	Residential	440712	406346
R7	Edderthorpe	Residential	441165	405846
R8	Highfield	Residential	441293	405220
R9	Grimethorpe	Residential	441869	408296
R10	Storrs Mill Lane	Residential	440108	407169

The assessment concludes that for human health, the predicted maximum off-site concentrations are assessed as 'not significant' or well below the relevant air quality standards for all pollutants considered.

This modelling presented within *Annex D – Air Quality Assessment and HHRA.*

7.3 Impact on Sensitive Habitat Sites

The Environment Agency's H1 guidance states that the impact of emissions to air on vegetation and ecosystems should be assessed for the following habitat sites within 10 km of the source:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive[1];
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive[2]; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance[3].

Within 2km of the source:

- Sites of Special Scientific Interest (SSSI) established by the 1981 Wildlife and Countryside Act;
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR);
- Local wildlife sites (Sites of Interest for Nature Conservation, SINC and Sites of Local Interest for Nature Conservation, SLINC); and
- Ancient woodland.

The location of the local habitat sites is presented in Table 7.2 below.

Table 7.2 Location of Habitat Sites

Receptor	Primary Habitat	Grid Reference
H1A. Dearne Valley Wetlands SSSI	Broadleaved, mixed and yew woodland	Modelled as polygon
H1B. Dearne Valley Wetlands SSSI	Standing open water and canals	441681, 405742
H1C. Dearne Valley Wetlands SSSI	Fen, marsh and swamp	441947, 405384
H2. Carlton Main Brickworks SSSI	Assumed low and medium altitude hay meadows	441278, 407895
H3. West Haigh Wood LNR/LWS/AW	Assumed woodland habitat	442250, 408248
H4. Sunny Bank, Horse Carr and Storrs Wood LWS/AW	Assumed woodland habitat	440493, 406918

1 Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
2 Council Directive 79/409/EEC on the conservation of wild birds
3 Ramsar (1971), The Convention of Wetlands of International Importance especially as Waterfowl Habitat.

H5. Edderthorpe Ings LWS	Assumed low and medium altitude hay meadows	441925, 407599
H6. Houghton Marsh LWS	Assumed fen, marsh and swamp	442132, 405547
H7. Little Park AW	Assumed woodland habitat	442253, 406936

The area surrounding the facility is sensitive to ecological impacts. There are two Sites of Special Scientific Interest (SSSI) within 2 km including the Dearne Valley Wetlands SSSI to the immediate north and west and the Carlton Main Brickworks SSSI (geological designation) 1.5 km to the north of the facility. In addition, there is one Local Nature Reserve (LNR) and four further Local Wildlife Sites (LWS) within 2 km. There are no internationally designated habitat sites within 10 km of the Site. The impact of airborne emissions on the identified habitat sites has been assessed within the air quality assessment.

The habitat assessment considers the impact of airborne concentrations of the oxides of nitrogen, sulphur dioxide, ammonia and hydrogen fluoride. Predicted concentrations have been compared to relevant critical levels. In addition, the impact of nutrient nitrogen deposition and acidification were assessed with deposition fluxes compared to the most stringent critical loads for the habitats present at each designated site. Where the impacts could not be screened out (i.e. long term exposure is greater than 1% or short term exposure is greater than 10% of the relevant critical levels/loads) an interpretation of the likelihood of effects on the habitat sites has been provided by the project ecologist.

Please refer to *Annex D – Air Quality Assessment and HHRA* for more information.

7.4 Global Warming Potential

The global warming potential of the plant has been addressed within *Annex L – Global Warming Potential.*

7.5 Impacts to Land

There are no impacts to land relating to this permit application.

7.6 Impacts to Controlled Waters

There are no impacts to controlled waters relating to this permit application.

7.7 Impact to Sewer

Any effluent arising from the process plant will be collected in an effluent collection tank and discharged via sewer (S1). There will be a maximum of $4m^3$/hr of effluent discharged to sewer which will mainly consist of treated effluent from the water treatment plant.

All domestic foul effluent arisings will also be discharged via sewer.

All discharges will be made under consent to Yorkshire Water.