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Portland Energy Recovery Facility

Powerfuel Portland Limited

Supporting Information

ENGINEERING — CONSULTING

Document approval

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1 Introduction

Powerfuel Portland Limited (herein referred to as Powerfuel) is proposing to build the Portland Energy Recovery Facility (the Facility) at a site within Portland Port on the Isle of Portland, Dorset.

The Facility will incinerate refuse derived fuel (RDF) produced from domestic (municipal solid waste) and commercial & industrial (C&I) non-hazardous waste.

This document and its appendices contain the supporting information for the application for an Environmental Permit for the Facility. They should be read in conjunction with the formal application forms. In section 1, an overview of the Facility is provided. In section 2, further information in response to specific questions in the application forms is provided.

1.1 The Applicant

Powerfuel Portland Limited is registered in England (Company Number: 11831492) and is the Applicant for the proposed development. Powerfuel Portland Limited's registered address is 2nd Floor Regis House, 45 King William Street, London, EC4R 9AN.

Powerfuel Portland is a local company with an office in Dorset.

1.2 The Site

The site is located on the north eastern coast of the Isle of Portland, approximately 600 m east of the village of Fortuneswell. The site lies within the port and is not publicly accessible. Vehicular access is from the west, through the main Portland harbour complex, via Castletown, Castel Road, Lerret Road and A354.

The site is bordered to the south west by Incline Road, which is a private road within the port that is actively used by port traffic, and a former railway embankment. Cliffs supporting grassland, scrub and woodland habitats lie to the south west of the embankment and rise steeply to approximately 125 m above ordnance datum (AOD). Her Majesty's Prison The Verne is approximately 430 m to the south west of the site at the top of the steep slope. The eastern site boundary is formed by the shingle shoreline and overland fuel pipes from Portland Bunkers, which are fuel bunkers in the nearby cliffs used for marine bunker fuel supply. Existing operational port development lies to the north and north west of the site.

Portland and its harbour were designated as HM Naval Base Portland in 1923. From 1958, Portland was home to Flag Officer Sea Training. During this time, the site was dominated by a weapons research establishment building in the south east, with other buildings dedicated to mechanical repair facilities for military vehicles. The naval base and two major weapons research establishments were closed in 1995/96 and Portland Port Ltd began the transformation of the harbour into a commercial port. The buildings on site have been demolished to create cargo storage space when they were not used by tenants. In 2016/17, the main road leading to Incline Hill was realigned along the base of the hill / scree, creating the open development area on site. The land has since been cleared and is regarded as 'brownfield' land.

A drawing showing the extent of the installation boundary is presented in Appendix A.

1.3 The Activities

The Facility will consist of a Schedule 1 installation activity (as defined in the Environmental Permitting Regulations) and directly associated activities. These include:

1. a single line waste incineration plant processing incoming waste which is delivered to the Facility via road or ship;
2. generation of power with electricity exported to the National Grid and potentially to ships moored at the port, with the potential to export heat from the Facility;
3. production of inert bottom ash material that will be transferred off-site to a suitably licensed waste treatment facility for recovery/disposal; and
4. generation of an air pollution control residue (APCr) that will be transferred to a suitably licensed hazardous waste facility for disposal or recovery.

The following table lists the Schedule 1 activities, from the Environmental Permitting Regulations, and directly associated activities:

Table 1-1: Scheduled and Directly Associated Activities

Type of Activity	Schedule 1 Activity	Description of Activity
Installation	Section 5.1 Part A (1) (b)	The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.
Directly Associated Activities		
Directly Associated Activities		The export of electricity to (i) the National Grid and (ii) to local businesses at the port and ships visiting the port (via "shore power" apparatus) and potential to export heat to local heat users.
Directly Associated Activities		Standby electrical generation to provide electrical power to the plant in the event of an interruption in the supply.
Directly Associated Activities		The receipt, storage and handling of non-hazardous waste prior to incineration.
Directly Associated Activities		The handling, storage and transfer of residues for transfer off-site.

1.4 The Facility

The main activities associated with the Facility will be the combustion of incoming waste to raise steam and the generation of electricity in a steam turbine/generator.

The Facility includes a single waste incineration line, waste reception hall and bale storage area, main thermal treatment process, turbine hall, on-site facilities for the treatment or storage of residues and waste water, flue gas treatment, stacks, boilers, devices and systems for controlling operation of the waste incineration plant and recording and monitoring conditions.

In addition to the main elements described, the Facility will also include weighbridges (in and out), water, gas oil and air supply systems, site fencing and security barriers, external hardstanding areas for vehicle manoeuvring, internal access roads and car parking, transformers, grid connection compound, effluent storage and treatment facilities, offices, workshop, stores and staff welfare facilities.

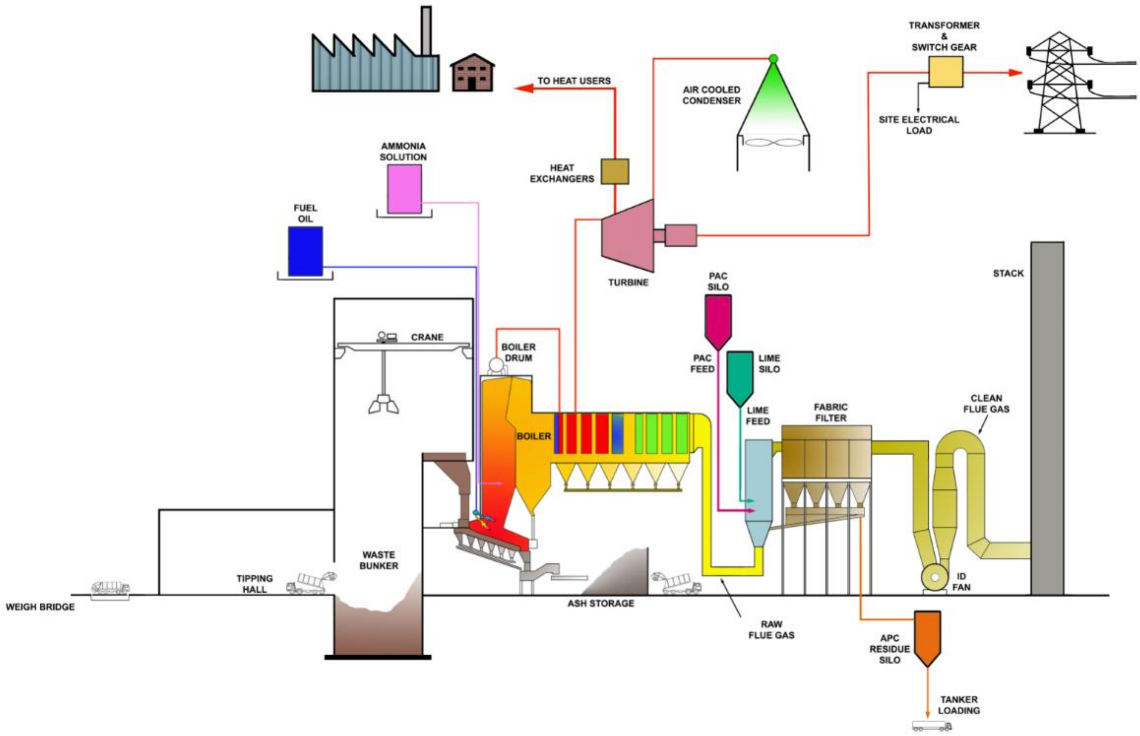
The Facility has been designed to export power to the National Grid as well as providing ship-to-shore power to boats which dock in the harbour. The turbine has been designed to generate up to 18.1 MWe. The Facility will have a parasitic load of approximately 2.9 MWe. Therefore, the Facility will be designed for the export of approximately 15.2 MWe. In addition to generating power, the Facility has been designed to be capable of exporting approximately 11 MWth heat to local heat users. At the time of writing this report, there are no formal agreements in place for the export of heat from the Facility. The power exported may fluctuate as fuel quality fluctuates, and if heat is exported from the Facility to local heat users in the future.

The Facility has been designed to thermally treat waste with a range of net calorific values (NCV's), with the average NCV being 11 MJ/kg.

The nominal design capacity of the thermal treatment lines is approximately 22.8 tonnes per line per hour of waste with an average NCV of 11 MJ/kg. The Facility has an expected availability of approximately 8,000 hours per annum. On this basis, the Facility will have a nominal design capacity of approximately 183,000 tonnes per annum. However, allowing for an availability of up to 8,760 hours per annum, the maximum capacity of the Facility will be approximately 202,000 tonnes per annum.

An indicative process diagram for the Facility is presented in Figure 1 below. A larger copy is also included in Appendix A.

Figure 1: Process Schematic



1.4.1 Raw Materials and Reagents

Waste will be delivered to the Facility as both baled waste and 'loose' RDF, and depending on what form the waste is delivered, there will be separate arrangements for the storage of the incoming waste. To allow for the different forms which incoming waste will be delivered, the Facility will have separate storage areas for the incoming waste – bale storage area and the waste storage bunker.

Upon arrival at the Facility, delivery vehicles will be weighed and periodically inspected at the gatehouse before being directed to the Waste Reception Area. The Waste Reception Area will be a fully enclosed building, maintained under slight negative pressure to ensure that no odours, dust or litter can escape the building.

Incoming baled waste which is delivered by ship will be offloaded at the 50 tonne berth on the Inner Breakwater, to the north east of the Facility (or other berthing locations as directed by the Port) and transferred to the Facility by HGV. The baled waste will be unloaded from the HGV via a dedicated crane and transferred to the bale storage area. The baled waste will be regularly transferred to the waste bunker, via the crane which will transfer the baled waste from the bale storage area to a 'de-baler'. The de-baled waste will then be conveyed to the waste bunker via a dedicated conveyor within the building.

Incoming waste which is delivered via road will be tip into the waste bunker. On completion of tipping, the waste delivery vehicles will exit the tipping hall and proceed to the weighbridge to record the weight of the vehicle prior to leaving the Facility.

The waste bunker will consist of a double bunker arrangement, with a shallow pit (referred to as the waste bunker) which will be used for the unloading of waste deliveries via road and also for the bales waste, before being transferred to the waste storage bunker for storage prior to processing within the ERF.

A grab crane will transfer waste from the waste storage bunker to the feed hopper. The grab will also be used to homogenise the incoming waste.

Hydrated lime (solid calcium hydroxide) will be used to react with the acid gases in the flue gas cleaning process. Lime will be stored in silos. The lime will be delivered by tanker and offloaded pneumatically by means of the onboard truck compressor into the silo. The displaced air will be vented to atmosphere through a fabric filter located on the top of the silo.

Powdered activated carbon (PAC) used for the absorption of volatile heavy metals and organic components will be injected with the lime. PAC will be stored in a silo. PAC is pneumatically transferred from the delivery truck by means of an onboard compressor. As with the lime, the exhaust air is de-dusted using a fabric filter located on the top of the silo.

Ammonia solution will be used as a reagent in the NOx reduction system. Ammonia will be delivered to the site and stored in a designated area in tanks, with secondary containment.

All silos will be fitted with high level alarms. The top of the silos will be equipped with a vent fitted with a fabric filter. Cleaning of the filter will be done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

Gasoil will be used on-site for the auxiliary burners.

High quality water is supplied from an onsite water treatment plant. It is used to supply the feedwater system. Boiler treatment chemicals will also be present on-site.

All liquid chemicals will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the storage capacity of the storage container or 25% of the total volume of materials being stored, in case of failure of the storage systems.

In addition, various maintenance materials will be stored in an appropriate manner and used in small quantities. These include hydraulic and silicone-based oils, greases, insulants, refrigerant gases for the air conditioning plant, glycol/antifreeze for cooling, welding gases (oxyacetylene, TIG, MIG), CO_2 and foam agents for fire-fighting, electrical switchgear and gas emptying and filling equipment.

1.4.2 Combustion Process

The combustion chamber will use a moving grate which will agitate the fuel bed to promote a good burnout of the waste and a uniform heat release. In a moving grate, the fuel is moved mechanically by means of reciprocating grate elements from the feed end, through a drying zone, a main combustion zone and, finally, a burn out zone.

The furnace will be designed to ensure that the exhaust gases are raised to a minimum temperature of 850°C, with a minimum of 2 seconds flue gas residence time at this temperature to ensure the destruction of dioxins, furans, PAHs and other organics. An adequate air supply will also be maintained to give the correct volume of oxygen for optimum combustion. The main source of airflow will be controlled through the grate. Gas temperatures will be continually monitored and recorded, and the control system will automatically start the auxiliary burners if there is a risk that the temperature will start to fall towards 850°C. The control system will regulate combustion conditions and control the boiler.

Primary combustion air will be drawn from the waste reception areas to maintain negative pressure, and fed into the combustion chamber beneath the grate. Secondary combustion air will be injected into the flame body above the grate to facilitate the combustion of waste on the grate. Further up the flue, above the combustion zone, ammonia will be injected to react with oxides of nitrogen formed in the combustion process. Water, carbon dioxide and nitrogen will be formed as products as a result of this. By controlling the dosing rate of the ammonia introduced into the gas stream, the concentration of NOx will be reduced to achieve the required emission limits.

The combustion chamber is provided with auxiliary burners, which will be of a low NOx design, and combust gas oil. The burners will raise the combustion chamber temperature to the required 850°C prior to the feeding of waste into the combustion chamber. There will be interlocks preventing the charging of waste until the temperature within the combustion chamber has reached 850°C. During normal operation, if there is a risk that the temperature will fall below 850°C, the burners will be initiated to maintain the temperature above this minimum. The auxiliary burners will typically operate for up to 16 hours during a start-up event, and up to 2 hours during a shutdown. Air flow for combustion will be controlled by measuring excess oxygen content in the flue gas. This is set to maximise the efficiency of the heat recovery process while maintaining the combustion efficiency.

1.4.3 Energy Recovery

Heat will be recovered from the flue gases by means of a water tube boiler integral with the furnace. Heat will be transferred through a series of heat exchangers. The hot gases from the furnace would first pass through evaporators that raise the steam. The hot flue gases would then pass into the boiler. The boiler will consist of a series of passes containing evaporators, superheaters and economisers. At the boiler outlet, the flue gases will pass through an external economiser. The boiler economisers will be used to pre-heat the evaporator feedwater supply. The cooling medium in the external economiser will be condensate from the air-cooled condenser. The flue gas temperature will be reduced quickly through the critical range where dioxin reformation can occur.

Superheated steam will be supplied to a high efficiency turbine which, through a connecting shaft, turns a generator to produce electricity. It is anticipated, subject to detailed design that the superheated steam generated by the boiler will be 51 bar(a) at a temperature of 400°C. The turbine will have a series of extractions at different pressure that will be used for preheating air and water in the steam cycle. The remainder of the steam will pass out of the final low pressure condensing stage. To generate the pressure-drop, to drive the turbine, the steam will be condensed back to water. A fraction will condense at the exhaust of the turbine in the form of wet steam. The majority will be condensed in the air-cooled condenser (ACC) following the turbine at a pressure well below atmospheric.

Heat from the Facility will be available for export to potential heat users in the vicinity of the Facility, and potentially further afield. However, at this stage, there are no formal agreements for the export of heat in place.

Depending on the requirements of the heat users, either high pressure steam or hot water could be supplied. High pressure steam could be extracted from the turbine and piped directly to the heat users. Alternatively, low pressure steam exiting the turbine could pass through an onsite heat exchanger to heat up water for use in a heat network. The volume of steam extracted would vary depending on the heat load requirements of the heat users.

1.4.4 Flue Gas Abatement

Flue gases generated from the combustion process will be cleaned before being released into the atmosphere to the appropriate standards required to protect human health and the environment.

After the heat recovery stages, the flue gas passes to the flue gas treatment (FGT) system. This consists of:

1. Selective Non-Catalytic Reduction (SNCR);
2. Hydrated lime and activated carbon injection; and
3. A fabric filter.

The abatement of oxides of nitrogen (NOx) will be achieved by careful control of combustion air and selective non-catalytic reduction (SNCR). NOx will be formed in the boiler at high temperature from nitrogen in the waste and in the combustion air. Ammonia solution will be injected at the combustion chamber directly into the hot flue gases above the flame. It should be noted that the reagent to be used is subject to discussions with technology providers during detailed design. NOx will be chemically reduced to nitrogen, carbon dioxide and water by the ammonia. A layer of catalyst will be installed in the flue from the bag filters and prior to release from the stack to act as a 'polisher'. The SNCR system combined with the polishing will to ensure compliance with the proposed emission limit for NOx.

After heat recovery and NOx abatement, the flue gas will pass upstream where acid gases will be abated using the injection of lime and powder activated carbon in a dry system. This abatement technology has the benefit that it does not produce a liquid effluent, and so does not require additional heat in the boiler flue gas to evaporate water (as in a semi-dry process), increasing energy recovery. The dry FGT method chosen uses lime to reduce the concentrations of acid gases, such as sulphur oxides and hydrogen chloride, in the flue gas stream.

Powdered activated carbon (PAC) will be used as an adsorbent to remove volatile metals, dioxins and furans. Both PAC and lime will be held in dedicated storage silos and transported pneumatically and injected into to the flue gas stream. The flue gases containing the reagents will pass through a reaction chamber and into a bag filter arrangement, where reaction products and un-reacted solids will be removed from the flue gases. The residue produced, APCr, will accumulate on the outside of the filter bags. The filter bags will be periodically cleaned by a reverse jet of air displacing the filtered solids into chutes beneath.

The APCr collected by the bag filters will be held in a silo from where it will be recycled back into the flue gas stream at the top of the reaction chamber. The dosing rate for the acid gas reagent will be controlled by the upstream acid gas pollutant concentration measurements and proportioned to the volumetric flow rate of the flue gases. As fresh reagents are added, an equivalent quantity of residue collected from the bag filters will be removed.

There will be online monitoring of the pressure drop within bag filter compartments to identify when there has been bag filter failure. If a pressure drop is identified, the relevant bag filter compartments will be isolated to prevent uncontrolled emissions and repaired before being brought back on-line.

The cleaned gas will be monitored for pollutants and discharged to atmosphere via a 90m stack.

1.4.5 Ash Handling

The main material produced by the installation will be bottom ash, which is the burnt-out residue from the combustion process. Bottom ash will fall from the end of the combustion grate into the discharger which comprises a water bath followed by a chute inclined upwards that forms a water seal, preventing uncontrolled air ingress to the combustion chamber from the boiler house. The water serves as a quench and makes it possible to remove the cooled bottom ash without the generation of dust. Boiler ash, the ash fraction that collects within a boiler, will also be conveyed to the discharger, and will mix with the bottom ash within the quench to form the residue known as incinerator bottom ash (IBA). The ash will be pushed upwards and out of the water bath by hydraulically driven rams.

The quenched ash will be transferred to a dedicated IBA storage area. There will be regular collections of IBA from the IBA storage area for transfer off-site to a suitably licensed waste facility.

1.4.6 Emissions Monitoring

Emissions from the stack will be continuously monitored using a Continuous Emission Monitoring System (CEMS) for the following pollutants:

- particulates;
- sulphur dioxide;
- hydrogen chloride;
- carbon monoxide;
- nitrogen oxides;
- ammonia; and
- volatile organic compounds (VOCs), expressed as total organic carbon.

In addition, periodic sampling and measurement will be carried out for metals, hydrogen fluoride (HF), dioxins and furans. Periodic measurements will be carried out four times in the first year and twice per year thereafter.

There will also be an installed back-up which can operate in case of a CEMS failure. The CEMS will be MCERTS approved.

1.4.7 Liquid Effluent and Site Drainage

Under 'normal operation' there will not be any trade effluent discharged to water from the Facility. Where practicable, waste waters generated from the process (such as from water treatment and boiler blowdown) will be re-used/recycled within the process, for example in the ash quench system. In the case of excess effluents being generated, such as the emptying of the boiler, effluent will be discharged to foul sewer in accordance with a Trade Effluent Consent, which will be secured from the Sewerage Undertaker (Wessex Water) prior to commencement of operations. Washdown waters collected from internal process areas will be collected in a settlement tank for re-use in the Ash Quench System.

Surface water run off from vehicle movement areas, roadways and building roofs will be collected in a surface water drainage system. The surface water drainage system will be fitted with a retention interceptor and swales, prior to the discharge point, to prevent discharge of oils and sediment collected from vehicle movement areas and roadways being released off-site. All surface water run-off will be discharged, via separate discharge points, to Balaclava Bay (east) and/or Portland Harbour.

Domestic effluents from welfare facilities will be pumped to a sewerage system which in turn will connect to the local sewer network.

An indicative water schematic is presented in Appendix A.

1.4.8 Ancillary Operations

The Facility will require a water supply of approximately 7 m^3 per hr. The primary requirement of water will be to maintain the water level in the boiler system (steam cycle). Water would be primarily sourced from mains water. A water treatment plant will be included to provide feedwater for the boiler. Water treatment chemicals will be stored within a bunded area within the on-site water treatment plant.

Water for fire-fighting will be stored in dedicated firewater storage facilities with a duty electric pump and standby diesel pump.

A diesel generator will provide power to safely shutdown the Facility. The generator will provide sufficient power to run or shut the plant down in the event of the loss of a grid connection. The diesel generator is only expected to operate for short-term periods for testing purposes.

2 Other Information for Application Form

2.1 Raw Materials

2.1.1 Types and Amounts of Raw Materials

The types and amounts of main (>5 tonnes) raw materials which will be stored at the Facility are presented in Table 2-1. These values are indicative. Information on the potential environmental impact of these raw materials is included in Table 2-2.

Table 2-1: Types and amounts of raw materials and consumption rate at design load

Schedule 1 Activity	Material	Maximum Storage Capacity (tonnes)	Annual Throughput (tonnes per annum)	Description including any hazard code
Section 5.1 Part A (b)	Gas oil	80	880	Low sulphur fuel oil
	Ammonia	90	770	25% ammonia solution
	Hydrated Lime ($Ca(OH)_2$)	80	3,700	Calcium hydroxide
	Activated carbon	10	90	Powdered
	Boiler treatment chemicals	<5	<50	Oxygen scavenger, pH control, biocide, water treatment regeneration chemicals

Table 2-2: Raw materials and their effect on the environment

Material	Chemical Composition	Typical Quantity	Units	Environmental Medium			Impact Potential	Comments
				Air	Land	Water		
Gas oil	Typically <1% sulphur	880	tpa	100	0	0	Low impact	Fuel for start-up and shutdown of the ERF.
25% ammonia solution	NH_3 (aq)	770	tpa	0	100	0	Low impact	Reacts with nitrogen oxides to form nitrogen, carbon dioxide and water vapour. Any unreacted ammonia (a chemical intermediate) would be released to atmosphere at low concentrations. Dosing will be controlled as to minimise slip.
Hydrated Lime	$Ca(OH)_2$ (s)	3,700	tpa	0	100	0	Low impact	Injected lime would be removed with the APCR at the bag filter and disposed of as hazardous waste at a suitable licensed waste treatment facility.
Activated Carbon	C	90	tpa	100	0	0	Low impact	Injected carbon would be removed with the APCR at the bag filter and disposed of as hazardous waste at a suitable licensed waste treatment facility.
Boiler treatment chemicals	Oxygen scavenger, pH control, biocide, water treatment regeneration chemicals	<50	tpa	0	0	100	Low impact	Oxygen scavenger, pH control, biocide, water treatment regeneration chemicals will be used for the demineralized water production and for the treatment of the boiler feedwater.

Various other materials, which will be used in small quantities (<5 tonnes per annum) will be required for the operation and maintenance of the Facility, including:

1. hydraulic oils and silicone-based oils, greases, insulants;
2. isolation media within electrical switchgear;
3. refrigerant gases for the air conditioning plant;
4. glycol/antifreeze for cooling;
5. oxyacetylene, TIG, MIG welding gases;
6. gas emptying and filling equipment;
7. CO_2 / firefighting foam agents; and
8. ignition, test and calibration gases.

These will be supplied to standard specifications offered by main suppliers. All chemicals will be handled in accordance with COSHH Regulations as part of the quality assurance procedures and full product data sheets will be available on-site.

Periodic reviews of all materials used will be made in the light of new products and developments. Any significant change of material, where it may have an impact on the environment, will not be made without firstly assessing the impact and seeking approval from the EA.

The Operator will maintain a detailed inventory of raw materials used on-site and have procedures for the regular review of new developments in raw materials.

2.1.2 Raw Material & Reagent Storage

The details of the storage facilities for the storage of raw materials, reagents and residues are presented within section 5.2 of the Site Condition Report, refer to Appendix B. Materials will be stored in accordance with current guidance. All liquid chemicals will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the stored capacity.

Boiler water treatment chemicals will be used to control water hardness, pH and scaling and will be delivered in sealed containers and stored in a bunded area within the water treatment room. There will also be portable bottles of oxygen and acetylene gas stored on site for welding purposes. The gas bottles will be kept secure in a separate compound.

2.1.3 Raw Material & Reagent Selection

2.1.3.1 Acid Gas Abatement

There are several reagents available for acid gas abatement. Sodium hydroxide (NaOH) or lime slurry (calcium hydroxide ($Ca(OH)_2$) suspended in water) can be used in a wet flue gas treatment (FGT) system. Quicklime (CaO) suspended in water and used as a spray of fine droplets can be used in a semi-dry FGT system. Sodium bicarbonate ($NaHCO_3$) or hydrated lime ($Ca(OH)_2$) can be used in a dry FGT process.

The reagents for wet scrubbing and semi-dry abatement are not considered, since these abatement techniques have been eliminated in section 2 of the BAT assessment in Appendix E. The two alternative reagents for a dry system – lime and sodium bicarbonate - have therefore been assessed further.

The level of abatement that can be achieved by both reagents will be similar. However, the level of reagent use (and therefore residue generation and disposal) will be different, requiring a full assessment following the methodology in Environment Agency Horizontal Guidance Note H1. Whilst it is noted that this guidance has subsequently been withdrawn, the replacement guidance is not as prescriptive in the methodology required. Therefore, for the purposes of the BAT assessment, the requirements of the withdrawn guidance have been applied. The assessment is detailed in section 4 of Appendix E, and is summarised in Table 2-3 below.

Table 2-3: Acid gas abatement BAT data

Item	Unit	$NaHCO_3$	$Ca(OH)_2$
Mass of reagent required	kg/kmol	109.0	67.0
Mass of residue generated	kg/kmol	84.0	85.0
Cost of reagent	£/tonne	155	91
Cost of residue disposal	£/tonne	163	136
Overall Cost	£/op.hr/kmol	30.6	17.7
Ratio of costs	-	1.73	

Note: Data is based on the abatement of one kmol of hydrogen chloride

Whilst the use of sodium bicarbonate will lead to less residues than a lime-based system, this is significantly outweighed by the advantages of using lime as a reagent, which are as follows:

- The residue has a higher leaching ability, which will limit the disposal options;
- The reaction temperature doesn't match as well with the optimum adsorption temperature for carbon, which is dosed at the same time;
- The use of sodium bicarbonate has a slightly higher global warming potential due to the reaction chemistry; and
- The costs per kmol HCl abated are almost 73 % higher.

Taking all of the above into consideration, the use of lime is considered to represent BAT for the Facility.

2.1.3.2 NOx Abatement

NOx abatement systems can be operated with dry urea (prills), urea solution or aqueous ammonia solution. There are advantages and disadvantages with all options:

- urea is easier to handle than ammonia - the handling and storage of ammonia can introduce an additional risk;
- ammonia tends to give rise to lower nitrous oxide formation than urea;
- dry urea can be contained in Flexible Intermediate Bulk Containers (FIBCs or 'big-bags'), whereas ammonia solution is usually stored in silos and delivered in tankers; and
- ammonia emissions (or 'slip') can occur with both reagents, but good control will limit this.

The Environment Agency's sector guidance on waste incineration, titled *"Incineration of waste (EPR5.01)"*, considers all options as suitable for NOx abatement. It is proposed to use ammonia solution for the SNCR system, due to the lower nitrous oxide formation.

2.1.3.3 Abatement of Volatiles

PAC is the only viable option to remove volatile metals, dioxins and furans by adsorption, and hence alternatives have not been considered.

2.1.3.4 Auxiliary Fuel

As stated in Article 50 (3) of the Industrial Emissions Directive:

"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[1], p. 13., liquefied gas or natural gas."

Therefore, as identified by the requirements of IED the only available fuels that can be used for auxiliary firing are:

1. liquefied gas (LPG);
2. gas oil; or
3. natural gas.

Auxiliary burner firing on a well-managed waste combustion plant is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to the minimum 850°C.

LPG is a flammable mixture of hydrocarbon gases. It is a readily available product and can be used for auxiliary firing. As LPG turns gaseous under ambient temperature and pressure, it is required to be stored in purpose-built pressure vessels. If there was a fire within the site, there would be a significant explosion risk from the combustion of flammable gases stored under pressure. Considering the proximity of the Facility to the Port, this is not considered to be a suitable auxiliary fuel for the Facility due to explosion risk.

Natural gas can be used for auxiliary firing and is safer to handle than LPG. As stated previously, auxiliary firing will only be required intermittently. When firing, this would require large volumes of gas, which would need to be supplied from a high-pressure gas main within reasonable distance of the Facility. There is not a high-pressure gas main within the Installation Boundary or near to the site. Therefore, the supply of natural gas is not currently determined as being feasible for the purposes of auxiliary firing.

A gas oil tank can be easily installed at the site. Whilst it is acknowledged that gas oil is classed as flammable, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of gas oil will lead to emissions of sulphur dioxide, but these emissions can be minimised as far as reasonably practicable through the use of low sulphur gas oil.

Therefore, taking into account the availability of fuels which can be used for auxiliary firing, gas oil is considered to represent BAT and will be used for auxiliary firing.

[1] OJ L 121, 11.5.1999

2.2 Incoming Waste Management

2.2.1 Waste to be processed in the Facility

The plant will be used to recover energy from incoming waste, with European Waste Catalogue Codes listed in Table 2-4 as follows:

Table 2-4: Waste to be processed in the Facility

EWC code	Description of waste
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)

As stated in Section 1.4, the nominal design capacity of the thermal treatment line is approximately 22.8 tonnes per line per hour of waste, with an average NCV of 11 MJ/kg. The Facility will have an assumed availability of approximately 8,000 hours per annum. On this basis, the Facility will have a nominal design capacity of approximately 183,000 tonnes per annum. However, allowing for a maximum availability of 8,760 hours per annum, the maximum capacity of the Facility is approximately 202,000 tonnes per annum.

Checks will be made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed would be accepted.

The incoming waste would be observed by the operators in the waste reception area as it is tipped into the waste bunker, and by the crane driver and control room operator as it is mixed and transferred into the waste storage bunker. Where practicable, unacceptable waste would be removed from the waste bunker for further inspection and quarantine. The waste would be stored in a storage area in the tipping hall prior to transfer off-site to a suitable disposal/recovery facility.

The waste storage bunker will allow for back-loading of waste in the event of unplanned periods of prolonged shut-down.

The Environmental Management System (EMS) will include procedures to control the inspection, storage and onward disposal of unacceptable waste. Certain wastes will require specific action for safe storage and handling. The EMS will also contain procedures for controlling the blending of waste types to avoid mixing of incompatible wastes.

2.2.2 Waste Handling

2.2.2.1 Waste Acceptance and Pre-Acceptance Procedures

Waste supply contracts will be agreed internally with waste suppliers/producers, which will include specifications for the supply of incoming waste.

Documented procedures for pre-acceptance and acceptance of all wastes will be developed prior to the commencement of operation of each of the waste treatment processes, in accordance with the documented management systems for the Facility.

Documented procedures for the management and operation of the Facility will be developed prior to commencement of operations. Powerfuel would propose to provide the EA with a summary of the documented procedures prior to commencement of operation. This would include waste pre-acceptance and waste acceptance procedures for all wastes which the Facility is permitted to receive – following issuing of a permit by the EA.

The pre-acceptance and acceptance checks on wastes being delivered to the Facility will include audits of waste producers and/or fuel suppliers to review their operations to confirm that the waste which they are transferring to the Facility is in accordance with the waste descriptions, specifications and EWC codes that are permissible within the EP.

Procedures will be implemented on site for the review of incoming wastes at the weighbridges and for checking incoming wastes against the agreed specifications on a regular basis. This will include depositing waste loads onto the waste reception area floor for visual inspection. Crane drivers and other operatives will be trained in order to undertake these tasks.

2.2.2.2 Receiving Waste

Prior to the receipt of waste at the Facility, pre-acceptance and acceptance procedures will be developed which comply with the Indicative BAT requirements of Environment Agency sector guidance on waste incineration (titled *'Incineration of Waste (EPR5.01)*), including:

- A high standard of housekeeping would be maintained in all areas, and suitable equipment will be provided and maintained to clean up spilled materials.
- Vehicles would be loaded and unloaded in designated areas provided with impermeable hard standing. These areas will have appropriate falls to the process water drainage system.
- Fire-fighting measures will be in place, refer to Appendix H.
- Delivery and reception of waste will be controlled by a management system that will identify all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Incoming waste will be:
  - delivered in covered vehicles or containers; and
  - unloaded in the enclosed waste reception areas.
- Design of equipment, buildings and handling procedures will ensure there is insignificant dispersal of litter.
- Inspection procedures would be employed to ensure that any wastes which would prevent the Facility from operating in compliance with its permit are segregated and placed in a designated storage area pending removal.
- Further inspection will take place by the plant operatives during vehicle tipping and waste unloading.

2.2.3 Waste Minimisation (Minimising the Use of Raw Materials)

A number of specific techniques will be employed to minimise the generation of residues, focusing on the following:

1. Feedstock Homogeneity;
2. Dioxin and Furan Reformation;
3. Furnace Conditions;
4. Flue Gas Treatment Control; and

5. Waste Management.

All of these techniques meet the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration.

2.2.3.1 Feedstock Homogeneity

Improving feedstock homogeneity can improve the operational stability of the waste incineration process, leading to reduced reagent use and reduced residue production. Incoming RDF may originate from a variety of sources and suppliers. The mixing of incoming wastes within the waste storage bunker by the crane operator will improve the homogeneity of the fuel input into the boiler.

2.2.3.2 Dioxin and Furan Reformation

As identified within the Environment Agency sector guidance on waste incineration, titled *'Incineration of waste (EPR5.01)'*, there are a number of BAT design considerations required for the furnace. The furnace will be designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling would be avoided via boiler design to ensure the residence time would be minimised in the critical cooling section, to minimise the potential for de-novo formation of dioxins and furans.
- The gas residence time in the critical temperature range would be minimised by ensuring high gas velocities exist in these sections. The residence time and temperature profile (between 450 and 200°C) of flue gas would be considered during the detailed design phase to ensure that dioxin formation would be minimised throughout the process.
- Transfer surfaces would be above a minimum temperature of 170°C subject to other reaction considerations.
- Computational Fluidised Dynamics (CFD) will be applied to the design, where considered appropriate, to ensure gas velocities are in a range that negates the formation of stagnant pockets / low velocities.
- Minimising the volume in the critical cooling sections will ensure high gas velocities.
- Boundary layers of slow-moving gas along boiler surfaces would be prevented via design and a regular maintenance schedule to remove build-up of any deposits that may have occurred.

2.2.3.3 Furnace Conditions

Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal. Burnout in the furnace will reduce the Total Organic Carbon (TOC) content of the bottom ash to less than 3%, or Loss on Ignition (LOI) of the bottom ash to less than 5%, by optimising waste feed rate and combustion air flows.

2.2.3.4 Flue Gas Treatment Control – Acid Gases

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the quantity of APCr produced. Ammonia dosing for the NO_x abatement system will be optimised to prevent ammonia slip.

Lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring. The Facility's preventative maintenance regime will include regular checks and calibration of the reagent dosing system to ensure optimum operation. Back-up feed systems will be provided to ensure no interruption in the lime dosing system. The bag filter will be designed to build up a filter cake of unreacted acid gas reagent, which acts as a buffer during any minor interruptions in dosing.

Activated carbon dosing will be based on flue gas volume flow measurement. The activated carbon dosing screw speed frequency control responds automatically to the increase and decrease of flue gas volume. Maintaining a steady concentration of activated carbon in the flue gas and consequently on the filter bags will maintain the adsorption rate for gaseous metals and dioxins.

Activated carbon and lime will be stored in separate silos. The feed rates for the activated carbon and lime dosing systems will have independent control systems.

2.2.3.5 Flue Gas Treatment Control – NOx

The SNCR system will require the injection of an SNCR reagent, ammonia, into the radiation zone of the boiler at several levels.

The first boiler pass will be divided virtually into several segments. Each segment will consist of a distribution module and injection nozzles on several levels. The configuration of the nozzles will make it possible to achieve full-area coverage of the injection medium across the entire cross section of the radiation zone.

The optimal adjustment of the SNCR reagent injection and steady operation of the combustion process are crucial for maximising NOx reduction through the SNCR system. These will be ensured by the following measures.

1. Integrated combustion control system including an automatic adjustment to the quality of the waste incinerated.
2. Consistent oxygen and temperature profiles in the secondary combustion chamber by means of the swirl created by secondary air injection.
3. Subsequent radiation pass without any internals, thus ensuring a prolonged reaction zone for the NOx reduction.
4. The total flow of ammonia (controlled by the NOx emission measurement) is distributed equally to the distribution modules. The distribution module directs a mixture of ammonia and compressed air to the injection levels according to the following description:
   - Ammonia will be directed to the level with the optimal flue gas temperature.
   - All active levels will be charged with air at full pressure
   - All non-active levels will be charged with air at reduced pressure for the cooling of nozzles.
   - When a level is deactivated, the line will be purged with air at full pressure for a few seconds.
   - For controlling NOx in accordance with the proposed emissions limits, a number of injection levels will be installed and all distributors will be controlled by one temperature measurement at the ceiling of the first boiler pass.
5. Each injection level will consist of two nozzles at different angles to achieve a good coverage in the complete section of the boiler. The pressure drop in the nozzle tip will be designed to optimise the dispersion of the reagent. A high injection velocity for the reagent will be utilised to prevent fouling of the nozzles.

Following commissioning of the Facility, it is proposed to submit a report to the EA which describes the performance and optimisation of the SNCR system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values in the EP with the minimisation of nitrous oxide emissions. It is proposed that the report includes an assessment of the level of NOx and N_2O emissions that can be achieved under optimum operating conditions.

2.2.3.6 Waste Management

The arrangements for the management of residues produced by the installation are presented in Section 2.9. In particular, IBA and APCr from the flue gas treatment system will be stored and disposed of separately.

The procedures for handling of the wastes generated by the Facility will be in accordance with the Indicative BAT requirements in the Sector Guidance Note, refer to Section 2.2.2.

2.2.4 Waste Charging

The Facility will meet the indicative BAT requirements outlined in the Environment Agency sector guidance on waste incineration, titled *'Incineration of waste (EPR5.01)'* for fuel charging and the specific requirements of the IED:

- The combustion control and feeding system would be fully in line with the requirements of the IED. The conditions within the furnace would be continually monitored to ensure that optimal conditions are maintained and that the mandatory emission limits set out within the EP are not exceeded. Auxiliary burners fired with gas oil would be installed and used to maintain the temperature in the combustion chamber if needed.
- The waste charging and feeding systems will be interlocked with furnace conditions so that charging cannot take place when the temperatures drop below 850°C, both during start-up and if the temperature falls to the minimum 850°C during operation.
- The waste charging and feeding systems will also be interlocked with the continuous emissions monitoring system to prevent waste charging if the emissions to atmosphere are in excess of an emission limit value.
- Following loading into the feeding chutes by the grab, the waste will be transferred onto the grates by hydraulic powered feeding units.
- The backward flow of combustion gases and the premature ignition of waste will be prevented by keeping the feed chute full of waste and by keeping the furnace under negative pressure.
- A level detector will monitor the amount of waste in the feed chute and an alarm will be sounded if the fuel falls below the safe minimum level. Secondary air would be injected from nozzles in the wall of the furnace to control flame height and the direction of air and flame flow.
- In a breakdown scenario, operations would be reduced or closed down, as soon as practicable, until normal operations can be restored.

The waste feed rate to the furnace would be controlled by the combustion control system. If there is an intermediate waste feed-stop, requiring the auxiliary burners to operate to maintain the operation of the Facility without entering shutdown, the flue gas treatment systems will remain in operation.

2.3 Water Use

2.3.1 Overview

The main use of water at the plant will be to make up the water for the boilers (referred to as boiler feedwater). Other water consuming processes include the wet ash conveyor and the SNCR injection nozzles. The following key points should be noted:

- Most of the steam used in the turbine boiler will be recycled as condensate. The remainder will be lost as blow-down to prevent build-up of sludge and chemicals, through soot blowing, the ash quench system and the FGT system. Lost condensate will be replaced with treated water.
- Under 'normal operations', there will not be any process emissions to water from the Facility.
- Where practicable, waste waters generated from the process would be reused/recycled within the process. These would be collected in an intermediate storage vessel to be re-used in the Facility. Harvested rainwater may also be used to provide feedwater to the water treatment plant or more likely to top-up the ash quench system.
- Water from washdown will be discharged into a settlement tank prior to use in the ash quench system.
- Surface water run-off from vehicle movement areas and roadways will be passed through oil interceptors and silt traps prior to discharge into the surface water pond. The pond will have a release to an existing ditch network to the east of the site, as part of the existing drainage strategy for the industrial estate. In addition, in the case of fire or a significant spill, there will be an isolation system (penstock valve) to prevent the discharge of surface water from the site into the pond.
- The water system has been designed with two key objectives:
  - minimal process water discharge; and
  - minimal consumption of potable water.
- Firewater will be provided by an on-site firewater tank which is connected to the towns water supply.
- The Facility will have separate process/foul sewer and storm water systems (surface drainage).

2.3.1.1 Potable and Amenity Water

Water for drinking supplies for the offices and mess facilities will come from a potable water supply. The quantity of this water is expected to be small compared to the other water uses on site.

Waste water from showers, toilets, and other mess facilities will be discharged into a domestic drainage system for release to sewer for treatment.

2.3.1.2 Process Water

Process waters will be supplied by mains water. It is anticipated that the Facility will consume approximately 7 m^3/hour of mains water.

High quality water will be used to compensate for boiler blow-down losses. The Facility will have a water treatment plant which is designed to continuously supply high quality water.

Process effluents will be collected in a settlement tank (referred to as the wastewater pit). This effluent will then be re-used in the ash quench system. Under normal operating conditions, process effluents will be generated from the following processes:

1. regeneration of the resins in the water treatment plant;
2. process effluent collected in the site drainage system (e.g. boiler blowdown);
3. condensate from the condensate tank;
4. effluent generated through washing and maintenance procedures; and
5. water run-off collected from the bottom ash quench,

The wastewater pit will provide acid dosing for pH adjustment and settlement of process effluents so that it can be re-used within the ash quench. In the event of excess process effluents being generated, these will be discharged to sewer in accordance with a Trade Effluent Consent.

Washdown water consumption will be minimised by the use of trigger controls on all wash hoses.

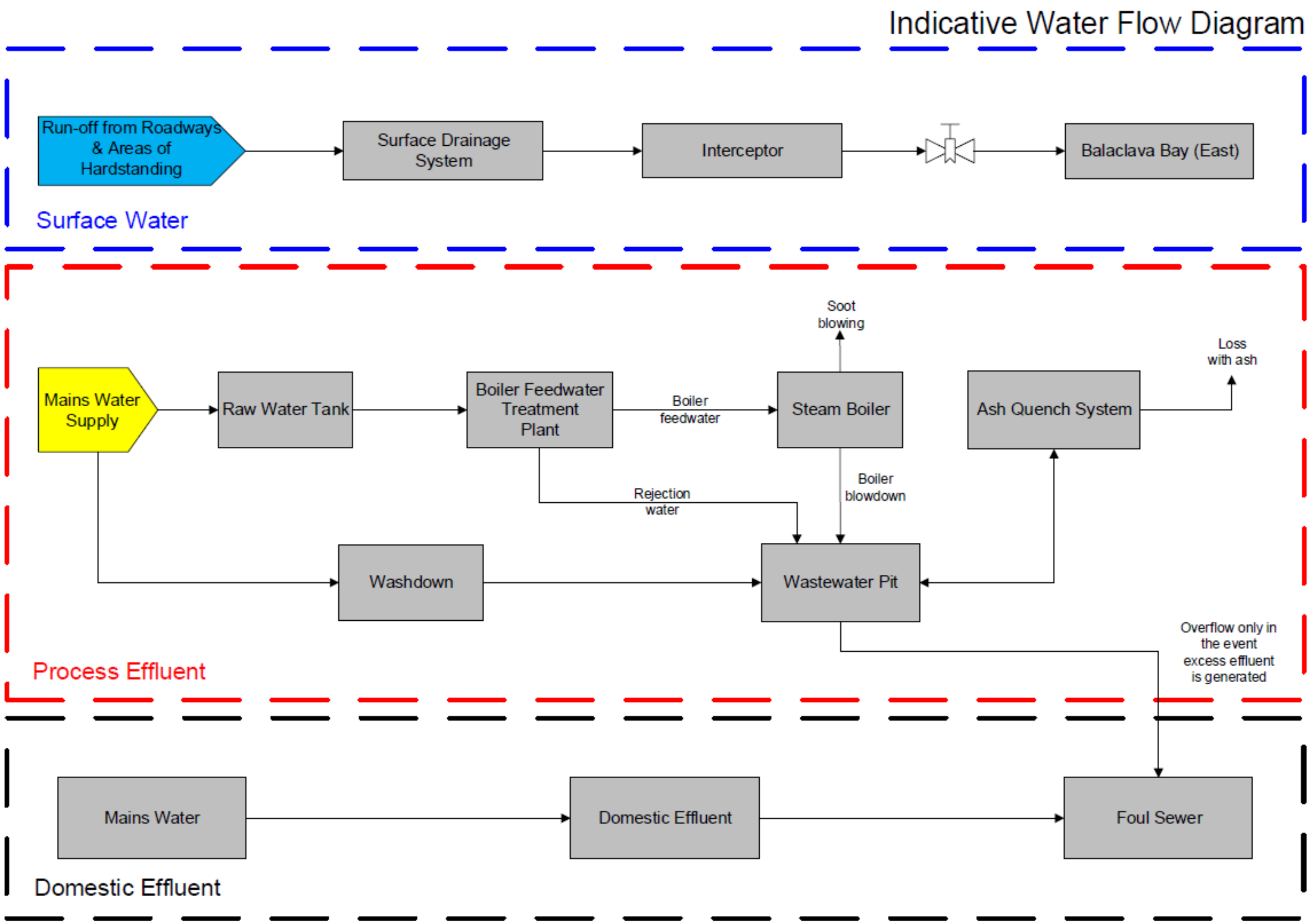
2.3.2 Water Supply

Potable water from the mains water supply will be used to provide feedwater for the boiler. This will be treated in an on-site water treatment plant to produce high quality boiler feedwater. Wastewater from the treatment plant will be re-used within the process, likely within the ash quench. Harvested rainwater may be used to provide feedwater to the water treatment plant; however, this would require significant treatment to ensure that it is of a suitable quality for use in the boiler. It is more likely to be used to top-up the ash quench system. The potential for a rainwater harvesting system to be installed will be examined during detailed design of the Facility.

Water for fire-fighting will be stored in dedicated firewater storage facilities.

An indicative water flow diagram for the Facility is presented in Figure 2. A larger version of the schematic is presented in Appendix A.

Figure 2: Indicative Water Flow Diagram



2.4 Emissions

2.4.1 Emissions to Air

The source of point source emissions to air from the Facility are presented in the table below:

Table 2-5: Proposed Emission Points

Emission point reference	Source
A1	ERF

The full list of proposed emission limits for atmospheric emissions is shown in the table below:

Table 2-6: Proposed Emission Limit Values (ELV's)

Parameter	Units	Half Hour Average	10-minute average	Daily Average	Periodic Limit
Emission Point A1					
Particulate matter	mg/Nm^3	30		5	-
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20		10	-
Hydrogen chloride	mg/Nm^3	60		6	-
Carbon monoxide	mg/Nm^3		150	50	-
Sulphur dioxide	mg/Nm^3	200		30	-
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400		120	-
Ammonia	mg/Nm^3			8	
Hydrogen fluoride	mg/Nm^3				1
Cadmium & thallium and their compounds (total)	mg/Nm^3				0.02
Mercury and its compounds	mg/Nm^3				0.02
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3				0.3
Dioxins & furans	ng I-TEQ/Nm^3				0.04
Dioxins & furans & dioxin like PCB's	ng WHO-TEQ/Nm^3				0.06

Note: All expressed at 11% oxygen in dry flue gas at standard temperature and pressure.

Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

The BAT Reference Document on Waste Incineration (herein referred to as the Waste Incineration BREF) and the European Union Commission Implementing Decision (EU) 2019/2010 dated 12 November 2019 (establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) were published in December 2019. Therefore, in accordance with the Waste Incineration BAT Conclusions, the

Facility will be required to comply with the BAT-AELs, for a 'new' facility, from commencement of operation. The emission limits being applied for are in accordance with the upper end of the BAT AEL ranges for a 'new' facility, except that the emission limit for ammonia is slightly lower in order to provide additional protection for protected habitats, as discussed in the air quality assessment in Appendix D.

2.4.2 Fugitive Emissions to Air

In addition to point source emissions to air, there will be potential fugitive emissions to air from refilling of raw material storage facilities, such as tanks and silos. Where appropriate, these will be vented to the tanker during refilling.

The lime and activated carbon silos will be filled by bulk tanker, offloaded pneumatically with displaced air vented through a reverse pulse jet filter. The silos will be fitted with high-level controls and alarms. All silos will be fitted with bag filter protection to prevent the uncontrolled release to dusts during refilling. Cleaning of the filter will be done automatically with compressed air after the filling operation. The filters will be inspected regularly for leaks.

The APCr silo will be unloaded by a chute system, which will back-vent into the tanker to prevent the release of dusty air to the atmosphere from silo unloading operations.

All waste handling activities will be undertaken within enclosed buildings, and therefore will minimise fugitive emissions of dust from the Facility. Incoming waste is stored in an enclosed waste reception area (bale storage area and waste storage bunker). To maintain negative pressure in the waste reception area, primary combustion air will be drawn from the area and fed into the combustion chamber beneath the grate. Additional bale storage and bunker management procedures, and the inclusion of regular clear-downs of the waste reception area, will minimise the release of litter or dusts.

2.4.3 Emissions of Odour

The storage and handling of waste is considered to have potential to give rise to odour. The Facility would be designed in accordance with the requirements of EA Guidance Note H4: Odour. The Facility will include a number of controls to minimise odour from the installation during normal and abnormal operation.

Odour will be controlled and contained within the waste reception area by maintaining these areas at a negative pressure. Air from the waste reception areas (bale storage area and waste storage bunker) will be extracted to be used as combustion air within the waste incineration plant.

During normal operation of the Facility, daily inspections will be undertaken to monitor for odour and will include the following:

- waste reception area;
- external boundary;
- monitoring the position of louvres; and
- monitoring combustion air flow, with odorous air extracted via the boiler and the stack.

During periods of shutdown the frequency of the above inspections would be extended, including monitoring combustion air flow if the Induced Draft fan operation can be maintained, for instance during periods of maintenance. In addition, during shutdown, a daily 'sniff test' and inspection around the boundary of the Facility would be conducted.

Waste management procedures for the bale storage area and the waste storage bunker, will be employed to avoid the development of anaerobic conditions and decomposition which could potentially generate further odorous emissions. These management procedures will include the frequent mixing and rotation of waste, and periodic emptying and cleaning. Waste rotation would be carried out on a rotational sequence, with the use of designated 'zones' to ensure regular and well distributed turnover of the incoming waste within the waste storage bunker. The process also results in a more homogeneous fuel, which would increase fuel efficiency in the incineration process. During periods of shutdown, bunker management procedures would not normally be implemented as this will avoid the generation of odorous emissions especially when waste volumes within the bunker are low.

Prior to periods of planned maintenance, bunker management procedures will reduce the amount of incoming waste within the waste storage bunker prior to the shutdown. In the event of an extended unplanned shutdown, if unacceptable levels of odour are identified at the installation boundary waste will be unloaded from the waste storage bunker, or the bale storage area, for transfer off-site to a suitably licensed waste management facility.

2.4.4 Emissions to Water and Sewer

Under normal operation, there will be no emissions of process effluent from the Facility discharged to sewer, and the only effluent discharge to sewer will be domestic effluents.

Under 'normal operation' there will not be any trade effluent discharged to water from the Facility. Where practicable, waste waters generated from the process (such as from water treatment and boiler blowdown) will be re-used/recycled within the process, for example in the ash quench system. In the case of excess effluents being generated, such as the emptying of the boiler, effluent will be discharged to foul sewer in accordance with a Trade Effluent Consent, which will be secured from the Sewerage Undertaker (Wessex Water) prior to commencement of operations.

Surface water run-off from vehicle movement areas, roadways and building roofs will be collected in a surface water drainage system. The surface water drainage system will be fitted with a retention interceptor and swales, prior to the discharge point, to prevent discharge of oils and sediment collected from vehicle movement areas and roadways being released off-site. All surface water run-off will be discharged, via separate discharge points, to Balaclava Bay (east) and/or Portland Harbour.

An indicative water schematic diagram which shows the different flows of water and effluents within the Facility is presented in Appendix A.

2.4.5 Contaminated Water

All chemicals will be stored in an appropriate manner, incorporating the use of suitably designed secondary and tertiary abatement measures to ensure appropriate containment. This includes the use of hardstanding in suitable areas, to prevent any spills from causing pollution to the soil or groundwater underneath. Where appropriate, bunding will be utilised as a containment measure for some tanks. The potential for accidents, and associated environmental impacts, is therefore limited.

All storage facilities for chemicals will be designed in accordance with recognised industry good practice to prevent pollution, and UK government Guidance for Pollution Prevention (GPPs).

Deliveries of all chemicals will be unloaded and transferred to suitable storage facilities. Areas and facilities for the storage of chemicals and liquid hazardous materials will be situated within secondary containment. Secondary containment facilities will have capacity to contain whichever is the greater of 110% of the tank capacity or 25% of the total volume of materials being stored, in case of failure of the storage systems.

Tanker off-loading of chemicals will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery. This may include measures such as areas of hardstanding with falls to a gully and/or sump.

Adequate quantities of spillage absorbent materials will be made available at easily accessible location(s), where chemicals are stored. A site drainage plan, including the location of process and surface water drainage will be made available on-site following completion of detailed design.

Any spillage that has the potential to cause environmental harm or to leave the installation would be reported to the site management and recorded in accordance with the Facility's inspection, audit and reporting procedures. Where appropriate, the relevant regulatory authorities (the EA/Health and Safety Executive) would be notified of the incident, in accordance with the Facility's documented management procedures.

The effectiveness of the emergency response procedures will be subject to Management Review and will be revised and updated as appropriate following any major spillages.

In the event of a fire, contaminated water used for fighting fires will be collected through the surface water drainage system. The drainage system will be fitted with an isolation valve to prevent the discharge of water from the drainage system in the event of a fire.

2.4.6 Noise

The Facility has been designed with all waste storage, handling and processing activities undertaken within suitably enclosed buildings/structures. Where practicable, the layout and design of the Facility has taken into consideration, the proximity to sensitive receptors and noise sources from the Facility.

A noise assessment which considers the impact of operational noise upon sensitive receptors is presented in Appendix C.

2.5 Monitoring Methods

Regarding emissions monitoring, sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The Facility will be equipped with modern monitoring and data logging devices to enable checks to be made of process efficiency.

The purpose of monitoring has three main objectives:

1. To provide the information necessary for efficient and safe plant operation;
2. To warn the operator if any emissions deviate from predefined ranges; and
3. To provide records of emissions and events for the purposes of demonstrating regulatory compliance.

2.5.1 Monitoring Emissions to Air

The following parameters for the emissions from the Facility will be monitored and recorded continuously using a CEMS):

1. Carbon monoxide;

2. Hydrogen chloride;
3. Sulphur dioxide;
4. Nitrogen oxides;
5. Ammonia;
6. VOCs; and
7. Particulates.

In addition, the oxygen content, water vapour content, temperature and pressure of the flue gases will be monitored so that the emission concentrations can be reported at the reference conditions as required by the Industrial IED.

The installation and function of the CEMS system would be subject to control and periodic surveillance tests by an independent testing company at frequencies to be agreed with the EA.

The following emissions from the Facility will also be monitored by means of spot sampling:

1. Hydrogen fluoride;
2. Group 3 Metals: cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb); chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V);
3. Cadmium (Cd) and Thallium (Tl);
4. Mercury (Hg);
5. Nitrous Oxide;
6. Dioxins and furans; and
7. Dioxin like PCBs.

The methods and standards used for emissions monitoring will be in compliance with guidance note EPR5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard.

The frequency of periodic measurements will comply with the IED as a minimum. The flue gas sampling techniques and the sampling platform will comply with Environment Agency Technical Guidance Notes M1 and M2.

All monitoring results would be recorded, processed and presented in such a way as to enable the EA to verify compliance with the operating conditions and the regulatory emission limit values within the EP.

Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations.

2.5.1.1 Reliability

IED Annex VI Part 8 allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. IED Annex VI Part 8 also requires that no more than 10 daily averages are discarded per year.

These reliability requirements will be met primarily by selecting MCERTS certified equipment.

Calibration of the CEMS will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181 and the BS EN 15267-3. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier. The CEMs will be supplied with remote access to allow service engineers to provide remote diagnostics.

There will be a 'duty' CEMS installed, with an additional stand-by CEMS in the event of a failure. This will ensure that there is continuous monitoring data available even if there is a problem with the duty CEMS.

2.5.1.2 Start-up and Shutdown

The emission limit values under the IED do not apply during start-up and shutdown, but the abatement equipment will operate during start-up and shutdown. Therefore, a signal will be sent from the main plant control system to the CEMS system to indicate when the plant is operational and burning waste. The averages will only be calculated when this signal is sent, but raw monitoring data will be retained for inspection.

2.5.2 Monitoring Emissions to Water and Sewer

There would be no process emissions to water from the Facility. Therefore, monitoring of emissions to water is not proposed.

2.5.3 Process Monitoring

The Facility will be controlled from a dedicated control room. A modern control system, incorporating the latest advances in control and instrumentation technology, will be used to control operations, optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over. The system will control and/or monitor the main features of the plant operation including, but not limited to the following:

- Combustion air;
- Fuel feed rate;
- SNCR system;
- Flue gas oxygen concentration at the boiler exit;
- Flue gas composition at the stack;
- Combustion process;
- Boiler feed pumps and feedwater control;
- Steam flow at the boiler outlet;
- Steam outlet temperature;
- Boiler drum level control;
- Flue gas control;
- Power generation; and
- Steam turbine exhaust pressure.

The response times for instrumentation and control devices will be designed to be fast enough to ensure efficient control.

The following process variables have particular potential to influence emissions:

1. Fuel throughput will be recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput will be recorded;
2. Combustion temperature will be monitored at a suitable position to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C;
3. The differential pressure across the bag filters will be measured, in order to optimise the performance of the cleaning system and to detect bag failures; and
4. The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment.

Water use would be monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This will be achieved by monitoring the incoming water supplies and the boiler water makeup.

In addition, electricity and gas oil consumption will be monitored to highlight any abnormal usage.

2.5.4 Validation of Combustion Conditions

The Facility would be designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of a minimum 850°C. This criterion will be demonstrated using CFD modelling during the design stage and confirmed by the recognized measurements and methodologies during commissioning in accordance with EA Guidance Note EPR5.01, and the EA's further guidance titled, *'Review of BAT for New Waste Incineration Issues: Part 2 – Validation of Combustion Conditions'.*

During commissioning it will be demonstrated that the Facility can achieve complete combustion by measuring concentrations of carbon monoxide, VOCs and dioxins in the flue gases and TOC of the bottom ash.

During the operational phase, the temperature at the 2-seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes would be selected using the results of the CFD model. If it is not possible to locate the temperature probes at precisely the 2-seconds residence time point, then a correction factor will be applied to the measured temperature. The CFD model for the design will be made available to the EA following detailed design of the boiler.

Ammonia will be injected into the flue gases at a temperature of between 850 and 1,000°C. This narrow temperature range is needed to reduce NOx successfully and avoid unwanted secondary reactions. This means that multiple levels of injection points will be required in the radiation zone of the furnace.

Sufficient nozzles will be provided at each level to distribute the ammonia correctly across the entire cross section of the radiation zone. CFD modelling will be used to define the appropriate location and number of injection levels as well as number of nozzles to make sure the SNCR system achieves the required reduction efficiency for the whole range of operating conditions while maintaining the ammonia slip below the required emission level.

The CFD modelling will also be used to optimise the location of the secondary air inputs into the combustion chamber.

2.5.5 Measuring Oxygen Levels

The oxygen concentration at the boiler exit of the Facility would be monitored and controlled to ensure that there will always be adequate oxygen for complete combustion of combustible gases. Oxygen concentration will be controlled by regulating the combustion airflows and the waste feed rate.

2.6 Technology Selection

Within this section, qualitative and quantitative BAT assessments have been presented for the following:

- combustion technology;
- NO_x abatement technology;

- acid gas abatement technology;
- particulate matter; and
- steam condenser.

Where appropriate, the quantitative assessments draw on information and data obtained by Fichtner from a range of different projects using the technologies which have been identified as potentially representing BAT from an initial qualitative assessment.

2.6.1 Combustion Technology

It is proposed that the waste treatment/energy recovery technology for the Facility would be a moving grate furnace. This is the leading technology in the UK and Europe for the combustion of the fuel types likely to be treated by the Facility. The grate is comprised of inclined fixed and moving bars that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

The Waste Incineration BREF and the BREF for Large Combustion Plants identify a number of alternative technologies for the combustion of waste fuels. The suitability of these technologies alongside other waste incineration technologies has been considered as follows:

Grate Furnaces

- As stated in the EA Guidance Note EPR5.01, these are designed to handle large volumes of waste.
- Grates are the leading technology in the UK and Europe for the combustion of biomass and waste fuels. The moving grate comprises inclined fixed and moving bars (or rollers), or a vibrating grate that will move the fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.
- Grate systems are designed for large quantities of heterogeneous waste, and so would be appropriate for the fuel to be processed at the Facility.

Fixed Hearth

- These are not considered suitable for large volumes of waste. They are best suited to low volumes of consistent waste. Therefore, these systems are not considered suitable for the proposed design capacity and have not been considered any further.

Pulsed Hearth

- Pulsed hearth technology has been used in the past for the combustion of waste derived fuels, such as those proposed to be combusted at the Facility. However, there have been difficulties in achieving reliable and effective burnout of waste, and it is considered that the burnout criteria required by Article 50 (1) of the IED would be difficult to achieve. Therefore, these systems are not considered practical and have not been considered any further.

Rotary and Oscillating Kilns

- Rotary kilns are used widely within the cement industry which uses a consistent fuel feedstock, and they have been used widely within the healthcare sector in treating clinical waste, but they have not been used in the UK for large volumes of waste derived fuels. The energy conversion efficiency of a rotary kiln is lower than that of other thermal treatment technologies due to the large areas of refractory lined combustion chamber.

- An oscillating kiln is used for the incineration of municipal waste at only two currently known sites in England and some sites in France. The energy conversion efficiency in these systems is lower than that of other thermal treatment technologies due to the large areas of refractory lined combustion chamber.
- The capacity per rotary or oscillating kiln unit is limited to 8 tonnes per hour, and for this application around three kilns would be required to achieve the nominal design throughput. Considering the proposed capacity of the Facility, this is not considered practical and would lead to significant efficiency losses, therefore this option has not been considered any further.

Fluidised Bed Combustor

- Fluidised beds are designed for the combustion of relatively homogeneous fuel. They are sensitive to inconsistencies within the fuel, and can require the pre-treatment of incoming waste to ensure that it is suitable for processing in a fluidised bed. Whilst fluidised bed facilities have been installed in the UK for processing municipal wastes, the plants which have been installed have had significant issues with their commissioning and have been subject to regular breakdowns. On this basis, Powerfuel do not consider that they are a proven technology.
- While fluidised bed combustion can lead to slightly lower NOx generation, the injection of a NOx reagent is still required to achieve the relevant emission limits specified in the IED.
- Fluidised beds can have elevated emissions of nitrous oxide, a potent greenhouse gas. Some have been designed to minimise the formation of nitrous oxide.

Pyrolysis /Gasification

- In pyrolysis, the waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be from the combustion of part of the syngas.
- Various suppliers are developing pyrolysis and gasification systems for the incineration of waste derived fuels. However, as there are no operational facilities at the capacity required for the Facility, Powerfuel do not consider that they are a robust and proven technology. Therefore, these systems have not been considered any further.

A quantitative BAT assessment for a grate and conventional fluidised bed has been undertaken and is presented in Appendix E, section 5. The conclusions of the assessment are summarised in Table 2-7.

Table 2-7: BAT assessment combustion techniques

		Grate	Fluidised Bed	Rotary Kiln
Global Warming Potential	t CO_2eq p.a.	-42,600	-41,500	-31,000
Ammonia Consumption	t.p.a.	800	500	1,000
Residues	t.p.a	38,842	38,842	38,842
Total Materials Costs	p.a.	£2,360,000	£2,620,000	£2,390,000
Power Revenue	p.a.	£5,978,000	£5,831,000	£4,361,000

All combustion technologies will produce similar quantities of residue, although the fluidised bed produces more residue due to the losses of sand from the furnace.

Out of the three options, the grate option has the lowest global warming potential. A grate option would consume approximately 60% more ammonia than a fluidised bed system, and approximately 20% less ammonia than a rotary kiln system.

The material costs are approximately 10% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue. However, it is acknowledged that it is marginal. However, it should be noted if the incoming waste requires any additional pre-processing treatment to be suitable for combustion within a fluidised bed, then this will significantly increase the material costs associated with the fluidised bed.

The rotary kiln is less efficient, which has a significant impact on the global warming potential and the associated operating costs. In addition, the capital cost associated with a rotary kiln is likely to be significantly higher as additional streams will be required to achieve the proposed processing capacity.

As stated within the qualitative BAT assessment, grate combustion systems are designed for large quantities of heterogenous waste, whereas fluidised bed systems are more sensitive to inconsistencies within the fuel. Due to the robustness of grate combustion systems, they are considered to represent BAT for the Facility.

2.6.2 NOx Abatement Technology

As stated within the relevant EA sector guidance (EPR5.01), there are three recognised technologies available for the abatement of emissions of NOx:

1. Flue Gas Recirculation (FGR);
2. Selective Non-Catalytic Reduction (SNCR); and
3. Selective Catalytic Reduction (SCR).

Flue Gas Recirculation (FGR)

For the purposes of the application, it is assumed that the Facility will not employ FGR. However, this is subject to discussions with technology providers during detailed design.

It is important to understand that FGR is not a bolt-on NOx abatement technique. The recirculation of a proportion of the flue gases into the combustion chamber to replace some of the secondary air changes the operation of the plant in various ways, by changing the temperature balance and increasing turbulence. This requires the boiler to be redesigned to ensure that the air distribution remains even.

Some suppliers of grates have designed their combustion systems to operate with FGR and these suppliers can gain benefits of reduced NOx generation from the use of FGR. Other suppliers of grates have focussed on reducing NOx generation through the control of primary and secondary air and the grate design, and these suppliers gain little if any benefit from the use of FGR.

It is also important to emphasise that, even where FGR does improve the performance of a combustion system, it does not reduce NOx emissions to the levels required by IED. Therefore, it would not alleviate the need for further NOx abatement systems.

Selective Non-Catalytic Reduction

SNCR involves distributing a spray containing an aqueous ammonia or aqueous urea solution (the de-NOx reagent) into the flue gas flow path at an appropriate location (typically the secondary combustion chamber), at a gas temperature of 850 to 1,050°C. The reagent reacts with the NOx formed in the combustion process to produce a combination of nitrogen, water and carbon dioxide (when urea is used as the reagent). NOx levels are primarily controlled by monitoring the combustion air.

Extensive dosing of reagent or low reaction temperatures can lead to ammonia slip, resulting in the formation of ammonia salts downstream in the flue gas path and discharge to atmosphere of unreacted ammonia. Ammonia may be controlled under the plant's permit and can lead to secondary problems, so should be kept to a minimum. This can be addressed by employing systems to control the rate of reagent dosing.

SNCR is widely deployed across waste, biomass and coal power plants in the UK and Europe. It is proposed to use SNCR for the Facility to control NOx levels, alongside the monitoring of combustion air. Ammonia solution will be used as the SNCR reagent.

Selective Catalytic Reduction

The use of Selective Catalytic Reduction (SCR) has also been considered. In this technique, ammonia or urea solution is injected into the flue gases immediately upstream of a reactor vessel containing layers of catalyst. The NOx is converted into nitrogen, water and carbon dioxide, with the reaction most efficient in the temperature range 200 to 350°C.

The catalyst is expensive, and to achieve a reasonable working life it is necessary to install the SCR downstream of the flue gas treatment plant. This is because the flue gas treatment plant removes dust which would otherwise cause deterioration of the catalyst.

The reaction takes place at lower temperatures than SNCR methods, however, since the other flue gas cleaning reactions take place at an optimum temperature of approximately 140°C, the flue gases have to be reheated before entering the SCR. This requires some thermal energy which would otherwise be converted to electrical power output, reducing the overall energy recovery efficiency of the facility. The catalytic reactor also creates additional pressure losses to be compensated by a bigger exhaust fan, reducing further the overall energy efficiency.

Full SCR systems are considerably more complicated and more capital intensive than SNCR systems.

Whilst the technology provider has proposed an SNCR system to abate emissions of NOx from the furnace, to ensure compliance with the proposed emission limit for NOx and the reduced limit for ammonia, shown in Table 2-6, the technology provider has indicated that it may be necessary for a layer of catalyst to be installed in the flue from the bag filters and prior to release from the stack to act as a 'polisher'. It is proposed that a pre-operational condition is included within the EP which requires confirmation of the final design of the NOx abatement system to be confirmed to the EA, following completion of detailed design.

A quantitative BAT assessment of the available NOx abatement technologies has been undertaken and is presented in Appendix E. The SNCR system combined with the polishing will ensure compliance with the proposed emission limits for NOx and ammonia. For the purposes of this BAT assessment it has been assumed that the proposed system is classified as an SNCR system with an SCR polisher, rather than an SCR system.

Table 2-8 below compares the use of SNCR, SCR and SNCR with FGR in a quantitative assessment of BAT.

Table 2-8: BAT assessment NOx abatement

Parameter	Units	SNCR	SCR	SNCR + FGR
NOx released after abatement	t p.a.	140	90	140

Parameter	Units	SNCR	SCR	SNCR + FGR
NOx abated	t p.a.	290	340	240
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq p.a.	-5,300	-3,400	-5,300
Global Warming Potential	t CO2 p.a.	600	1,900	800
Ammonia	t.p.a.	770	200	640
Annualised Cost	£ p.a.	£265,000	£1,178,000	£332,000
Cost per tonne NOx abated	£ p.t NOx.	£910	£3,460	£1,380

As can be seen from the table above, applying SCR to the Installation:

1. increases the annualised costs by approximately £1 million;
2. abates an additional 50 tonnes of NO_x per annum;
3. reduces the benefit of the Facility in terms of the global warming potential by approximately 1,300 tonnes of CO_2 per annum;
4. reduces reagent consumption by approximately 570 tonnes per annum; and
5. costs approximately an additional 300% per tonne of NO_x abated.

The additional costs, and higher global warming potential associated with SCR are not considered to represent BAT for the Facility. On this basis, SNCR is considered to represent BAT.

Including FGR to the SNCR system to abate NO_x increases the cost per tonne of NO_x abated by nearly 50% compared to SNCR only. It has no effect on the direct environmental impact of the plant, but it increases the impact on climate change by approximately 200 tonnes of CO_2 per annum while reducing ammonia consumption by approximately 130 tonnes per annum. Allowing for the increase in the costs of NO_x abatement for a SCR system compared to the climate change and reagent consumption associated with FGR, an SNCR system with or without FGR is considered to represent BAT. It is proposed that a Pre-Operational Condition is included within the EP which requires the details of the proposed NOx abatement system to be confirmed following detailed design.

2.6.3 Acid Gas Abatement System

There are currently three technologies widely available for acid gas treatment on similar plants in the UK:

1. Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.
2. Semi-dry, involving the injection of quick lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the quick lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue

gases in the boiler, making the steam cycle less efficient. The quick lime and reaction products are collected on a bag filter, where further reaction can take place.

3. Dry, involving the injection of lime or sodium bicarbonate into the flue gases as a powder. The reagent is collected on a bag filter to form a cake and most of the reaction between the acid gases and the reagent takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more reagent than the semi-dry system. However, this can be improved by recirculating the flue gas treatment residues, which contain some unreacted lime and reinjecting this into the flue gases.

Wet scrubbing is not considered to be suitable for the Facility, due to the production of a large volume of hazardous liquid effluent and a reduction in the power generating efficiency of the plant. In addition, a visible plume is generated through the use of wet scrubbing.

Dry and semi-dry systems can easily achieve the emission limits required by the IED and both systems have been demonstrated to achieve the relevant emission limits on numerous operational throughout Europe. Furthermore, both are considered to represent BAT within the EA Sector Guidance Note (EPR5.01). The advantages and disadvantages of each technique are varied which makes assessment complex; therefore, the assessment methodology described in Horizontal Guidance Note H1 has been used and is detailed in Appendix E Section 2.

For the purposes of the EP application, a quantitative assessment of the available technologies for the proposed capacity was undertaken using data obtained by Fichtner from a range of different projects. The options are considered in Table 2-9.

Table 2-9: BAT assessment acid gas abatement

	Units	Dry	Semi-Dry
SO_2 abated	tpa	480	480
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq pa	140	140
Global Warming Potential	t CO_2 eq pa	1,900	3,700
Additional water consumption compared to a dry system	tpa		16,825
APC Residues	tpa	5,550	5,000
Annualised Cost	£ pa	3,582,000	3,715,000

The performance of the options is very similar.

The dry system only requires a small quantity of water for conditioning of the lime so that it is suitable for injection into the reaction chamber, whereas the semi-dry system requires the lime to be held in solution (quick lime). This requires significantly more water than a dry system.

The dry system has a reduced global warming potential and a reduced annualised cost However, the semi-dry option benefits from medium reaction rates that mean that a shorter residence time is required in comparison with a dry system. In addition, within a semi-dry system recycling of reagent within the process is not proven, but it is proven in a dry system.

Due to the low water consumption and proven capability for recycling of reagents, the dry system is considered to represent BAT for the Facility.

2.6.4 Particulate Matter Abatement

The Facility will use a multi-compartment fabric filter for the control of particulates. There are a number of alternative technologies available, but none offer the performance of the fabric filter. Fabric filters represent BAT for this type of waste incineration plant for the following reasons:

- Fabric filters are a proven technology and are used in a wide range of applications. The use of fabric filters with multiple compartments allows individual bag filters to be isolated in case of individual bag filter failure.
- Wet scrubbers are not capable of meeting the same emission limits as fabric filters.
- Electrostatic precipitators are also not capable of abating particulates to the same level as fabric filters. They could be used to reduce the particulate loading on the fabric filters and so increase the acid gas reaction efficiency and reduce lime residue production, but the benefit is marginal and would not justify the additional expenditure, the consequent increase in power consumption and significant increase in the carbon footprint of the Facility.
- Ceramic Filters have not been proven for this type of waste incineration plant design, and are regarded as being more suited to high temperature filtration.

Fabric filters are considered to represent BAT for the removal of particulates for the Facility.

The bag filter will not require a flue gas bypass station, as the bag filters will be preheated allowing start-up without a bypass, which is considered to represent BAT.

For plants which include a bypass in their design, there is a risk that during normal operation, pollutant residues can build up in the inlet duct to a bypass station. If the bypass is then operated during start-up, as is common until the bag filter is at operating temperature, these residues will be emitted from the stack with no abatement.

2.6.5 Steam Condenser

There are three potential BAT solutions considered in Environment Agency sector guidance on waste incineration, titled *'Incineration of waste (EPR5.01)'* as representing indicative BAT for the ERF, which are:

1. Air Cooled Condensers (ACC);
2. Water Cooling; and
3. Evaporative Condensers.

Water cooling can be achieved through once-through cooling systems or by a recirculating water supply to condense the steam. Both cooling systems require significant quantities of water, and a receiving watercourse for the off-site discharge of cooling water. Whilst a supply of water is available from Portland Port, and this could also receive the discharge, initial design work for a water-cooled system has identified that neither are feasible. As Portland Port is an operational port, the volumes of cooling water which would need to be discharged into the Port would create problems for the manoeuvring boats within the port. In addition, the significant infrastructure required for the extraction and discharge of water from the Port would introduce a hazard for the manoeuvring of boats. On this basis, neither of these technologies are considered to be available for the Facility.

ACCs do not require significant quantities of water. It is acknowledged that ACCs can have noise impacts, but mitigation measures can be applied to the design to ensure that the noise impacts associated with the ACCs are at an 'acceptable' level. Furthermore, ACCs do not create a visual impact (visible plume), unlike that from evaporative cooling. The ACCs can be designed and guaranteed by the technology supplier with sufficient capacity to maintain turbine efficiency during warm weather. Therefore, the Facility will operate an ACC to condense the steam output from the turbine to allow return of the condensate to the boiler, with ACCs considered to represent BAT for the Facility.

2.7 The Legislative Framework

2.7.1 Specific Requirements of the Industrial Emissions Directive (2010/75/EU)

This section presents information on how the Facility will comply with the Waste Incineration requirements of the Industrial Emissions Directive (IED).

Chapter IV of the IED includes 'Special Provisions for Waste Incineration Plants and Waste Co-incineration Plants'. Review of provisions for waste incineration as presented in the IED has identified that the following requirements are applicable to the Facility:

- Article 46 – Control of Emissions;
- Article 47 – Breakdown;
- Article 48 – Monitoring of Emissions;
- Article 49 – Compliance with Emission Limit Values;
- Article 50 – Operating Conditions;
- Article 52 – Delivery & Reception of Waste;
- Article 53 – Residues; and
- Article 55 – Reporting & public information on waste incineration plants and waste co-incineration plants.

Table 2-10 below identifies the relevant Articles of the IED and explains how the Facility will comply with them. Many of the articles in the IED impose requirements on regulatory bodies, in terms of the permit conditions which must be set, rather than on the operator. The table below only covers those requirements which the IED imposes on 'Operators', and either explains how this is achieved or refers to a section of the application where an explanation can be found.

Table 2-10: Summary table for IED compliance

Article	Requirement of the IED	How requirement is met (or reference)
22 (2)	Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state	Refer to Appendix B – Site Condition Report.

Article	Requirement of the IED	How requirement is met (or reference)
	upon definitive cessation of activities provided for under paragraph 3. The baseline report shall contain at least the following information: (a) information on the present use and, where available, on past uses of the site; (b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned. Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.	
44	An application for a permit for a waste incineration plant or waste co-incineration plant shall include a description of the measures which are envisaged to guarantee that the following requirements are met: (a) the plant is designed, equipped and will be maintained and operated in such a manner that the requirements of this Chapter are met taking into account the categories of waste to be incinerated or co-incinerated;	Refer to sections 2.2.1 to 2.2.4 of the Supporting Information.
	(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable through the generation of heat, steam or power;	Refer to section 2.7.2 of the Supporting Information.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to section 2.9 of the Supporting Information.
	(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law.	Refer to section 2.9 of the Supporting Information.
46 (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.	Refer to Appendix D – Air Quality Assessment.

Article	Requirement of the IED	How requirement is met (or reference)
46 (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.	Refer to Table 2-6 of the Supporting Information.
46 (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.	Refer to Appendix B – Site Condition Report, and Appendix I – Environmental Risk Assessment.
46 (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 time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	Refer to Appendix D – Air Quality Assessment.
47	In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.	Refer to section 2.2.4. (In addition, relevant information regarding shutdown is also described in section 2.5.1.2 and section 2.2.1).
48 (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.	Refer to section 2.5.1 of the Supporting Information.
48 (4)	All monitoring results shall be recorded, processed and presented in such a way as to	Refer to section 2.5.1 of the Supporting Information.

Article	Requirement of the IED	How requirement is met (or reference)
	enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	
49	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.	There will be no emissions from flue gas treatment systems to water/sewer from the Facility.
50 (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.	TOC or Loss on Ignition testing.
50 (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.	Refer to section 2.5.3 of the Supporting Information.
50 (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 (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas.	Refer to section 2.1.3.4 of the Supporting Information.
50 (4)	Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations:	Refer to section 2.2.4 of the Supporting Information.

Article	Requirement of the IED	How requirement is met (or reference)
	(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;	Refer to section 2.2.4 of the Supporting Information.
	(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Refer to section 2.2.3.4 of the Supporting Information.
50 (5)	Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable.	Refer to section 2.7.2 of the Supporting Information.
50 (6)	Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.	This requirement will not apply as the Facility will not receive infectious clinical waste.
52 (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.	Refer to section 2.2.2 of the Supporting Information.
52 (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.	Refer to section 2.2.1 of the Supporting Information.
53 (1)	Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	Refer to section 2.9 of the Supporting Information.
53 (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.	Refer to section 2.9 of the Supporting Information.
53 (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	Refer to section 2.9 of the Supporting Information.

Article	Requirement of the IED	How requirement is met (or reference)
	chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	

2.7.2 Requirements of the Waste Incineration BREF

The Waste Incineration BREF was published by the European IPPC Bureau in December 2019. Upon adoption of the Waste Incineration BREF, the EA is required to review and implement conditions within all permits which require operators to comply with the requirements set out in the BREF.

It is understood from that the EA requires details of how the Facility will satisfy the requirements of the Best Available Techniques (BAT) conclusions as set out in the Waste Incineration BREF. Table 2-11 explains how the Facility will comply with the requirements of the individual BAT conclusions.

Table 2-11: Summary table for WI BREF BAT conclusions compliance

#	BAT Conclusion	How met or reference
1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the features as listed in BAT 1 of the BREF.	A general summary of the proposed EMS is presented in Section 2.10 of the Supporting Information. The EMS will be developed throughout the development stage of the project. It is proposed that a pre-operational condition in included within the EP which requires Powerfuel to provide a summary of the proposed EMS prior to commencement of operation.
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.	As stated in the greenhouse gas assessment (refer to Appendix D), the gross electrical efficiency of the plant is calculated to be approximately 26%. Therefore, Powerfuel understands that this is in accordance with the requirements of BAT 2.
3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF.	As set out in section 2.5 of the Supporting Information, the process parameters for monitoring of emissions to air are as follows: • water vapour content • temperature; and • pressure. The oxygen content and flow rate of the flue gases will also be monitored. Temperature will be monitored in the combustion chamber. There will be no emissions of water from FGC systems and there will be no bottom ash treatment undertaken at the Facility – therefore, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply to the Facility. Powerfuel can confirm that the Facility will include for monitoring of the key process parameters relevant for emissions to air in accordance with BAT 3.
4	BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international	It is anticipated that emissions to air will be monitored with the following frequency: <u>Continuous Monitoring</u>

#	BAT Conclusion	How met or reference
	standards that ensure the provision of data of an equivalent scientific quality.	• Oxygen; • Carbon monoxide; • Hydrogen chloride; • Sulphur dioxide; • Nitrogen oxides; • Ammonia; • Volatile organic compounds (VOCs); and • Particulates. Periodic Monitoring • Hydrogen fluoride; • Group 3 heavy metals (Sb, As, Pb, Cr, Co, CU, Mn, Ni, V) – once every six months; • Cadmium and thallium – once every six months; • Mercury – once every six months; • Nitrous oxide – once every year; • Dioxins and furans - once every six months (except long-term sampling of PCDD/F once every month); and • Dioxin-like PCBs (once every six months for short-term sampling, once every month for long-term sampling). As set out in section 2.5.1 of the Supporting Information, the methods and standards used for emissions monitoring will be in compliance with EPRS5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit. Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or

#	BAT Conclusion	How met or reference
		equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality. Powerfuel considers that the proposals for monitoring of emissions to air are in accordance with the requirements of BAT 4.
5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).	Powerfuel understands that the UK regulatory agencies are currently consulting with the UK waste incineration industry on the definition of 'appropriate monitoring' of emissions to air during OTNOC. On this basis, POWERFUEL are not able to confirm how the Facility will comply with BAT 5. Powerfuel proposes that a Pre-Operational Condition is included within the permit which requires confirmation of the proposals for monitoring of emissions to air during OTNOC – this will include need to include confirmation from the EA of operating conditions and an agreed definition of OTNOC.
6	BAT is to monitor emissions to water from Flue Gas Cleaning (FGC) and/or bottom ash treatment with at least the frequencies set out in BAT 6 of the BREF 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.	As explained in section 1.4.4 of the Supporting Information, the Facility will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGC systems. Furthermore, there will not be any emissions to water from the treatment or handling bottom ash. Therefore, it is understood that the requirements of BAT 6 are not applicable to the Facility.
7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards.	As explained in section 2.2.3.3 of the Supporting Information, Total Organic Carbon (TOC) will be measured in the bottom ash to confirm that it is less than 3%, and/or Loss on Ignition (LOI) will be measured to confirm it is less than 5%. Measurements will be taken at least once every 3 months and will be in accordance with EN standards. Powerfuel considers that the proposals for monitoring of slags and bottom ashes are in accordance with the requirements of BAT 7.
8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams	The Facility will not incinerate hazardous waste. Therefore, Powerfuel does not consider that the requirements of BAT 8 are applicable to the Facility.

#	BAT Conclusion	How met or reference
	(e.g. slags and bottom ashes, flue-gas, wastewater) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	
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) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f).	As described in Section 2.2 of the Supporting Information, the Facility will employ the following techniques as required by the BREF: • Determination of the types of waste that can be incinerated. The Facility will incinerate waste in accordance with the list of EWC waste codes that will be listed in the permit, and waste that falls into the range of calorific values as per the firing diagram. The list of EWC codes will characterise the physical state, general characteristics and hazardous properties of the waste. • Implementation of waste acceptance procedures. The Operator will develop acceptance procedures for all wastes delivered to the Facility, in order to ensure that only the wastes which the Facility is permitted to receive are received at the Facility. Paperwork accompanying each delivery will be checked. Periodic inspections of the waste will be undertaken as part of the scope where practicable, prior to transfer into the bunker, to confirm that it complies with the specifications of the waste transfer note (WTN). Waste will be inspected by the crane operator as it is tipped and mixed. • Powerfuel will develop and implement waste pre-acceptance and acceptance procedures at the Facility. The waste acceptance procedures will identify the records required for wastes to be accepted at the Facility and where records associated with the waste should be retained in the document management system which will be employed at the Facility. • Waste acceptance procedures will be used to identify any unacceptable wastes which are not suitable for processing within the Facility and require quarantine and transfer off-site.

#	BAT Conclusion	How met or reference
		It is understood that technique (f) of BAT 9 does not apply as the Facility will not incinerate hazardous waste. Powerfuel considers that the proposed arrangements for the receipt and segregation of waste complies with the requirements of BAT 9.
10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	The Facility will not include a bottom ash treatment plant within the installation boundary. Therefore, Powerfuel does not consider that the requirements of BAT 10 apply to the Facility.
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 9c) including, depending on the risk posed by the incoming waste, the elements as listed in BAT 11 of the BREF.	As described in Section 2.2.2.1 of the Supporting Information, and explained in relation to BAT 9 above, periodic monitoring of waste deliveries will be undertaken at the Facility. This will include the following elements in accordance with the BREF: • Weighing of the waste deliveries by use of a weighbridge at the entrance/exit of the Facility. • Periodic visual inspection of waste either prior to being tipped into the bunker, or where this is not practicable, as it is tipped into the bunker by the crane operator. • Periodic sampling of waste deliveries and analysis of key properties, such as calorific value and metal content. The Facility will not undertake radioactivity detection tests as it is not anticipated that any radioactive waste will be received. Powerfuel considers that the proposed arrangements for monitoring the waste deliveries as part of the waste acceptance procedures complies with the requirements of BAT 11.
12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the following techniques:	The surfaces of the waste reception, handling and storage areas have been designed and will be constructed as impermeable structures. Adequate drainage infrastructure will be fitted to areas where receipt, handling and storage of waste takes place – these areas will have appropriate falls to the process water drainage system. The integrity of areas of hardstanding will be

#	BAT Conclusion	How met or reference
	Use impermeable surfaces with an adequate drainage infrastructure; and Have adequate waste storage capacity.	periodically verified by visual inspection. Regular maintenance of the drainage systems will be undertaken in accordance with documented management procedures to be developed for the Facility. Adequate waste storage capacity will be available on site – the maximum waste storage capacity of the waste bunker will be clearly established and not exceeded. The quantity of waste will be visually monitored against the maximum storage capacity. During periods of planned maintenance, quantities of fuel within the bunker will be run down where possible. Powerfuel considers that the proposed arrangements for environmental risks associated with the reception, handling and storage of waste comply with the requirements of BAT 11.
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 as listed in BAT 13 of the BREF.	The Facility will not process clinical or hazardous waste. Therefore, Powerfuel considers that the requirements of BAT 13 are not applicable to the Facility.
14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags 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 below:	Bunker crane mixing and advanced control systems will be employed at the Facility. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in Section 2.5.3 of the Supporting Information, the system will control and/or monitor the main features of the plant operation including, but not limited to the following: • combustion air; • fuel feed rate; • SNCR system; • flue gas oxygen concentration at the boiler exit;

#	BAT Conclusion	How met or reference
		• flue gas composition at the stack (including HCl measurements); • combustion process; • boiler feed pumps and feedwater control; • steam flow at the boiler outlet; • steam outlet temperature; • boiler drum level control; • flue gas control (including differential pressure across the bag filters); • power generation; and • steam turbine exhaust pressure. Water, electricity and gas oil usage will also be monitored to highlight any abnormal usage. Powerfuel considers that the proposed arrangements for ensuring the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste comply with the requirements of BAT 14.
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, as and when needed and practicable, based on the characterisation and control of the waste.	The Facility will be controlled from a dedicated control room, with an advanced control system to optimise the process. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system: for example, ammonia solution dosing will be optimised and adjusted to minimise the ammonia slip. Lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring. Activated carbon dosing will be based on flue gas volume flow measurement.

#	BAT Conclusion	How met or reference
		Powerfuel considers that the proposed control systems will ensure that the Facility is designed to allow for the adjustment of the plant's settings to comply with the requirements of BAT 15.
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.	The Facility will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable. Waste will be kept at suitable levels in the waste bunker to maintain operation during holiday periods. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations. Powerfuel considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations to comply with the requirements of BAT 16.
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 wastewater treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability.	The FGC and wastewater treatment systems will be appropriately designed and operated within the design range. The FGC and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures. Powerfuel considers that the design and operation of the FGC and wastewater treatment plants will ensure that emissions to air (and water where applicable) are reduced, and will ensure their optimal availability, to comply with the requirements of BAT 17.
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 EMS that includes the elements as identified in BAT 18 of the BREF.	It is currently understood that, at the time of writing, the approach to OTNOC (including definition, associated limits and required monitoring) is still to be determined between ESA and the EA. Powerfuel requests that the EA confirm any conditions relating to OTNOC be updated or varied in-line with any required changes following finalisation of these discussions. It is anticipated that a risk-based OTNOC management plan will be required to be incorporated into the Facility's EMS. This would include the following elements: • Identification of potential OTNOC, root causes and potential consequences. • Regular update of the list of identified OTNOC following periodic assessment.

#	BAT Conclusion	How met or reference
		• Appropriate design of critical equipment (the Facility will utilise compartmentalisation of the bag filter and ensure that the bag filter is not bypassed during periods of start-up or shutdown). • Implementation of preventative maintenance plans for critical equipment. • Monitoring and recording of emissions during OTNOC and associated circumstances. • Periodic assessment of the emissions and circumstances occurring during OTNOC and implementation of corrective actions if necessary. Powerfuel considers that the incorporation of a risk-based OTNOC management plan will ensure the Facility's compliance with BAT 18.
19	In order to increase resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	The Facility will use a steam boiler to produce steam which is used to produce electricity. The Facility will also have the provision to export heat to local users. Powerfuel considers that the use of a heat recovery boiler is in direct compliance with the requirements of BAT 19.
20	In order to increase energy efficiency of the incineration plant, BAT is to use an appropriate combination of techniques as listed in BAT 20 of the BREF.	The Facility will use the following techniques to increase the energy efficiency of the plant: • Minimise heat losses via the use of an integral furnace boiler – heat will be recovered from the flue gases by means of a steam boiler integral with the furnace; • Optimisation of the boiler design to improve heat transfer – the boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste fuel that is combusted; • High steam conditions (51 bar(a) at a temperature of 400°C, subject to detailed design), to increase electricity conversion efficiency; • Cogeneration of heat and electricity – the Facility has been designed as a combined heat and power plant and will have the capacity to provide heat

#	BAT Conclusion	How met or reference
		to local users. Subject to commercial agreements with heat users, a scheme for the export of heat will be implemented. Powerfuel considers that the techniques listed above will increase the energy efficiency of the plant and ensure that the Facility will comply with the requirements of BAT 20.
21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to use the methods as stated in BAT 21 of the BREF.	In accordance with the BREF, the Facility will employ the following measures to reduce odour emissions: • Waste in the Facility will be stored in an enclosed bunker area under negative pressure. The extracted air will be used as combustion air for incineration. • The operation of the Facility will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to the Facility. • Odour will be controlled during shutdown periods by minimising the amount of waste in storage. Waste will be run-down prior to periods of planned maintenance. In addition, doors to the bunker hall will be kept shut during periods of shutdown. The measures listed above to reduce odour emissions will ensure that the Facility will comply with the requirements of BAT 21.
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.	Gaseous wastes and liquid wastes will not be accepted at the Facility. Therefore, the requirements of BAT 22 do not apply to the Facility.
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 EMS the following diffuse dust emission management features:	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 23 do not apply to the Facility. However, identification of the most relevant diffuse dust emissions, and definition and

#	BAT Conclusion	How met or reference
		implementation of appropriate actions and techniques, will be included within the scope of the EMS at the Facility.
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 as given in BAT 24 of the BREF.	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 24 do not apply to the Facility. However, it can be confirmed that the following techniques will be employed at the Facility to minimise dust emissions: • All ash handling including conveying undertaken within enclosed buildings. • Where possible, minimising the height of ash discharge. • Use of a water ash quench to minimise the generation of dusts from ash handling activities.
25	In order to reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 25 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air: • Bag filters – to reduce particulate content of the flue gas. • Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of lime to abate acid gases. The concentrations of metals and metalloids will be monitored in accordance with the permit for the Facility. It is considered by Powerfuel that the techniques listed above to reduce channelled emissions to air will ensure that the Facility will comply with the requirements of BAT 25.
26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air, BAT is to treat the extracted air with a bag filter.	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 26 do not apply to the Facility. The bottom ash hall will not be held under negative pressure, however the methods as listed in response to BAT 24 will enable dust emissions to be minimised from the handling of bottom ash.
27	In order to reduce channelled emissions of HCl, HF and SO2 to air from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 27 of the BREF.	BAT 27 of the waste incineration BREF states that BAT is to use one or a combination of the following techniques: • Wet scrubber;

#	BAT Conclusion	How met or reference
		• Semi-wet absorber; • Dry sorbent injection; • Direct desulphurisation (only applicable to fluidised beds); and • Boiler sorbent injection. In a dry sorbent injection system, the reagent is injected into the flue gas stream within the flue gas treatment system, located after the boiler. In direct boiler sorbent injection, the reagent is injected directly into the flue gas stream within the boiler. This only achieves partial abatement of the acid gases and does not eliminate the need for additional flue gas cleaning stages. As stated in section 2.6.3, it is considered BAT for the Facility to utilise a dry sorbent injection system to abate acid gases. The dry system will be designed to ensure that the Facility will operate in accordance with the relevant ELVs, assumed to be the BAT-AELs, without the requirement for any additional abatement measures. The design of the dry sorbent injection system will include the following controls to ensure that the Facility operates in accordance with the relevant ELVs: • A flue gas monitoring system at the exit of the boiler to control reagent dosing rate within the flue gas treatment system; and • Recirculation of a proportion of the flue gas treatment residues to reduce reagent consumption. It is considered by Powerfuel that the use of dry sorbent injection to reduce channelled emissions to air of acid gases is in compliance with the requirements of BAT 27.
28	In order to reduce channelled 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	In accordance with the BREF, the following techniques will be employed at the Facility to reduce peak emissions of HCl, HF and SO_2 whilst limiting reagent consumption and residue generation from dry sorbent injection:

#	BAT Conclusion	How met or reference
	absorbers, BAT is to use optimised and automated reagent dosage, or both the previous technique and the recirculation of reagents.	• The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment, including automated reagent dosage. • A proportion of the APC residues will be recirculated to reduce the amount of unreacted reagent in the residues. • The concentrations of HCl, HF and SO_2 released from the Facility will comply with BREF limits. The techniques listed above to reduce channelled peak emissions to air of acid gases will ensure that the Facility will comply with the requirements of BAT 28.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	The following elements have been incorporated into the design of the Facility: • Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14); • An SNCR system which is supplemented with a layer of catalyst which will be installed in the flue from the bag filters and prior to release from the stack to act as a 'polisher'; and • Optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip). As justified in section 2.6.2 of the Supporting Information, the use of flue gas recirculation will be confirmed during detailed design of the Facility. The design elements listed above to reduce channelled NOx emissions to air (whilst limiting emissions of CO, N_2O and NH_3) will ensure that the Facility will comply with the requirements of BAT 29.

#	BAT Conclusion	How met or reference
30	In order to reduce channelled 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 below to reduce channelled emissions to air of organic compounds: Optimisation of the incineration process; Control of the waste feed; On-line and off-line boiler cleaning; Rapid flue-gas cooling; Dry sorbent injection; Fixed-or-moving bed adsorption; SCR; Catalytic filter bags; and Carbon sorbent in a wet scrubber.	The Facility will employ the following techniques to reduce channelled emission to air of organic compounds: • Optimisation of the incineration process – the boiler will be designed to minimise the formation of dioxins and furans as follows: • Minimise residence time in critical cooling section to avoid slow rates of combustion gas cooling, minimising the potential for 'de-novo' formation of dioxins and furans. • Utilisation of an SNCR system which inhibits dioxin formation and promotes their destruction. • Apply CFD modelling to the design where appropriate to ensure gas velocities are in a range that negates the formation of stagnant pockets/low velocities. • Minimise volume in critical cooling sections. • Prevent boundary layers of slow-moving gas along boiler surfaces via good design and regular maintenance. • Online and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler. • Dry sorbent injection using activated carbon and lime, in combination with a bag filter. The concentrations of dioxins and furans released from the Facility will comply with BREF limits. As described above, it can be confirmed that the Facility will use techniques (a) – (d) and also technique (e), dry sorbent injection, to reduce channelled emissions to air of organic compounds. The Facility will not use catalytic filter bags. The Facility will utilise the injection of ammonia in an SNCR system to abate NOx emissions. This is considered to be a proven method to reduce NOx

#	BAT Conclusion	How met or reference
		emissions to below the required ELVs and has been successfully used on a number of plants in the UK and Europe. It should be noted that catalytic filter bags are generally used as a replacement for other filter bags which may already absorb dioxins by the injection of activated carbon, as is proposed for the Facility. The removal of activated carbon injection from the process may result in an increase in mercury emissions and would require additional abatement techniques to be installed for the removal of mercury. This is not considered to represent BAT for the Facility. It is stated within the WI BREF that the flue gas temperature when entering the catalytic filter bags should be above 170 – 190°C in order to achieve effective destruction of PCDD/F and prevent adsorption in the media. As stated in the air quality assessment, the temperature of the flue gas leaving the stack is expected to be approximately 140°C. Therefore, the use of catalytic filter bags is not considered to be appropriate for the design of the Facility, as the flue gases would require re-heating which will reduce the efficiency of the process. The techniques described above to reduce channelled emission to air of organic compounds will ensure that the Facility will comply with the requirements of BAT 30. Therefore, the Facility will meet the requirements of BAT 30 without the use of catalytic filter bags.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility in combination with a bag filter. It is considered by Powerfuel that the use of these techniques will ensure that the Facility will comply with the requirements of BAT 31.
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.	There will be separate foul/domestic water, process water and surface water drainage systems at the Facility. Foul effluents from domestic sources will be discharged to sewer in accordance with a Trade Effluent Consent.

#	BAT Conclusion	How met or reference
		It can be confirmed that there will be no wastewater arising from flue gas treatment. Bottom ash handling will be undertaken in an enclosed building with a dedicated drainage system. The drainage in the Facility's waste reception, handling and storage areas will be contained and reused within the process. Uncontaminated water streams, such as surface water run-off, will be segregated from other wastewater streams requiring treatment. Surface water runoff from roadways and vehicle movement areas will pass through interceptors to contain oil and sediments prior to discharge. An Indicative water flow diagram depicting the segregation of different water streams for the Facility is presented in Appendix A. It is considered by Powerfuel that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility will comply with the requirements of BAT 32.
33	In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce water usage and prevent wastewater generation: • Use of an FGC system that does not generate wastewater – by utilising dry sorbet injection of lime and PAC. • Where practicable process effluents will be re-used within the process. Excess amount of process effluent will require discharge, which will either be discharged to sewer or tankered off-site for treatment. It is considered by Powerfuel that the techniques listed above to reduce water usage and prevent/reduce the generation of wastewater will ensure that the Facility will comply with the requirements of BAT 33.
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 as listed in BAT 34 of the BREF, and to use	There will be no treatment of slags and bottom ashes undertaken on-site. In addition, there will be no emission to water from FGC. The risk of emissions to water from the storage of bottom ash at the Facility will be minimised – any overflow from the ash quench will be contained and

#	BAT Conclusion	How met or reference
	secondary techniques as close as possible to the source in order to avoid dilution.	reused within the process and hence there will not be any release of effluent from the ash quench system. In accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above. It is considered by Powerfuel that the Facility will comply with the requirements of BAT 34 by reducing emissions to water from the storage of bottom ash.
35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	It can be confirmed that bottom ash and APCr will be handled and disposed of separately at the Facility. Therefore, Powerfuel considers that the Facility will comply with the requirements of BAT 35.
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 as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	There will be no bottom ash treatment undertaken at the Facility. Therefore, it is understood that the requirements of BAT 36 do not apply to the Facility.
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 as listed in BAT 37 of the BREF.	In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the Facility to prevent or reduce noise emissions: • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. • Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Waste deliveries will take place primarily during daytime hours. • Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level.

#	BAT Conclusion	How met or reference
		• Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. • Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. In addition, refer to the Noise Assessment presented in Appendix C. It is considered by Powerfuel that the techniques listed above to reduce noise emissions will ensure that the Facility will comply with the requirements of BAT 37.

2.8 Energy Efficiency

2.8.1 General

The Facility will utilise steam boilers which will generate steam to be supplied to a turbine, for electricity generation and subsequently export off-site. The Facility will supply electricity to the local electricity grid, as well as to ships which are docked within the Port.

In addition, the Facility has been designed for the export of heat and a number of potential heat users have been identified. However, at this stage there are no formal agreements in place with specific heat users.

In considering the energy efficiency of the Facility, due consideration has been taken of the requirements of the DEFRA and EA guidance titled *'Energy Efficiency standards for industrial plants to get environmental permits'*, dated February 2016.

2.8.2 Basic Energy Requirements

The turbine will be designed to generate up to approximately 18.1 MWe gross power (design maximum) and have the potential to export up to approximately 11 MWth of heat. The Facility is expected to have a parasitic load of approximately 2.9 MWe, so it will be capable of exporting up to approximately 15.2 MWe of power.

The Facility will have a nominal design capacity of approximately 22.8 tonnes of fuel per hour, with a net calorific value of 11 MJ/kg. Assuming an operational availability of 8,000 hours per annum, the nominal design capacity of the plant is approximately 183,000 tonnes per annum of waste. Therefore, the Facility will annually generate approximately 144,800 MWh and export 121,600 MWh of electricity.

In the table below, these figures are compared with the benchmark data for MSW incineration plants, given in the EA Sector Guidance Note (EPR5.01) and in the Waste Incineration BREF.

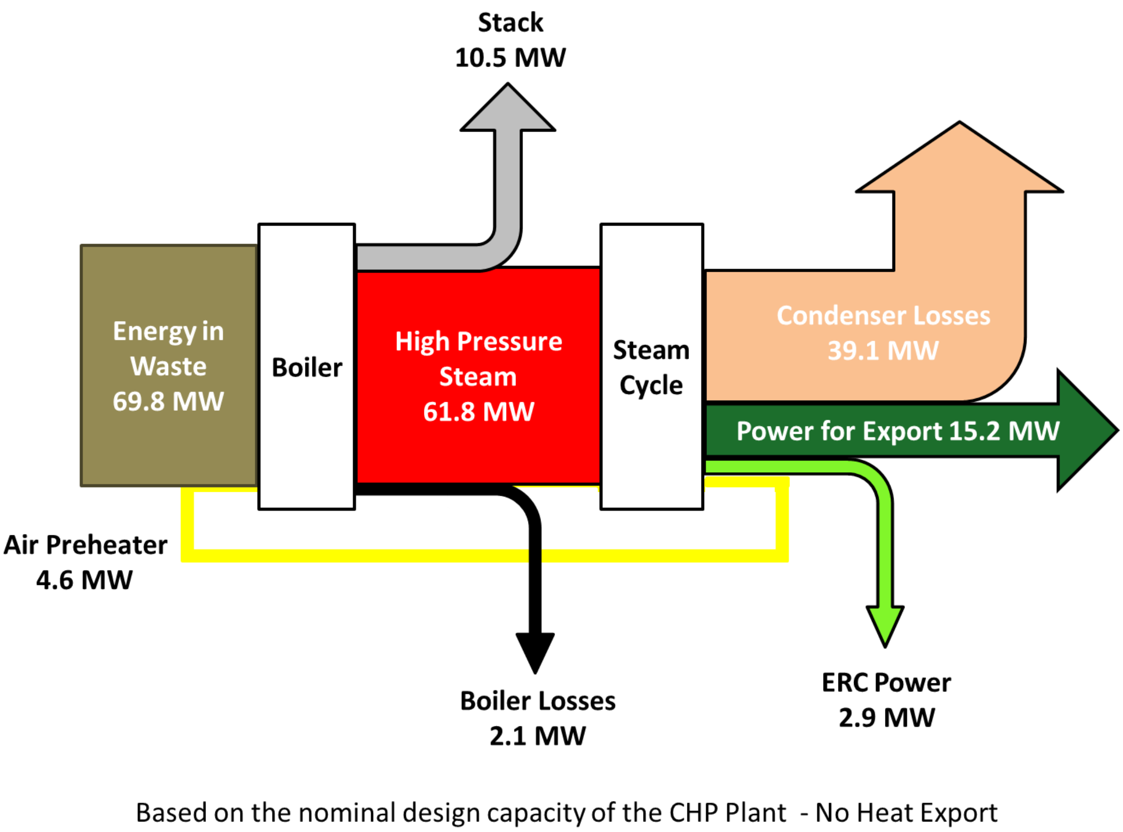
Table 2-12: Facility Design Parameters Comparison Table

Parameter	Unit	The Facility	Benchmark
Gross power generation, nominal design	MWh/t waste	0.79	0.415-0.644
Net power generation, nominal design	MWh/t waste	0.67	0.279-0.458
Internal power consumption, nominal design	MWh/t waste	0.13	0.15
Power generation (assumed gross) for 100,000 tpa of waste	MWe	9.9	5-9

Benchmark Sources: EPR 5.01 for power generation per 100,000 tpa of waste, BREF WI otherwise

An Indicative Sankey Diagram for the Facility (exporting power only) is presented in Figure 3, with a larger version presented in Appendix A.

Figure 3: Indicative Sankey Diagram



Note: Based on the nominal design capacity – no heat export.

The most significant energy consumers are anticipated to be the following:

- Primary and secondary combustion air fans;
- Induced Draft fan;
- Boiler feed water pumps;
- ACC fans;
- Air compressors;
- Fuel loading and transfer systems
- Residue conveying systems; and
- Offices and ancillary rooms.

The Facility has been designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high efficiency variable speed drives, high standards of cladding and insulation etc

The Facility will also be designed to achieve a high thermal efficiency. In particular:

- The boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste fuel that is combusted;
- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;

- Low grade heat will be extracted from the turbine and used to preheat combustion air in order to improve the efficiency of the thermal cycle;
- Steady operation will be maintained where necessary by using gas oil firing; and
- Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

Due consideration will be given to the recommendations in the Sector Guidance Note (EPR5.01) and the Waste Incineration Directive.

2.8.2.1 Operating and Maintenance Procedures

An O&M manual will be developed for the Installation. The O&M procedures will include the following aspects.

1. Good maintenance and housekeeping techniques and regimes across the whole plant.
2. Plant Condition Monitoring will be carried out on a regular basis. This will ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks.
3. Operators will be trained in energy awareness and will be encouraged to identify opportunities for energy efficiency improvements.

Due consideration would be given to the recommendations given in the Environment Agency sector guidance on waste incineration, titled *'Incineration of waste (EPR5.01)'* and waste treatment activities *'Recovery and disposal of hazardous and non-hazardous waste (S5.06)'*.

2.8.2.2 Energy Efficiency Measures

An energy efficiency plan would be built into the operation and maintenance procedures of the plant ensuring maximum, practical, sustainable, safe and controllable electricity generation. This plan would be reviewed regularly as part of the environmental management systems.

During normal operation, procedures will be reviewed and amended, where necessary, to include improvements in efficiency as and when proven new equipment and operating techniques become available. These are assessed on the implementation cost compared with the anticipated benefits.

2.8.3 Further Energy Efficiency Requirements

Under the Industrial Emissions Directive, heat should be recovered as far as practicable. In order to demonstrate this, the following points should be noted:

- Economisers are installed to recover flue gas heat, compatibly with the temperature requirements of the FGT system.
- The boiler will operate with superheated steam.

The plant will not be subject to a Climate Change Levy agreement.

A Heat Plan, which identifies potential heat users (refer to Appendix F), and a CHP-Ready Assessment (refer to Appendix G) have been developed for the Facility.

2.9 Residue Recovery and Disposal

The main residue streams arising from the Facility are:

1. IBA; and

2. APCr

As described below, the waste recovery and disposal techniques will be in accordance with the indicative BAT requirements. The wastes generated from the operation of the installation are summarised in Table 2-13.

Prior to the transfer of any residues off-site, where appropriate, the residues will be tested in accordance with the requirements of Technical Guidance *'WM2: Hazardous Waste: Interpretation of the definition and classification of hazardous waste'*.

Any materials which are to be transferred to landfill from the Facility would be Waste Acceptance Criteria (WAC) tested for leachability to ensure that they meet the WAC for the landfill that they are to be transferred to.

In accordance with the requirements of Article 4 (Waste Hierarchy) of the Waste Framework Directive, which sets out the priorities for the prevention and management of waste, Powerfuel will review the options for the recovery and recycling of all residues generated by the Facility.

2.9.1 Incinerator Bottom Ash

Ash which is collected in the boiler (boiler ash) will be mixed with ash which comes off the end of the grate (bottom ash). The mixture of boiler ash and bottom ash is normally a non-hazardous waste which can be recycled and is referred to as Incinerator Bottom Ash (IBA). If the boiler ash were to be mixed with the APC residues, the mixture would be defined as hazardous waste and this would restrict the ability of the operator to transfer the boiler ash for recovery.

IBA has been used for at least 20 years in Europe as a substitute for valuable primary aggregate materials in the construction of roads and embankments. Powerfuel intend to transfer IBA from the waste incineration plant to an off-site IBA processing facility for recovery/recycling.

2.9.2 Air Pollution Control residue (APCr)

APCr is predominantly composed of calcium as hydroxide, carbonate, sulphate and chloride/hydroxide complexes. Typical major element concentration ranges for the UK residues are as follows:

- 30-36% w/w calcium;
- 12-15% w/w chlorine;
- 8-10% w/w carbonate (as C); and
- 3-4% w/w sulphate (as S).

Silicon, aluminium, iron, magnesium and fluorine are also present in addition to traces of dioxins and the following heavy metals: zinc, lead, manganese, copper, chromium, cadmium, mercury, and arsenic.

APCr is classified as hazardous (due to its elevated pH) in accordance with EA technical guidance *'WM3: Waste Classification – Guidance on the classification and assessment of waste'*. Hazardous waste requires specialist landfill disposal or treatment. It may be possible to send the residue to an effluent treatment contractor, to be used to neutralise acids and similar materials, or to another licensed waste management facility for recycling/treatment. Using the residues in this way avoids the use of primary materials. If these options are not available, it will be sent to a suitably licensed hazardous waste landfill for disposal as a hazardous waste.

APCr will be removed from site in enclosed tankers, thereby minimising the chance of spillage and dust emissions. During the tanker filling operation displaced air would vent back to the silo, and any potential releases to atmosphere would pass through a fabric filter, preventing the release of fugitive dusts from unloading.

Table 2-13: Key residue streams from the Facility

Source/ Material	Properties of Residue	Storage location/ volume stored	Future annual quantity of residue produced (estimate)	Disposal Route and Transport Method	Frequency
Incinerator Bottom Ash	Grate ash. This ash may be mixed with boiler ash, both being relatively inert and classified as non-hazardous.	IBA storage area, 510 tonnes.	34,000 tonnes	Transport off-site for recycling.	Daily
APCr	Ash that does not drop out from the boiler (fly ash) and ash from the flue gas treatment (APCr) are often mixed. The product may contain some unreacted lime, and is classed as hazardous.	Silo(s), 95 tonnes	6,000 tonnes	Transport off-site to a hazardous landfill.	Daily

2.10 Management

The Facility will be designed and constructed following the latest international and national regulations, standards and guidance. This will incorporate risk management techniques such as hazard and operability (HAZOP) studies prior to construction and thorough commissioning and testing before facility takeover.

Powerfuel will ensure that continued Safety, Health and Environmental excellence will be ensured by employing the latest management best practice as outlined below.

2.10.1 Management Systems

As part of its ongoing commitment to sustainable and responsible development and to regulatory compliance, Powerfuel will develop and implement a documented EMS. Measures will be undertaken to ensure that this is communicated, understood and effectively maintained throughout the organisation to meet the requirements of the BS EN ISO 14001:2004 Environmental Management System Standard.

Powerfuel will develop a management structure and a site specific EMS. The EMS will form part of the facility's management system and will establishes an organisational structure, responsibilities, practices, procedures and resources for achieving, reviewing and maintaining the company's commitment to environmental protection. Powerfuel regards the development of documented management systems to be of considerable importance and relevance to a waste treatment facility. It is an assurance to the local authority, regulator, neighbours, and others alike that the facility operation is undertaken in strict compliance with the regulations in force and with the management seeking continual improvements. It requires the company to work in a transparent way, to maintain and improve the confidence of regulators and neighbours, and to have a proactive approach to environmental improvement.

2.10.1.1 Scope and Structure

The scope of the EMS for the Facility is expected to cover three key areas, as follows:

- The design and development of the plant;
- The operation of the plant; and
- The processing of controlled waste.

Where applicable, documented procedures will detail specifically how each activity will be controlled. These will be contained in an Environmental Procedures Manual and identified related documents. The site EMS will contain procedures for accident management that comply with the requirements set out in Agency guidance "*Control and monitor emissions for your environmental permit*". This will be in the form of an accident management plan that will be developed before the plant is commissioned.

2.10.1.2 General Requirements

The EMS objectives and scope will ensure that the EMS includes the following requirements:

- identifying potential environmental impacts;
- documenting and implementing standard procedures to mitigate and control these impacts;
- determining a procedural hierarchy that considers the interaction of the relevant processes;

- ensuring adequate responsibility, authority and resources to management necessary to support the EMS;
- establishing performance indicators to measure the effectiveness of the procedures;
- monitoring, measuring and analysing the procedures for effectiveness; and
- implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

2.10.1.3 Personnel

Sufficient numbers of staff, in various grades, will be required to manage, operate and maintain the plant on a continuous basis, seven days per week throughout the year. The plant will be managed, operated and maintained by experienced managers, boiler operators and maintenance staff.

The key environmental management responsibilities will be allocated as described below.

1. The General Manager will have overall responsibility for management of the ERF and compliance with the operating permit. The general manager will have extensive experience relevant to his or her responsibilities.
2. The Operations Managers will have day-to-day responsibility for the operation of the plant, to ensure that the plant is operated in accordance with the permit and that the environmental impact of the plant's operations is minimised. In this context, he or she will be responsible for designing and implementing operating procedures which incorporate environmental aspects.
3. The Maintenance Manager will be responsible for the management of maintenance activities, for maintenance planning and for ensuring that the plant continues to operate in accordance with its design.

2.10.1.4 Competence, Training and Awareness

Powerfuel aims to ensure that any persons performing tasks for it, or on its behalf, which have the potential to cause significant environmental impact are competent on the basis of appropriate education and training or experience.

Powerfuel's EMS will contain a training procedure to make employees aware of:

- the importance of conformity with the environment policies and procedures and with the requirements of the EMS;
- potentially significant environmental aspects associated with their work;
- their roles and responsibilities in achieving conformity with the requirements of the EMS, including emergency preparedness and response requirements;
- the relevance and importance of their activities and how they contribute to the achievement of the environmental and quality objectives; and
- the potential consequences of the departure from specified procedures.

Powerfuel will comply with industry standards or codes of practice for training (e.g. WAMITAB), where they exist. The EMS will contain an archiving procedure to ensure all training is recorded and all associated records are retained.

2.10.1.5 Competence

Powerfuel will identify the minimum competencies required for each role. These will then be applied to the recruitment process to ensure that key role responsibilities are satisfied. Powerfuel will pay particular attention to potential candidate's experience, qualifications, knowledge and skills.

2.10.1.6 Induction and Awareness

Staff induction programmes are location and job role specific and will include, as a minimum, the induction of:

1. the Environmental Policy;
2. the requirements of the Environmental Permit;
3. the Health and Safety Policy and Procedures; and
4. the EMS Awareness Training

2.10.1.7 Training

Powerfuel will be required to train staff during commissioning of the Portland ERF and before the plant is operational. Line Managers will be required to identify and monitor staff training needs as part of the appraisal system.

Training records will be maintained onsite. Where applicable, will be required to comply with industry standards or codes of practice for training (e.g. WAMITAB), where they exist.

2.11 Closure

2.11.1 Introduction

The minimum operational lifetime of the Facility would be many decades (likely more than 25 years), and any longer-term decommissioning timescale would be dependent on a number of factors including:

- the continued supply of waste and fuel; and
- the development of alternative methods competing for the same waste fuels.

When the Facility has reached the end of its operational life, it may be redeveloped for extended use or demolished as part of a redevelopment scheme and the site cleared and left in a 'satisfactory state'.

2.11.2 General

At the end of the economic life of the Facility, the development site and buildings may be redeveloped for extended use or returned to its current status. The responsibility for this may well rest with other parties if the Facility is sold. However, Powerfuel recognises the need to ensure that the design, the operation and the maintenance procedures facilitate decommissioning in a safe manner without risk of pollution, contamination or excessive disturbance to noise, dust, odour, groundwater and surface watercourses.

To achieve this, a site closure plan would be prepared. This is described in the following sections.

2.11.3 Site Closure Plan

The following is a summary of the measures to be considered within the site closure plan to ensure the objective of safe and clean decommissioning. A detailed Closure Plan will be developed and submitted to the EA, for approval, prior to the commencement of commissioning.

2.11.3.1 General Requirements

The general requirements associated with implementation of the site closure plan will include, but not be limited to, the following:

- Underground pipework for the transfer of process chemicals to be avoided except for supply and discharge utilities such as mains water supply, electrical connections, sewerage lines and gas supply;
- Safe removal of all chemical and hazardous materials;
- Adequate provision for drainage, vessel cleaning and dismantling of pipework;
- Disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, release of dust or other hazardous substances;
- Where practicable, the use of construction material which can be recovered (such as metals);
- Methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater; and
- Soil and groundwater sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report and any ongoing monitoring undertaken during operation of the Facility).

2.11.3.2 Specific Details

The specific details associated with implementation of the site closure plan will include, but not be limited to, the following:

- A list of recyclable materials/components and current potential outlet sources;
- A list of materials/components not suitable for recycling and potential outlet sources;
- A list of materials to go to landfill with current recognised analysis, where appropriate;
- A list of all chemicals and hazardous materials, location and current containment methods;
- A Bill of Materials detailing total known quantities of items throughout the site such as:
  - Steelwork;
  - Plastics;
  - Cables;
  - Concrete and Civils Materials;
  - Oils;
  - Chemicals;
  - Consumables;
  - Contained Water and Effluents;
  - Recovered ferrous metals; and
  - IBA and APCr.

2.11.3.3 Disposal Routes

Each of the items listed within the bill of materials will have a recognised or special route for disposal identified; e.g. landfill by a licensed contractor, disposal by high sided, fully sheeted road vehicle or for sale to a scrap metal dealer, disposal by skip/fully enclosed container, or dealer to collect and disposal by container via road.

2.12 Improvement Programme

Powerfuel is committed to continual environmental improvement of all their operations. Therefore, Powerfuel is proposing that a small number of improvement conditions be incorporated into the final EP. These have been set out below. It is understood that the proposed conditions are consistent with EP's which the EA has granted for waste combustion facilities in England.

2.12.1 Prior to Commissioning

Prior to commencement of commissioning of the Facility, Powerfuel will comply with the typical pre-operational conditions which will be included for this type of installation, as follows;

- Submit a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazardous status to the EA for approval. Sampling and testing will be undertaken in accordance with the protocol as approved.
- Provide a written commissioning plan, including timelines for completion, for approval by the EA. The commissioning plan will include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to the EA in the event that actual emissions exceed expected emissions. Commissioning will be carried out in accordance with the commissioning plan as approved.
- Submit a report on the details of computational fluid dynamics (CFD) modelling used in the design of the boiler. The report would demonstrate whether the BAT design stage requirements, given in Environment Agency sector guidance on waste incineration, titled '*Incineration of waste (EPR5.01)*', have been completed. In particular, the report will demonstrate whether the residence time and temperature requirements would be met.
- Submit a written report to the EA demonstrating the performance and optimisation of the NOx abatement systems, and combustion settings to minimise NO_x emissions. The report would also confirm and justify the design of the NOx abatement systems and whether it will include FGR for the abatement of NOx. This would include provision of the procedures for the safe handling and management of the reagent, alongside an assessment of the level of NO_x and N_2O emissions that can be achieved under optimum operating conditions.

2.12.2 Post Commissioning Conditions

Following commissioning of the Facility, Powerfuel will comply with the typical Improvement Conditions which will be included for this type of installation, as follows:

- Submit a written summary report to the Agency to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified within the EP complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2, and QAL3.

- Carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnace whilst operating under the anticipated most unfavourable operating conditions. Results shall be submitted to the EA.
- Provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the PM_{10} and $PM_{2.5}$ ranges. The report will detail a timetable for undertaking the tests and producing a report on the results.
- Submit a written report to the EA on the commissioning of the Facility. The report will summarise the environmental performance of the Facility as installed against the design parameters set out in the application.

Appendices

A Plans and Drawings

B Site Condition Report

C Noise Assessment

D Air Quality Assessments

E BAT Assessment

F Heat Plan

G CHP-r Assessment

H Fire Prevention Plan

I Environmental Risk Assessment

J Environmental Statement

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