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Table S1.2 - Operating Techniques

Review of Operating Techniques

For the purposes of the review of the Operating techniques listed within the EP, the following documents have been reviewed as follows:

1. Application documents – Supporting information: Section 1.3, 1.4, 1.5,2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10;
2. Response to Schedule 5 Notice dated 09/02/2015;
3. Variation application EPR/MP3333WX/V002; and
4. Additional information in support of application EPR/ MP3333WX/V002.

From the review, only documents 1 and 2 will require changes to the Operating Techniques. The proposed changes to the Operating Techniques are identified within this application.

A Application documents

1.4 The Listed Activity

The Installation will consist of a single Schedule 1 installation activity (as defined in the Environmental Permitting Regulations) and directly associated activities.

Table 1: Environmental Permit Activities

Type of Activity	Schedule Activity	Description of Activity
Installation	Section 5.1 Part A1 (b)	The incineration of waste derived fuels in a facility with a nominal design capacity of greater than 3 tonnes per hour.
Directly Associated Activities		
Directly Associated Activities		The receipt, screening and storage of pre-processed waste derived fuels prior to combustion.
Directly Associated Activities		The handling, storage and transfer of residues for transfer off-site.
Directly Associated Activities		The export of electricity and potential export of heat from the Installation.

The Stationary Technical Unit (the Installation) includes the fuel reception, fuel preparation and storage, water, fuel oil and air supply systems, furnace, boiler, steam turbine/generator set, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and wastewater, stack, devices and systems for controlling combustion operations, recording and monitoring conditions.

The nominal operating capacity of the Installation will be approximately 33.4 tonnes per hour of fuel, with a nominal calorific value of 11.0 MJ/kg.

The plant will have an estimated availability of around 7,884 hours. Therefore, the plant will have a nominal design capacity of approximately 263,000 tonnes per annum.

As shown in the Firing Diagram provided within the Application Pack, the Facility will process wastes with a range of NCV's (9 – 14 MJ/kg). Assuming the lower NCV fuels, the Facility will process up to 38 tph of fuel. Assuming the maximum theoretical availability, the Facility will have a maximum capacity of up to 333,000 tonnes per annum.

An Installation boundary drawing is also presented in Annex 1.

1.5 The Installation

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

The installation will be based around 3 main buildings comprising the turbine hall and boiler house, a fuel reception and storage building. Other main features of the plant include a stack of approximately 105 m in height and an air-cooled condenser with additional ancillary infrastructure including;

5. 2 vehicle weighbridges;
6. Offices, control room and staff welfare facilities;
7. Site fencing and security barrier;
8. External hard standing areas for vehicle manoeuvring/parking;
9. Internal access roads and car parking;
10. Cooling fans;
11. Boiler sump;
12. Water tank;
13. Ammonia tank;
14. Flue gas treatment equipment;
15. Bottom ash storage and transfer area;
16. Fly ash silo (x2);
17. Lime silo;
18. Transformers; and
19. Grid connection compound.

The Installation will have a design thermal fuel input capacity of approximately 102 MWth through a single combustion line. As stated previously the installation will combust fuels with a range of net calorific values – 9.0 MJ/kg to 14 MJ/kg,

The steam turbine will generate electricity, allowing approximately 28.9 MWe to be exported to the local public electricity supply network.

The Installation has been designed for the export of heat to local heat users. A Heat Plan Report is presented in Annex 7.

The process is illustrated in Figure 1 below. A larger copy is also included in Annex 1.

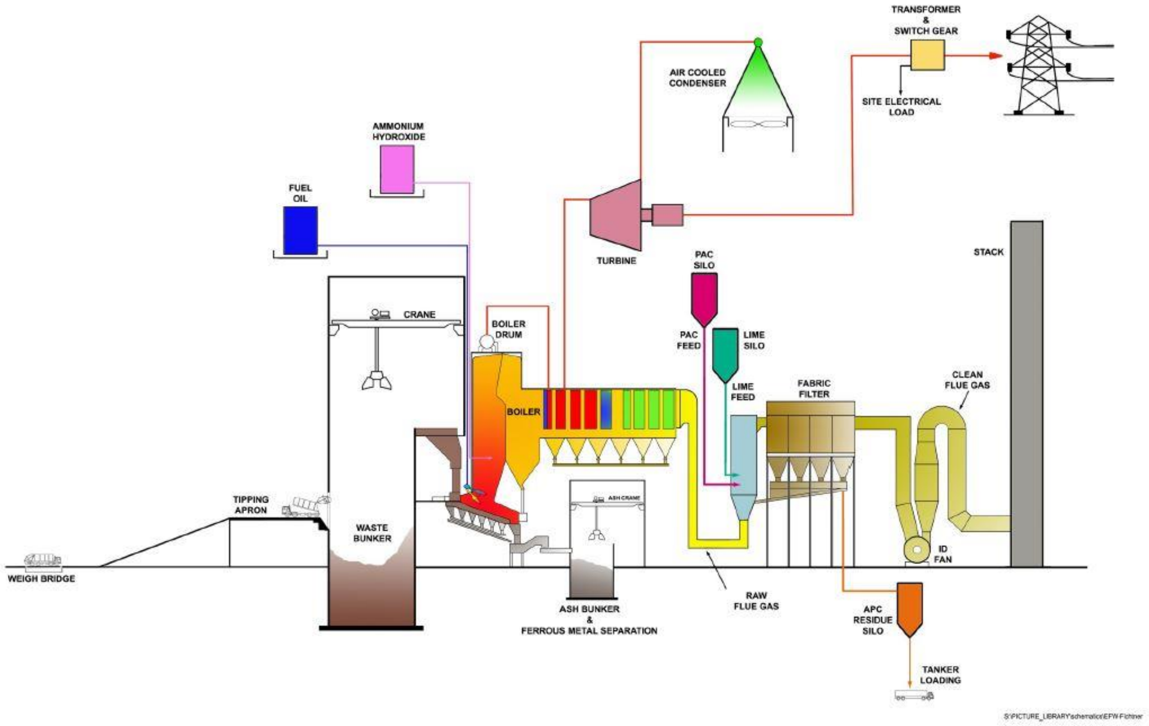


Figure 1 - Indicative Process Diagram

1.5.1 Raw Materials

The Installation will receive deliveries of waste derived fuel by road.

The Installation will also use consumables including:

1. lime;
2. activated carbon;
3. ammonia (<25% solution);
4. gas oil; and
5. other boiler treatment chemicals.

1.5.1.1 Fuel Reception

Waste derived fuel will be sourced from a range of municipal, commercial and industrial sources. The fuel will be pre-processed to meet an agreed specification prior to transport to the Installation.

Incoming fuels will be delivered in covered vehicles or containers. The vehicles will be weighed via an automatic weighbridge before proceeding to the fuel reception area.

The fuel will be unloaded in the enclosed Fuel Reception Area, and tipped into the below ground waste reception bunker, with the existing cranes used to transfer from the bunker to the fuel storage area. The storage capacity of the Fuel Reception bunker and storage area is equivalent to approximately 4 days of waste fuel (3,100 tonnes). The existing cranes will move waste derived fuel from the storage area to the conveying system loading hopper. The waste derived fuel is then transported via enclosed high-level conveyor to the enclosed above ground boiler feed fuel storage bunker.

The fuel storage bunker will have a capacity equivalent to approximately 4 days of fuel (3,100 tonnes), so that operation during an extended weekend/bank holiday is possible without fuel being delivered to the site. Waste will be transferred from the waste storage bunker to the boiler fuel feed hopper via enclosed conveyor.

There are various procedures that will apply to fuel deliveries during planned and unplanned shutdowns. During a short plant shutdown, fuel will be unloaded in the designated unloading area. Fuel deliveries will be suspended for the duration of longer shutdowns.

The fuel storage area is maintained under negative pressure at all times, with the extracted air passing through a carbon filter to remove odour prior to exhausting to atmosphere via a dedicated stack located adjacent to the Waste Reception building.

1.5.1.2 Consumables

All consumables (hydrated lime, NOx reagent and activated carbon) will be delivered to the Installation by road.

Air which is displaced by the ammonia solution, from deliveries of ammonia, will be vented back into the tanker via a filter and the tank will be fitted with an emergency pressure valve which will discharge to atmosphere via a filter.

All liquid chemicals will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the stored capacity.

Lime and activated carbon will be delivered to the plant for storage in silos. Both the lime and the activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo.

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.

Gas oil will be used on site for the auxiliary support burners and mobile plant and equipment. The fuels will be stored in dedicated steel tanks.

1.5.2 Combustion Process

The combustion system is a based on the grate technology (moving grate) which is a proven technology for the combustion of waste derived fuels in Europe and the UK. The fuel will be transferred into the furnace and will fall onto the grate and will burn out gradually.

The hearth, a mechanical moving grate design, will ensure continuous mixing of the fuel and hence promote good combustion. In a moving grate, the fuel is moved mechanically by means of reciprocating or rotating grate elements from the feed end, through a drying zone, a main combustion zone and, finally, a burn out zone. The purpose of the grate is to move and mix the fuel and to distribute primary combustion air evenly across the bed of material. Bottom ash (the inert burnt-out residue from the combustion process) is conveyed off the end of the grate where it is quenched with water and transferred to a storage area for transfer off-site.

Primary air for combustion will be fed to the underside of the grate by a single inverter-driven fan. Secondary air will be injected higher in the grate to create turbulence and ensure complete combustion with minimum levels of oxides of nitrogen (NOx). The volume of both primary and secondary air will be regulated by a combustion control system. An ammonia based reagent will be injected into the combustion chamber to react with the oxides of nitrogen, chemically reducing them to nitrogen and water.

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 audible and visible alarms will trigger in the control room if the temperature starts to fall towards 850°C. The control system will regulate combustion conditions and control the boiler.

The plant will also be fitted with auxiliary burners, which will be designed for firing on gas oil. The burners will be set to operate when the temperature within the furnace drops to 860-870°C. These auxiliary burners will also be fired during plant start up and shut down.

1.5.3 Energy Recovery

The heat released by the combustion of the fuel is recovered in a water tube boiler, which is integral to the furnace and will produce (in combination with superheaters) high pressure superheated steam. The steam from the boiler will then feed a steam turbine which will generate approximately 32.4 MW of electricity. The site electrical load will be approximately 3.5 MW, leaving approximately 28.9 MW of electrical power available for export to the local public electricity supply network.

After the turbine, the steam will be cooled using an air-cooled condenser in which the low pressure exhaust steam from the turbine is condensed by blowing ambient air over heat exchangers from large diameter, slow speed axial fans. The condensed steam is returned as feed water in a closed-circuit pipework system to the boiler.

The Installation will have the potential to export approximately 11 MWth of heat to local heat users. Whilst such export of heat would reduce the electrical output of the installation, the net effect would be to increase the overall thermal efficiency of the Installation.

1.5.4 Flue Gas Treatment

The flue gas treatment system consists of:

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

Concentrations of NOx will be regulated by the careful control of combustion air and the use of the SNCR process in which an ammonia-based reagent will be injected into the high temperature region of the boiler to further reduce the amount of NOx in the gas stream.

Hydrated lime and activated carbon will be injected into the flue gases upstream of the fabric filter in order to abate acidic gases, heavy metals and any remaining dioxins and furans. The hydrated lime will abate the emission of acidic components, including hydrogen fluoride, hydrogen chloride and sulphur dioxide. The activated carbon will abate emissions of mercury, organic compounds and dioxins. The hydrated lime and activated carbon will be stored in separate silos adjacent to the FGT system.

Following the injection of lime and activated carbon, the flue gas will then pass through the fabric filter, which will remove the particulates and reaction products, collectively known as Air Pollution Control residues (APCr).

1.5.5 Ancillary Operations

The Installation will include a water treatment plant which will be used to provide feed water of the required for use in the boilers.

Water for firefighting will be stored in tank(s) with a dedicated pump set.

Standby generators will be provided. These will provide sufficient power to run or shut the plant down in the event of the loss of a grid connection. The generators will have their own exhaust gas emission point.

1.5.6 Ash Handling

The main material produced by the installation will be bottom ash. Bottom ash is the burnt-out residue from the combustion process. Bottom ash collected at the end of the combustion grate and boiler ash collected at the bottom of the boiler passes will be removed by a wet ash conveyor. The conveyor will comprise a water-filled trough (or ash quench) into which the ash will fall. Transportation of the wet ash in the conveyor is by means of a chain conveyor sliding on the bottom of the trough and the inclined section. The purpose of the ash quench is to cool and moisten the bottom ash to limit particulate emissions and to ensure an airtight seal to the furnace to avoid air ingress. The bottom ash will then be conveyed to a bottom ash storage bunker which is designed for 2-3 days storage.

The APCr will be extracted from the hopper of the bag filter unit and conveyed to the fully enclosed storage silos which will have a 5 day operating capacity. The air vent from the storage silos will be fitted with filters to prevent dust releases during filling of the silos. The APCr, which is alkaline in nature, will be discharged from the silos into powder tankers or other suitable containers through specially adapted equipment. To prevent fugitive emissions during filling, a telescopic chute will be connected between the silo discharge and the filling opening of the tanker. Air displaced from the tanker will be vented via a filter unit to prevent fugitive emissions.

It is intended that the bottom ash and APCr would be transferred off-site to a suitably licensed waste management facility for recovery or disposal.

1.5.7 Liquid Effluent and Site Drainage

Process effluents from water treatment and boiler blowdown will be re-used within the ash quench system or used within the boiler to control combustion temperatures.

Uncontaminated rainwater from buildings roofs will be discharge to the site surface water drainage system which discharges into the River Tees.

Surface water run-off roadways, vehicle movement areas and areas of hardstanding will be collected and discharged into the site surface drainage system having passed through interceptors.

1.5.8 Emissions Monitoring and Main Stack

An induced draught fan will draw the flue gas through the boiler and the flue gas cleaning system and release the cleaned flue gas via a 105m stack.

A Continuous Emission Monitoring Station (CEMS) will be installed to monitor the concentrations in the flue gas before it leaves the Installation through the stack. In addition, periodic sampling and measurement will be carried out.

2 Other Information For Application Form

2.1 Raw Materials

2.1.1 Types and Amounts of Raw Materials

Table 2: Types and amounts of raw materials (for the Schedule 1 Activities)

Material	Storage		Estimated Consumption (tonnes per annum)	Description
	Number of silos/ tanks	Storage facility		
Gas Oil	1	Tank	2,340[(1)]	Low sulphur gas oil
Ammonia solution	1	Tank	1,530	Ammonia solution
Lime	1	Silo	6,000	Dry, hydrated or conditioned
Activated carbon	1	Silo	150	Powdered
Other boiler treatment chemicals			<50	Corrosion inhibitor, scale inhibitor, biocide, ion exchange resins (sodium hydroxide, sulphuric acid)
Activated carbon (odour control)	1	Filter Bed	60	Pellets
Note: Assumed to be used as only auxiliary fuel.				

Table 3: Raw materials and their effect on the environment

Product	Chemical composition	Expected quantity	Units	Environmental medium			Impact potential	Comments
				Air	Water	Land		
Gas oil	Low sulphur (<0.1%)	2,340	tpa	100	0	0	Low impact	Used for plant start-ups and maintaining good combustion conditions in the boiler. Plant combustion products released to atmosphere after passing through flue gas treatment plant.
Ammonia solution	NH_4OH	1,530	tpa	100	0	0	Low impact	Reacts with nitrogen oxides to form nitrogen, oxygen, and water vapour. Any unreacted ammonia is released to atmosphere at low concentrations, and is continuously monitored.
Lime	$Ca(OH)_2$ > 95%	6,000	tpa	0	0	100	Low impact	Injected lime is removed with the APCr at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
Activated carbon	C	150	tpa	0	0	100	Low impact	Injected carbon is removed with the APCr at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
Activated carbon (odour control)	C	60	tpa	0	0	100	Low impact	Activated carbon is in pellet form and held in a filter bed to absorb odour. Spent material will be removed via specialist suction system and disposed of or regenerated at an appropriately licenced facility

Various other materials will be required for the operation and maintenance of the plant, including:

1. hydraulic oils and silicone-based oils;
2. electrical switchgear;
3. gas emptying and filling equipment;
4. refrigerant gases for the air conditioning plant;
5. oxyacetylene, TIG, MIG welding gases;
6. CO2 / fire-fighting foam agents; and
7. test and calibration gases.

These will be supplied to standard specification 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 Environment Agency.

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 Reagent Storage

A range of chemical substances and hazardous materials associated with the energy plant process, including ammonia solution, lime and activated carbon, will be stored on site. These 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.

The SNCR system will use ammonia solution as the reagent. The reagent and boiler water treatment chemicals will be stored in suitable containers or tanks provided with a pressure relief valve and vent scrubber system, as appropriate. In the event of a spillage, the bunds will retain the liquid.

Lime and activated carbon, used within the Air Pollution Control process, will be stored within separate storage silos and will be dosed with separate dosing controls. Storage will be in dedicated steel silos with equipment for filling from a tanker through a sealed pipe work system. 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. Delivery to site will be by bulk powder tanker.

Boiler water treatment chemicals will be used to control water hardness, pH and scaling and will be delivered in sealed containers and stored in the water treatment room.

Gas oil will be used on site for the auxiliary support burners and mobile plant and equipment. The fuel will be stored in dedicated steel tanks.

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 adjacent to the workshop and only used as necessary.

2.1.3 Raw Materials Selection

2.1.3.1 Reagent Selection

Acid Gas Abatement

There are several reagents available for acid gas abatement. Sodium hydroxide (NaOH) or hydrated lime ($Ca(OH)_2$) can be used in a wet scrubbing system. Quicklime (CaO) can be used in a semi-dry Air Pollution Control system. Sodium bicarbonate ($NaHCO_3$) or dry lime (referred to as hydrated lime) can be used in a dry Air Pollution Control system.

The reagents for wet scrubbing and semi-dry abatement are not considered, since these abatement techniques have been eliminated by the BAT assessment in Annex 6 section 2. The two alternative reagents for a dry system – lime and sodium bicarbonate – are therefore assessed further.

The level of abatement that can be achieved by both reagents is similar. However, the level of reagent use and therefore residue generation and disposal is different and requires a full assessment following the methodology in Horizontal Guidance Note H1. The assessment is detailed in Annex 6 section 4 and is summarised in the table below.

Table 4: Acid Gas Abatement BAT Data (to abate 1kmol of HCl)

Item	Unit	NaHCO3	Ca(OH)2
Mass of reagent required	kg	109.0	67.0
Mass of residue generated	kg	84.0	85.0
Cost of reagent	£/tonne	155	94
Cost of residue disposal	£/tonne	150	125
Overall Cost	£/ kmol	29.50	16.90
Ratio of costs		1.74	-

Note: Data based on abatement of one kmol of Hydrogen Chloride

In summary, there is a small environmental benefit for using sodium bicarbonate, in that the mass of residues produced is smaller. However, there are a number of significant disadvantages.

1. The residue has a higher leaching ability than lime-based residue, which will limit the disposal options.
2. The reaction temperature doesn't match as well with the optimum adsorption temperature for carbon, which is dosed at the same time.
3. The sodium bicarbonate system has a slightly higher global warming potential due to the reaction chemistry (by around 1,200 tonnes of CO_2).
4. The costs are almost 75% higher.

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

NOx Abatement

An SNCR system can be operated with dry urea, urea solution, or aqueous ammonia solution. There are advantages and disadvantages with all options.

1. Urea is easier to handle than ammonia; the handling and storage of ammonia can introduce additional risk.

2. Dry urea needs big-bags handling whereas urea solution can be stored in silos and delivered in tankers.
3. Ammonia tends to give rise to lower nitrous oxide formation than urea. Nitrous oxide is a potent greenhouse gas.
4. Ammonia emissions (or 'slip') can occur with all reagents, but good control will limit this.
5. The Sector Guidance on Waste Incineration considers all options as suitable for NOx abatement.

Due to the advantages and disadvantages of both reagents, both reagents are considered to represent BAT.

For the purposes of developing the different assessments within this EP application, it has been assumed that the selected reagent is ammonia. However, the selection of reagent for the SNCR system will not be finalised as part of the conversion process. On this basis, it is proposed that a Pre-operational Improvement Condition is included within the EP which requires the Operator to submit further information to the EA on the reagent to be used within the SNCR system and the controls associated with the delivery, receipt, storage and handling of the chosen reagent.

2.1.3.2 Auxiliary Fuel

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

> *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 [850°C]. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber.*

The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels, liquefied gas or natural gas.

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

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

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 850°C.

Natural gas can be used for auxiliary firing. As stated previously, auxiliary firing will only be required intermittently. When auxiliary firing, large volumes of gas would be required. These would need to be supplied from a high-pressure gas main. There is no high-pressure gas main within the site or in the local area. On this basis, natural gas is not considered to be available for the Installation.

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. A storage tank can be easily installed at the Installation. However, the infrequent but large demand for LPG means the tanks would need to be large and unnecessarily introduce a hazard to the site.

A gas oil tank can be easily installed at the Installation. It is acknowledged that gas oil is classed as flammable. 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.

The use of gas oil is considered to represent BAT for the installation. In order to ensure availability of fuels for auxiliary firing, the low NOx burners for auxiliary firing will be gas oil burners. Storage facilities for gas oil will be incorporated into the design of the Installation.

2.1.4 Incoming Fuel

As presented in the firing diagram presented in Annex 1, the Installation is capable of combusting a fuel with a Net Calorific Value (NCV) of between 9.0 and 14 MJ/kg. The nominal design capacity of the Installation is 33.4 tonnes per hour of fuel with an NCV of 11.0 MJ/kg. The Facility expected operational availability is 7,884 hours per annum (90%), which is regarded as typical for this type of installation. Therefore, the nominal design capacity for the installation is 263,000 tonnes per annum.

The plant is designed to operate continuously throughout the year, 7 days a week, 24 hours a day, with the exception of plant shutdowns. Planned and unplanned shutdown time periods will vary from year to year.

However, the annual fuel input capacity could increase or decrease depending on the availability of the plant. If the Installation performed above average and/or operated above the nominal availability during the year, it could be required to shut down unnecessarily if there was no 'headroom' allowance in the annual permitted tonnage.

Moreover, there will also be fluctuations in the net calorific value of the incoming fuel. If the net calorific value of the fuel received is lower than expected, the plant will operate at a higher mechanical throughput than its nominal design capacity. In this case, it again could be required to shut down unnecessarily before the end of the year if there was no 'headroom' allowance in the annual permitted tonnage.

2.1.4.1 Fuel to be Combusted

The table below presents the fuels to be combusted within the Installation.

Table 5: EWC Codes to be processed at the Facility

EWC Code	Waste Description
Waste from agriculture horticulture aquaculture forestry and fishing	
02-01-07	Wastes from Forestry
02-01-09	Agrochemical waste other than those mentioned in 02 01 08
Wastes from wood processing and the production of panels and furniture pulp paper and cardboard	
03-01-01	waste bark and logs
03-01-05	sawdust, shavings cuttings wood particle board and veneer other than those mentioned in 03-012-04
03-03-01	waste bark and wood
03-03-08	Waste from sorting of paper and cardboard destined for recycling
Wastes form leather, fur and textile industries	
04-02-21	Wastes from unprocessed textile fibres

EWC Code	Waste Description
04-02-22	wastes from processed textile fibres
Wastes form the photographic industry	
09-01-08	Photographic film and paper free of silver or silver compounds
Waste packaging absorbents wiping cloths filter materials and protective clothing not otherwise specified	
15-01-01	Paper and cardboard packaging
15-01-02	plastic packaging
15-01-03	Wooden packaging
15-01-05	Composite packaging
15-01-06	Mixed packaging
Construction and demolition wastes including excavated soil from contaminated sites	
17-02-01	Wood
Wastes from waste managements facilities off site waste water treatments plants and preparation of water intended for human consumption and water for industrial use	
19-12-01	Paper and Card
19-12-04	Plastic and rubber
19-12-07	Wood other than that mentioned in 19-12-06
19-12-08	Textiles
19-12-10	Combustible wastes (refuse derived fuel)
19-12-12	Other waste (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19-112-11
Municipal wastes (household wastes or similar commercial industrial and institution wastes including separately collected fractions.	
20-01-01	Process waste from segregated clean sources of paper
20-01-11	Textiles
20-01-38	Wood other than that mentioned in 20-01-37
20-01-39	Process waste form segregated clean sources of plastics
20-03-01	Mixed municipal waste (no black bag waste)

Checks will be made on the paperwork accompanying each delivery to ensure that only fuels for which the plant has been designed will be accepted. During fuel unloading operations, the operator will undertake a visual inspection of the fuel to confirm it complies with the specifications of the supporting paperwork.

Any unacceptable materials will be rejected and stored in a designated area within the fuel reception and storage building. The Environmental Management System (EMS) will include procedures to control the inspection, storage and onward disposal of unacceptable waste.

2.1.4.2 Fuel Delivery, Reception and Handling

The procedures used will comply with the Indicative BAT requirements in the Sector Guidance Note, including the measures listed below.

1. The weight and EWC code for each fuel delivery to the Installation will be recorded and records retained in accordance with the Installations management systems.
2. A high standard of housekeeping will be maintained in all areas and suitable equipment to clean up spilled materials will be provided and maintained.
3. Loading and unloading of vehicles will take place in designated areas provided with impermeable hard standing. These areas will have appropriate falls to the process water drainage system.
4. Firefighting measures will be designed by consultation with the Local Fire Officers, with particular attention paid to the fuel handling and storage equipment.
5. Delivery and reception of fuel will be controlled by a management system that will identify all risks associated with the reception of fuel and shall comply with all legislative requirements, including statutory documentation.
6. Inspection procedures will be employed to ensure that any fuels which would prevent the power station from operating in compliance with its permit are segregated and placed in a designated storage area pending removal.
7. The fuel will be a waste derived fuel.
8. All fuel will be delivered to site in covered/enclosed waste delivery vehicles.
9. Fuel reception and handling equipment, building and procedures will be designed to minimise fugitive emissions from loading/unloading areas.
10. Conveyors for the transfer of fuels within the Installation will be covered.

2.1.5 Waste Minimisation Audit (Minimising the Use of Raw Materials)

A number of specific techniques will be employed to minimise the production of residues. All of these techniques meet the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration.

2.1.5.1 Feedstock Homogeneity

Improving feedstock homogeneity can improve the operational stability of the plant, leading to reduced reagent use and reduced residue production. The Installation will be designed to combust waste derived fuels. Off-site processing and mixing of waste within the bunker will ensure that the waste which is fed to the boiler is a homogeneous fuel.

2.1.5.2 Dioxin & Furan Reformation

As identified within the sector guidance for the Incineration of Waste (EPR5.01), there are a number of BAT design considerations required for the boiler. The boiler has been designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling will be avoided via boiler design to ensure the residence time is minimised in the critical cooling section and avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans.
- The gas residence time in the critical temperature range will be minimised by ensuring high gas velocities exist in these sections. Additional NOx control measures up stream of the boiler and

the residence time and temperature profile (between 450 and 200°C) of flue gas will be considered during the detailed design phase to ensure that dioxin formation is minimised throughout the process.

- Transfer surfaces will 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. A copy of the CFD model will be supplied to the Environment Agency following detailed design and prior to commencement of commissioning.
- Minimising the volume access in the critical cooling sections will ensure high gas velocities.
- Boundary layers of slow-moving gas along boiler surfaces will be prevented via design and a regular maintenance schedule to remove build-up of any deposits that may have occurred.

2.1.5.3 Furnace Conditions

Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal.

2.1.5.4 Flue Gas Treatment Control

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the residues produced. SNCR reagent dosing 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. Variable lime dosing rates will be rapidly and precisely varied to match the acid load. The plant preventative maintenance regime will include regular checks and calibration of the lime dosing system to ensure optimum operation. Back-up feed systems will be provided to ensure no interruption in lime dosing. The bag filter is 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 have independent storage and dosing systems.

2.1.5.5 Waste Management

Details of waste management arrangements and procedures can be found in Section 2.7. In particular, bottom ash and residues from the flue gas treatment system will be stored and disposed of separately.

2.1.6 Water Use

2.1.6.1 Overview

The main use of water at the Installation will be make up water for the boiler. Other water consuming processes include the following:

1. wet ash conveyor;

2. SNCR injection nozzles; and
3. water/steam soot blowers.

The key points listed below should be noted.

1. The water system has been designed with the key objective of minimal consumption of potable water.
2. Most of the steam produced will be recycled as condensate. The remainder will be lost as blow down to prevent build-up of sludge and chemicals, through soot blowing and through continuously flowing sample points.
3. Lost condensate will be replaced with demineralised treated water.
4. Process effluents will be re-used in the bottom ash quench system or injected into the furnace to control combustion temperatures.
5. The Installation will have completely separate foul sewer systems and storm water systems (surface drainage).

2.1.6.2 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 an onsite packaged waste water treatment system which discharges to a soakaway. The soakaway is subject to a separate EP (Ref: EPR/GB3996VR).

2.1.6.3 Process Water

Al process waters will be supplied by mains water.

Demineralised water will be used to compensate for boiler blow down losses. The Installation will have a water treatment plant. It is anticipated that the Installation will consume a nominal 6 m^3/hr of water. The water treatment plant is designed to continuously supply demineralised water.

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

Waste water will be collected in a waste water pit. Effluent collected in the waste water pit will be re-used in the ash quench system and as combustion temperature control. Under normal operating conditions, waste water will be generated from the following processes:

1. regeneration of the resins in the demineralised water treatment plant or concentrate from the reverse osmosis system;
2. process effluent collected in 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 waste water pit will provide acid dosing for pH adjustment and settlement of waste waters collected within the incineration lines. Effluent from the waste water pit that is not re-used on site will be transferred off-site via road tanker for treatment at a suitably licenced waste management facility.

An Indicative Water flow diagram is presented within Figure 2. A larger version of this drawing is included within Annex 1.

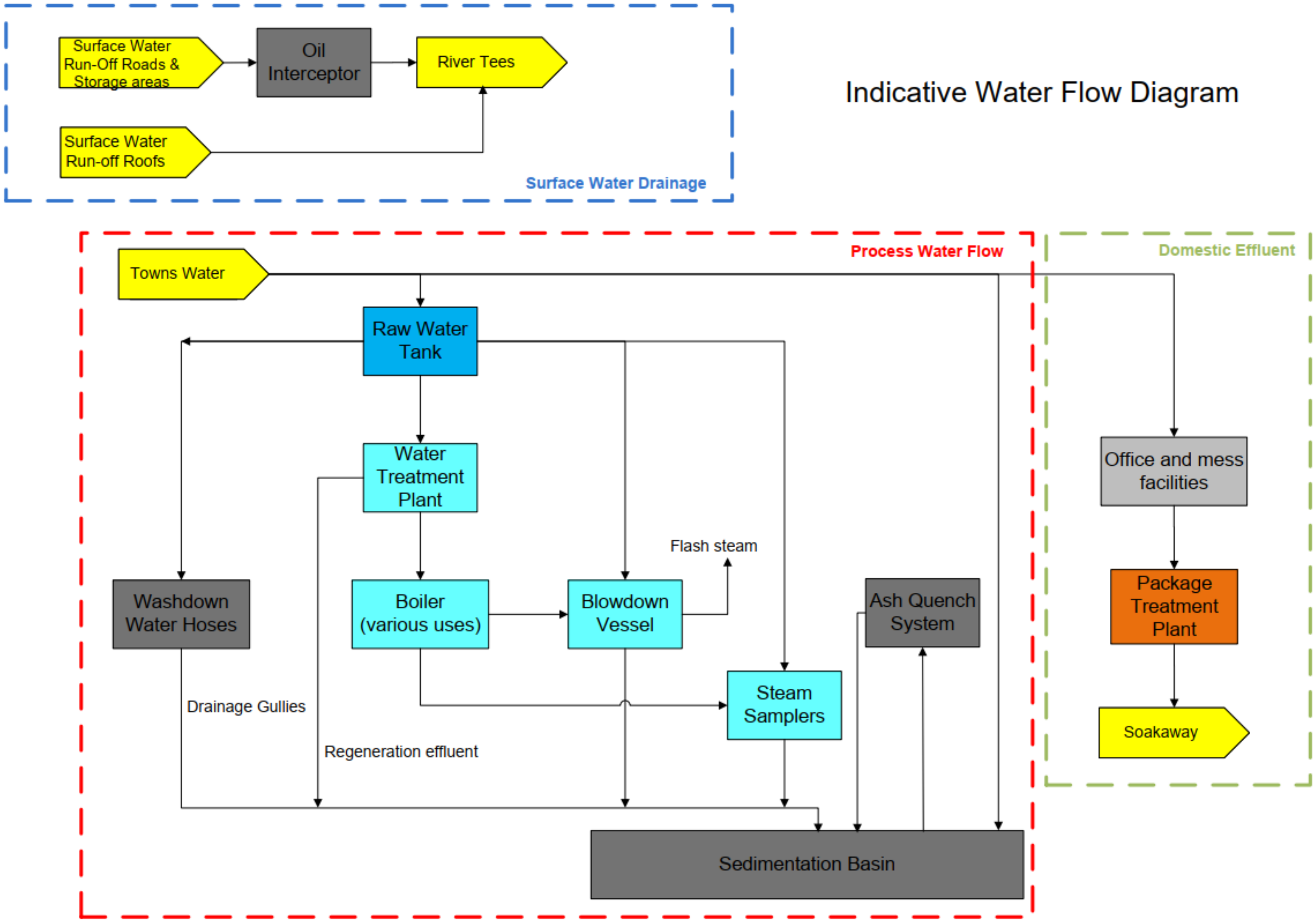


Figure 2 – Indicative Water Flow Diagram

2.2 Emissions

2.2.1 Point Source Emissions to Air

The full list of proposed emission limits for atmospheric emissions is shown in Table 6. This includes the information requested in Table 2 of the Application Form Part B3. The emission limits presented in the table below are based on the relevant emission limits as defined in Annex 4, Part 4 of the IED.

Table 6: Proposed Emission Limits

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
Particulate matter	mg/Nm3	30	10	-
VOCs as TOC	mg/Nm3	20	10	-
Hydrogen chloride	mg/Nm3	60	10	-
Hydrogen fluoride	mg/Nm3	4	1	
Carbon monoxide	mg/Nm3	100	50	-
Sulphur dioxide	mg/Nm3	200	50	-
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm3	400	200	-
Cadmium & thallium and their compounds (total)	mg/Nm3	-	-	0.05
Mercury and its compounds	mg/Nm3	-	-	0.05
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm3	-	-	0.5
Dioxins & furans ITEQ	ng/Nm3	-	-	0.1
All expressed at 11% oxygen in dry flue gas at 0°C and 1 bar-a.				

2.2.2 Fugitive Emissions to Air

In addition to the point source emissions to air, there will be potential fugitive emissions to air from refilling of raw material storage tanks such as fuel oil or ammonia. These will be vented to the tanker during refilling. Bulk liquid storage tanks will be fitted with high level controls and alarms.

Lime and APCr silos will be filled by bulk tanker. These raw materials will be offloaded pneumatically into the relevant silos with displaced air vented through a reverse pulse jet filter. Silos will be fitted with high-level control and alarm. Silos will be equipped with a vent fitted at the top with a fabric filter. Filter residues will be returned to the silo. Cleaning of the filter is done automatically with compressed air after the filling operation. The filter will be inspected regularly for leaks.

Fugitive dust emissions will be controlled as described below:

1. Incoming waste/fuel will be delivered in covered vehicles;
2. Waste will be stored within an enclosed waste reception and storage building;
3. Conveyors for the transfer of waste will be covered;
4. Waste will be stored in accordance with the latest industry standards; and

5. Ground surface damping will be used to prevent vehicle movements producing yard dust problems and mobile "mist air" water-based dust suppression is used to suppress material movement generated dust. These are typically only necessary in summer months or during extremely dry periods. If necessary, foam / water will be added to the material at the point it is transferred into the fuel reception (this is the stage at which most dust is produced).

2.2.3 Point Source Emissions to Water and Sewer

Surface water run-off from all external areas of hardstanding (roads and storage areas) will be discharged into the surface water system having passed through interceptors. All surface water run-off will be collected in the site surface water drainage system and discharged via emission point W1. Surface water run-off will discharge into the River Tees.

The facility will give rise to process effluents of boiler blowdown, waste water from the water treatment process and washdown waters. Process effluents will be recirculated through the ash quench system or injected to the furnace to control combustion temperatures. All excess process effluents which cannot be recirculated will be collected in the waste water system and removed from site for disposal at an appropriately licenced facility. Contaminated Water

External areas of hardstanding will be provided with kerbed containment, where appropriate, to prevent any potential spills from causing pollution of the ground/groundwater and surface water.

All chemicals will be stored in an appropriate manner incorporating the use of bunding and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment. The potential for accidents, and associated environmental impacts, is therefore limited.

Adequate quantities of spillage absorbent materials will be made available on-site, at an easily accessible location(s), where liquids are stored. A site drainage plan, including the locations of foul and surface water drains and interceptors, will be made available on-site.

Tanker off-loading of chemicals will take place within areas of concrete hardstanding with falls to a gully and/or a sump.

Storage tanks will be bunded at 110% of the tank capacity and the offloading point will be fully contained with the appropriate capacity to contain any spills during fuel or ammonia delivery.

Process water drains within the Installation will drain to the sedimentation basin.

Site drainage for external areas will be fitted with a shut-off alarm, linked to the fire detection systems to contain any contaminated water from firefighting from external areas. Additional storage will be available from site kerbing.

In accordance with the EMS, spillages will be reported to the site management and a record of the incident will be made. The relevant authorities (Environment Agency/ Health and Safety Executive) will be informed if spillages/leaks are significant.

The effectiveness of the Emergency Plan for spillages is subject to Management Review and will be reviewed following any major spillages and revised as appropriate.

2.2.4 Odour

As the storage and handling of RDF will introduce a potential for odour, an odour abatement system will be installed to extract the potentially odorous air from the fuel reception and storage building. The extracted air from the enclosed fuel reception and storage building will be passed through a carbon filter system prior to release to atmosphere via a dedicated stack.

2.3 Monitoring Methods

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

The three main objectives of monitoring are:

1. to provide the information necessary for safe and efficient 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.

2.3.1.1 Monitoring Emissions to Air

The following parameters at the stack will be monitored and recorded continuously using a Continuous Emissions Monitoring System (CEMS):

1. oxygen;
2. carbon monoxide;
3. hydrogen chloride;
4. hydrogen fluoride;
5. sulphur dioxide;
6. nitrogen oxides;
7. nitrous oxide;
8. ammonia;
9. VOCs; and
10. particulates.

In addition, the 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 required by the Industrial Emissions Directive.

The continuously monitored emissions concentrations will also be checked by an independent testing company at frequencies agreed with the Environment Agency.

The following parameters will also be monitored by means of spot sampling at frequencies agreed with the Environment Agency:

1. heavy metals; and
2. dioxins and furans.

The methods and standards used for emissions monitoring will be in compliance with Environment Agency Guidance Note S5.01 and the Industrial Emissions Directive. 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.

It is anticipated that:

1. HCl, CO, SO_2, NOx (NO, N_2O and NO_2), HF and NH_3 will be measured by an FTIR-type multi-gas analyser;
2. VOCs will be measured by an FID-type analyser;
3. particulate matter will be measured by an opacimeter; and
4. oxygen will be monitored by a zirconium probe.

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

2.3.1.2 Reliability

IED Annex VI Part 8 Paragraph 1.2 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. The IED 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 will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181. 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.

2.3.1.3 Start-up and shutdown

The emission limit values under the Industrial Emissions Directive do not apply during start-up and shutdown. Therefore, a signal would be sent from the main plant control system to the CEMS package to indicate when the plant is operational and burning waste derived fuel. The averages would only be calculated when this signal was sent, but raw monitoring data would be retained for inspection.

Start-up ends when all the following conditions are met.

1. The temperature within the combustion chamber is greater than 850°C
2. The flue gas cleaning plant, control systems, monitoring equipment, grate and ash extractors are all running.
3. Exhaust gas O_2 is less than 15% (wet measurement); and
4. The fuel feeding system is loading fuel into the boiler.

Shutdown begins when all of the following conditions are met.

1. The fuel feeding system is not loading fuel into the furnace.
2. The flue gas treatment systems are running.
3. Exhaust gas O_2 is equal to or greater than 15% (wet measurement); and
4. The auxiliary burner is maintaining the temperature at greater than 850°C within the boiler.

2.3.1.4 Monitoring Emissions to Land

Disposal of residues to land will comply with all relevant legislation.

2.3.1.5 Monitoring Emissions to Water

There will be no release of process emissions to water from the Installation, so there will be no monitoring requirements for emissions to water.

2.3.1.6 Monitoring of Process Variables

The following process variables have particular potential to influence emissions.

1. At least the daily and annual fuel throughput will be recorded to enable comparison with the design throughput.
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 oxygen concentration will be measured at the outlet from the boiler.
4. 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.
5. The concentration of HCl and/or SOx 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.

Additionally, water use will 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 town water, the water treatment plant, and the boiler water makeup.

2.4 Technology Selection

2.4.1 Combustion Technology

It is proposed that the combustion technology for the plant will be a moving grate. Moving grate systems are relatively simple and well proven. The Incinerator Sector Guidance Note EPR5.01 discusses a number of alternative technologies for the combustion of waste derived fuels.

Moving Grate Furnaces

As stated in the Sector Guidance Note, these are designed to handle large volumes of solid fuels. Moving Grate Furnaces are therefore regarded as being an appropriate combustion technology for the Installation.

Fixed Hearth

These are not considered suitable for large volumes of waste derived fuels, such as that proposed for the Installation. They are best suited to low volumes of consistent waste. Fixed Hearth technologies are therefore not regarded as being an appropriate combustion technology for of the Installation.

As confirmed in the Sector Guidance Note, fixed hearth designs can have difficulty in meeting the Chapter IV (Waste Incineration and Co-incineration) IED standards, mainly due to the semi-batch nature of the fuel travel on the grate and de-ashing operations. This is a further justification for not applying this technology to the Installation.

Pulsed Hearth

Pulsed hearth technology has been used for the combustion of solid fuels. However pulsed hearth Installations have had difficulties in achieving reliable and effective burnout of fuel and it is considered that the burnout criteria required by Chapter 4 of the IED would be difficult to achieve.

Therefore, Pulsed Hearth Furnaces are not regarded as being an appropriate combustion technology for the Installation.

Rotary Kiln

Rotary Kilns have been proven to achieve good fuel agitation and associated burn-out rates. Rotary kilns have been demonstrated to achieved good results with clinical waste, however they have had limited application in the UK.

Rotary Kilns operate at high temperature and are considered BAT for hazardous waste and lower throughput mixed feeds. The high temperatures promote NOx formation which may require additional abatement. The tumbling action of the kilns can generate high concentrations of fine particles which may require a secondary combustion chamber and additional abatement.

Rotary Kilns are regarded as being an appropriate combustion technology for the Installation.

Pyrolysis/Gasification

Various technology suppliers are developing pyrolysis and gasification systems. While pyrolysis and gasification systems which generate a syngas can theoretically take advantage of gas engines or gas turbines, which are more efficient than a standard steam turbine cycle, the syngas would require cleaning and filtration prior to combustion – if burnt in an engine. Additional products (such as oils) can be recovered from these techniques, but it is expected that this would be limited from a waste derived feed stock.

The losses associated with making the syngas and the additional electricity consumption of the site would mean that the overall efficiency is no higher than for a traditional combustion plant and for this type of waste derived fuel would generally be lower. This implies that a traditional combustion plant will have a more beneficial effect on climate change.

Pyrolysis and gasification are therefore not regarded as being appropriate energy recovery technologies for the Installation.

Fluidised Bed

Fluidised bed combustion can sometimes lead to slightly lower NOx generation, although injection of ammonia solution is still required to achieve the emission limits specified in the Industrial Emissions Directive. Fluidised bed technologies are designed to treat large quantities of waste derived fuel and are therefore regarded as being an appropriate combustion technology for the Installation.

A BAT assessment of a grate, fluidised bed and kiln combustion technologies has been carried out in Annex 5 section 5. The conclusions are summarised below.

2.4.1.1 Conclusions

The table below compares the three appropriate combustion technology options. This assessment considers the available technologies for the proposed nominal design capacity.

Table 7: Comparison, Combustion Options

Parameter	Unit	Grate	Fluidised Bed	Kiln
Global Warming Potential	tpa CO2 eq.	- 252,000	- 250,000	- 141,000
Ammonia solution	tpa	1,500	1,100	2,200
Total residues	tpa	11,600	16,540	11,600

Parameter	Unit	Grate	Fluidised Bed	Kiln
Additional loss of exported power compared to Grate	£ p.a.	-	350,000	17,790,000
Total power, reagents and disposal annual cost	£ p.a.	1,520,000	1,960,000	19,270,000

The lower power production of rotary kiln results in significantly higher annualised costs when compared to the other two solutions. Furthermore, the capacity of a rotary kiln unit is limited to 8 tonnes per hour, so multiple streams would be required to achieve the design throughput. On this basis, the Rotary Kiln is not considered to represent BAT for the Installation.

Both the grate and fluidised bed will produce similar quantities of ash, although the fluidised bed produces more fly ash.

Overall, the lower annualised costs associated with a grate system outweigh the additional material costs and higher ammonia consumption. On this basis a grate system is considered to represent BAT for this facility.

2.4.2 NOx Reduction System

NOx levels will primarily be controlled by monitoring the combustion air supply and the injection of water to tightly control the combustion temperatures. Selective non-catalytic NOx reduction (SNCR) methods will also be installed, using ammonia solution as a reagent.

The use of Selective Catalytic Reduction (SCR) has also been considered. In this technique, the reagent is injected into the flue gases immediately upstream of a reactor vessel containing layers of catalyst. The reaction is 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.

Since the other flue gas cleaning reactions take place at an optimum temperature of around 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, further reducing the overall energy efficiency of the Installation.

2.4.2.1 Flue Gas Recirculation (FGR)

FGR is not a bolt-on abatement technique. FGR involves the recirculation of a proportion of the flue gases into the combustion chamber to replace some of the secondary air and changes the operation of the plant in various ways, by changing the temperature balance and increasing turbulence.

The furnace has been designed to incorporate FGR and this means the Installation benefits from reduced NOx generation from the use of FGR.

2.4.2.2 Conclusion

A BAT assessment of both SNCR and SCR has been carried out in Annex 6 section 3 with an additional assessment of FGR plus SNCR. This assessment considers the available technologies for the proposed nominal design capacity. The conclusions are summarised below.

Table 8: Comparison Table, NOx Abatement Options

Parameter	Units	SNCR	SCR	SNCR+FGR
Total NOx abated	tpa	270	570	200
POCP		-17,600	-6,200	-17,600
Global Warming Potential	tpa CO2 eq	2,000	7,300	2,700
Ammonia solution	tpa	1,530	1,420	1,130
Total Annualised Cost	£ p.a.	603,000	2,546,000	758,000

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

1. increases the annualised costs by approximately £1.9 million;
2. abates an additional 300 tonnes of NOx per annum;
3. reduces the benefit of the facility in terms of the global warming potential by a minimum of 4,700 tonnes of CO2; and
4. reduces ammonia consumption by a minimum of approximately 110 tonnes per annum.

This gives an effective additional annual cost of approximately £6,333 per additional tonne of NOx abated when compared to SNCR or £6,622 per additional tonne of NOx abated when compared to SNCR + FGR. The additional costs associated with an SCR system are not considered to represent BAT for the Installation. Therefore, SNCR is considered to represent BAT for the Installation.

The two SNCR options, with and without FGR, are very similar. FGR results in a reduction of reagent consumption, but requires more power to operate, and therefore it has a higher global warming potential and slightly higher total annualised costs.

The choice of whether to include FGR is supplier dependent. The supplier selected for the facility has a proven track record of including FGR in the solution and FGR has been included in the Installation.

We would propose that a Pre-operational Improvement condition is included within the EP to allow the Operator to confirm whether the design will include FGR prior to the commencement of commissioning.

2.4.3 Acid Gas Abatement System

There are currently three technologies widely available for acid gas treatment on waste combustion 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 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 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 lime and reaction products are collected on a bag filter, where further reaction can take place.

3. Dry, involving the injection of solid lime into the flue gases as a powder. The lime is collected on a bag filter to form a cake and most of the reaction between the acid gases and the lime takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more lime 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 represent BAT for this type of waste burning Installation, due to the production of a large volume of hazardous liquid effluent and a reduction in the power generating efficiency of the plant.

The dry and semi-dry systems can easily achieve the emission limits required by the Industrial Emissions Directive and both systems are in operation on plants throughout Europe. Both can be considered to represent BAT by the Environment Agency Sector Guidance Note EPR 5.01. 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 Annex 6 section 1.

The table below compares the options for acid gas treatment, using lime as the selected reagent identified in section 2.1.3.1. This assessment considers the available technologies for the proposed capacity.

Table 9: Comparison Table, Acid Abatement Options

Parameter	Unit	Dry	Semi-Dry
SO2 abated	tpa	370	370
HCl abated	tpa	230	230
POCP	t-ethylene eq	580	580
Total site water use	tpa	55,300	72,000
Global Warming Potential	tpa CO2	7,000	14,500
APC Residues, incl. fly ash	tpa	3,800	3,600
Annualised Cost	£ p.a.	4,252,000	5,542,000

The overall performance of the two technical options is similar and therefore could be considered to represent BAT for the Installation. However, whilst the dry solution generates slightly more APC residues, it has a lower Global Warming Potential, water consumption and annualised costs. A dry system is considered to represent BAT for the Installation.

2.4.4 Particulate Abatement

The Installation 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 burning Installation for the reasons listed below.

1. Wet scrubbers are not capable of meeting the same emission limits as fabric filters.
2. 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 footprint of the Installation.

3. Ceramic Filters have not been proven for this type of waste combustion plant and are more suited to high temperature filtration.

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

2.4.5 Steam Condenser

There are three potential BAT solutions considered in Sector Guidance Note EPR 5.01 as representing indicative BAT for the Installation, which are:

1. air cooled condenser (ACC);
2. once though cooling (Water Cooling); or
3. evaporative condenser.

The Installation will operate an Air-Cooled Condenser (ACC) to condense the steam output from the turbine to allow return of the condensate to the boiler. The two main alternatives to an ACC are a water-cooled condenser or an evaporative condenser and all are considered in Sector Guidance Note S5.01 as potential BAT solutions. The former uses a recirculating water supply to condense the steam and the latter uses water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling.

Water cooled systems require significant volumes of water and a receiving watercourse for the off-site discharge of the cooling water. The River Tees estuary is approximately 400m to the south of the installation. This water is heavily laden with silts therefore any incoming water would need to be filtered prior to being used for cooling.

The filtration would reduce some of the efficiencies gained from a water-cooling system. Furthermore, PCEL understand that obtaining the relevant land access and wayleaves to be able to extract and return the cooling water to the river is complicated due to there being a significant number of landowners. Whilst PCEL would prefer to use this option, due to the reasons provided, the use of water-cooling is not considered to be an available option.

Air cooled condensers are therefore considered to represent BAT for the Installation.

2.5 Specific requirements of the Industrial Emissions Directive (2010/75/EU)

This section contains information how the plant 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 could be applicable to the Installation:

- 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.

Articles 51 (Authorising to change operating conditions) and 54 (Substantial change) will not apply to this application. In addition, the requirements of Article 55 (Reporting & public information on waste incineration plants and waste co-incineration plants) will apply to the competent authority (the Environment Agency), not the applicant.

A table showing compliance with the Waste Incineration requirements of the Industrial Emissions Directive is presented below.

Table 10: Summary Table for IED Compliance

IED Reference	Demonstrating Compliance
Article 22, paragraph (2)	A Site Condition Report for the Installation is presented in Annex 2.
Article 44 paragraph (a)	Refer to Section 2.1.4 of the Supporting Information
Article 44 paragraph (b)	Refer to section 2.6 of the Supporting Information and Annex 7 - Heat Study
Article 44 paragraph (c)	Refer to Section 2.7 of the Supporting Information
Article 44 paragraph (d)	Refer to Section 2.7 of the Supporting Information
Article 46, paragraph 1	A stack height assessment was developed and submitted in support of the planning application. This demonstrated that a stack height of 111 m would be appropriate for emissions from the Installation to safeguard human health and the environment.
Article 46, paragraph 2	As presented in section 2.2.1, the Installation has been designed to achieve the relevant emission limits within the IED.
Article 46, paragraph 3	There will be no discharges to water from the cleaning of waste gases from the Installation, therefore paragraph 3 will not apply to the Installation.
Article 46, paragraph 4	There will be no discharges to water from the cleaning of waste gases from the Installation, therefore paragraph 4 will not apply to the Installation.
Article 46, paragraph 5	As detailed in section 2.2.4, the facility has been designed to prevent the release potentially polluting substances into soil, surface water and groundwater. The containment arrangements for contaminated fire water have been detailed in section 2.2.4.
Article 46, paragraph 6	The Installation will comply with the abnormal operation requirements in accordance with the EP.
Article 47	The Installation will comply with the breakdown requirements in accordance with the EP.
Article 48, paragraph 1	As detailed in the Section 2.3 of this report the plant will have a CEMS which will continuously record the following pollutants within Annex VI: • Carbon monoxide; • Hydrogen chloride;

IED Reference	Demonstrating Compliance
	• Sulphur dioxide; • Hydrogen fluoride; • Nitrogen oxides; • VOCs; and • Particulates. In addition, the following parameters will also be monitored by means of spot sampling the following pollutants within Annex VI: • Heavy metals; and • Dioxins and furans. In addition, the 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 required by the sector guidance.
Article 48, paragraph 2	As detailed in section 2.3.1.1, calibration will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier.
Article 48, paragraph 3	As detailed in section 2.3.1.1, the location of sampling points will be installed in accordance with the requirements of Environment Agency Technical Guidance Notes M1 and M2.
Article 48, paragraph 4	The operator will submit all relevant emissions monitoring reports in accordance with the requirements of the EP.
Article 48, paragraph 5	At the time of submitting this application, the operator is not aware of there being recognised measurement techniques for the continuous measurement of heavy metals and dioxins and furans. Therefore, paragraph 5 does not apply to this application.
Article 49	The Installation has been designed with monitoring equipment which will be used to demonstrate compliance with the emission limits within Part 4 of Annex V of the IED. As required by the permit, reports will be submitted to the Environment Agency which will demonstrate compliance with the EP.
Article 50, paragraph 1	The Installation is an incineration facility, so this requirement does not apply.
Article 50, paragraph 2	As detailed in section 2.3.1.4, there will be process monitoring to ensure that the 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.
Article 50, paragraph 3	The Installation will have auxiliary burners, which will burn gas oil, as detailed in section 2.1.3.2. As detailed in section 2.3.1.4, the auxiliary burners will maintain the temperature at 850°C and will also be used for start-up and shutdown.

IED Reference	Demonstrating Compliance
Article 50, paragraph 4	The Installation will meet the indicative BAT requirements outlined in the Incinerator Sector Guidance Note for waste charging and the specific requirements of the IED. The combustion control and feeding system will be in accordance with the requirements of the IED. The conditions within the furnace will be continually monitored to ensure that optimal conditions are maintained and that the mandatory IED emission limits are not exceeded. The fuel charging and feeding systems will be interlocked to prevent fuel charging when the furnace temperature is below 850°C, both during start-up and if the temperature falls below 850°C during operation. The fuel charging and feeding systems will also be interlocked to prevent fuel charging if the emissions to atmosphere are in excess of an emission limit value due to disturbance or failures of the abatement equipment.
Article 50, paragraph 5	A heat study and CHP-Ready application have been developed and are presented in Annex 7.
Article 50, paragraph 6	It is not intended to incinerate infectious clinical waste within the Installation. Therefore, this requirement will not apply to the Installation.
Article 50, paragraph 7	The operator will ensure that the appropriate management structure and management systems are in place proper to commencement of operation of the Installation.
Article 52, paragraph 1	The fuel reception and handling arrangement for the Installation are presented in section 2.1.4.2.
Article 52, paragraph 2	The fuel delivery, reception and handling arrangements for the Installation are presented in section 2.1.4.2.
Article 52, paragraph 3	The Installation has not been designed to incinerate hazardous waste. Therefore, this requirement will not apply to the Installation.
Article 52, paragraph 4	The Installation has not been designed to incinerate hazardous waste. Therefore, this requirement will not apply to the Installation.
Article 52, paragraph 5	The operator does not wish to apply for any exemptions from any of the requirements stated within. Therefore, this requirement will not apply to the Installation.
Article 53, paragraph 1	The proposed arrangements for residues generated by the Installation are detailed in section 2.7.
Article 53, paragraph 2	The arrangements for the containment of dusts from the transport and intermediate storage of dry residues generated by the Installation are detailed in sections 2.7.2 and 2.7.3 and Annex 4 – Environmental Risk Assessment.

IED Reference	Demonstrating Compliance
Article 53, paragraph 3	Prior to the commencement of any transfer of residues generated by the Installation, they will be tested to ensure that they are acceptable to receiving facility.

2.6 Energy Efficiency

2.6.1 General

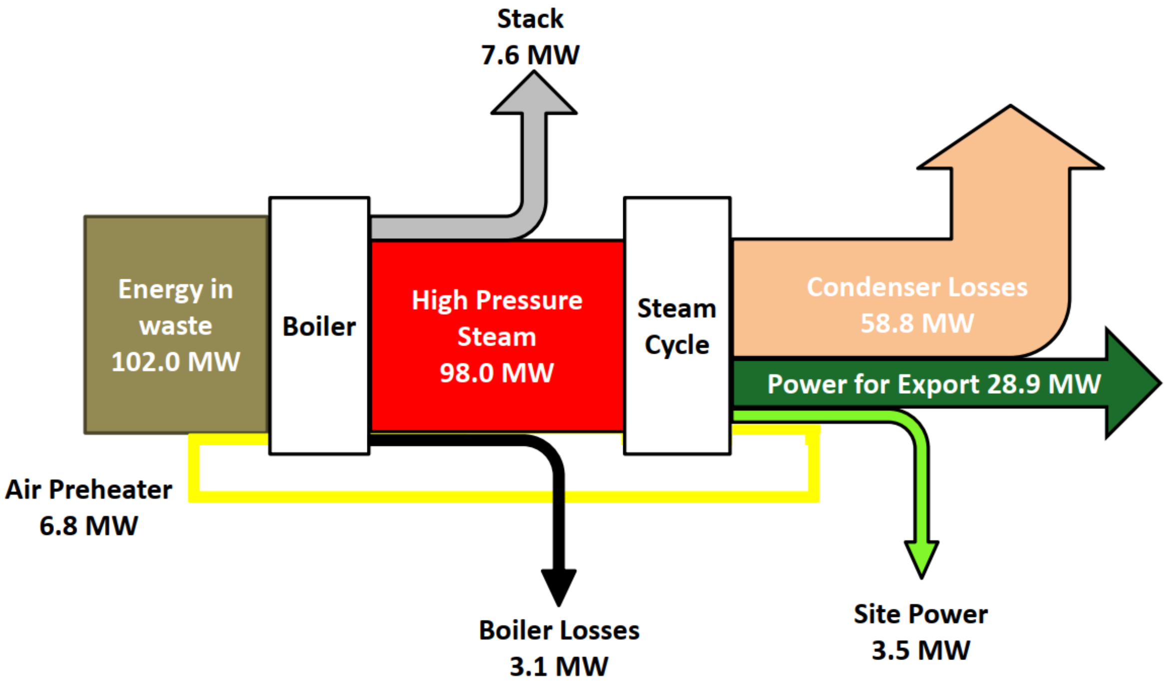
The generated steam will be diverted to a steam turbine/generator set for the production of electricity. A fraction of the generated electricity will be used by the Installation and the remainder will be exported to the local electricity grid.

In the case of failure of the electricity supply, emergency generators will be provided to run or safely shut down the Installation and to provide an emergency supply.

In considering the energy efficiency of the Installation, due account has been taken of the requirements of the Environment Agency's Horizontal Guidance Note H2 on Energy Efficiency.

2.6.2 Basic Energy Requirements

An indicative Sankey Diagram for the Installation is presented in Figure 3:



Based on the nominal design capacity (NCV – 11 MJ/kg, 33.4 tph)

Figure 3 – Indicative Sankey diagram

It is estimated that the Installation will generate approximately 32.4 MW of electricity. Approximately 3.5 MW of this electricity will be used within the Installation, with the remaining 28.9 MW being exported to the local electricity grid.

The plant will have a nominal design capacity of approximately 33.4 tonnes per hour of fuel, with a net calorific value of 11.0 MJ/kg. Assuming an operational availability of 7,884 hours per annum, the nominal design capacity of the plant is approximately 263,000 tonnes per annum. Therefore, the Installation will annually generate approximately 255,000 MWh and export 228,000 MWh of electricity.

In the table below, these figures are compared with the BREF for large combustion plants (BREF LCP) with reference to the level associated with the application of BAT measures for waste derived fuel fired combustion plants based on spreader/stoker. Moreover, benchmark data valid for MSW incineration plants, given in the Environment Agency Sector Guidance Note EPR5.01 and in the BREF for Waste Incineration (BREF WI), have been used.

Table 11: Comparison Table

Parameter	Unit	Teesside REP	Benchmark	Source
Net electrical efficiency	%	28.34	>23	BREF LCP
Gross power generation, nominal design	MWh/t waste	0.87	0.415-0.644	BREF WI
Net power generation, nominal design	MWh/t waste	0.87	0.279-0.458	BREF WI
Internal power consumption, nominal design	MWh/t waste	0.10	0.062-0.257	BREF WI
Power generation (assumed net) for 100,000 tpa of waste	MW	11.0	5-9	EPR 5.01

As can be seen from the comparison, the Installation exceeds all of the relevant benchmark values for energy efficiency.

2.6.2.1 Energy Consumption and Thermal Efficiency

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

1. combustion air fans;
2. induced draught fan;
3. boiler feed water and cooling water pumps;
4. air cooled condenser fans;
5. air compressors;
6. fuel loading systems and ash and residue conveying systems; and
7. offices and ancillary rooms.

The Installation will be designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high standards of cladding and insulation, etc.

The plant will be designed to achieve a very high thermal efficiency applying the following measures.

1. The boilers will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the fuel that is being burnt.
2. Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemical and the heat contained within the steam and water.

3. 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.
4. Steady operation will be maintained where necessary by using auxiliary fuel firing.
5. Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.
6. Due consideration will be given to the recommendations given in the Sector Guidance Note.

2.6.2.2 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.

2.6.2.3 Energy Efficiency Measures

An energy efficiency plan will be built into the operation and maintenance procedures of the plant ensuring maximum, practical, sustainable, safe and controllable electricity generation.

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 will be assessed on the implementation cost compared with the anticipated benefits.

2.6.3 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.

1. Economisers are installed to recover flue gas heat,
2. compatibly with the temperature requirements of the flue gas treatment system
3. The boiler will operate with superheated steam at 80 bar-a and 450°C.

The plant will not be subject to a Climate Change Levy agreement, although the energy generated will be exempt from the levy.

A Heat Plan and CHP-Ready application have been developed for the Installation. These are presented in Annex 7.

2.7 Residue Recovery and Disposal

2.7.1 Introduction

The main residue streams arising from the Installation are:

1. bottom ash from the combustion process (Residue Type RT1); and
2. APC residue and fine ash particles (Residue Type RT2).

As described below, the waste recovery and disposal techniques will be in accordance with the indicative BAT requirements. The main wastes to be generated from the operation of the Installation are summarised in Table 12.

2.7.2 Air Pollution Control residues

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

1. 30-36% w/w calcium;
2. 12-15% w/w chlorine;
3. 8-10% w/w carbonate (as C); and
4. 3-4% w/w sulphur (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.

It may be possible to send the residue to an effluent treatment contractor, to be used to neutralise acids and similar materials or to be used in the production of concrete building products. Using the residues in this way avoids the use of primary materials. If this option is not practicable then it will be sent to a secure 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 will vent back to the silo and any releases to atmosphere would pass through a fabric filter.

2.7.3 Bottom Ash

Boiler ash will be mixed with bottom ash. The mixture of boiler ash and bottom ash is a non-hazardous waste which can typically be recycled in the manufacture of blocks. If the boiler ash were to be mixed with the APCr, the mixture would be defined as hazardous waste, and this would restrict the ability of the operator to recycle the boiler ash.

PCEL is proposing to transfer IBA for recovery at an off-site IBA treatment facility, where it will be processed into a secondary aggregate for use in construction.

2.7.4 Summary

The table below summarises the expected quantities and properties of the main residue streams.

Table 12: Key residue streams

Source/ material	Properties of residue	Storage location/ volume stored	Annual quantity of residue - estimated	Disposal route and transport method
Fly ash/ APCr	Fly ash and APC residues, which may contain unreacted lime.	APCr silos.	11,910 tonnes per annum	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.

Source/ material	Properties of residue	Storage location/ volume stored	Annual quantity of residue - estimated	Disposal route and transport method
Bottom ash	Grate ash, grate riddling, boiler ash. This ash is relatively inert, classified as non-hazardous.	Bottom ash storage area.	52,600 tonnes per annum	Sent to a suitable licensed recovery facility to be used as a secondary aggregate.

2.8 Management

2.8.1 Introduction

PCEL's commitment to their socio-environmental responsibilities will be demonstrated by operating the facility to the highest environmental, health and safety and professional standards. The Teesside REP will use the most up-to-date international and national regulations, standards and guidance that govern the good design and construction of waste combustion plants.

An effective management system will be employed as outlined in the Environment Agency Guidance Note IPPC S5.06 and Horizontal Guidance Note H6 – Environmental Management Systems. This will be required to implement an EMS in accordance with BS EN ISO 14001:2004 Environmental Management System Standard and with the operating and maintenance instructions of the designer of the plant.

2.8.2 Management Systems

PCEL will develop an EMS that clearly defines the Installations management structure as well as setting out roles and responsibilities of all staff. The development of the EMS will also include:

- An Environmental Policy;
- Health and Safety Procedures; and
- An operational guidance manual which will include process plant operating procedures for both standard and emergency conditions.

The Construction (Design and Management) Regulations will apply during the construction and commissioning period. In addition, management will undertake inspections and reviews for quality control, performance measurements, and staff appraisals.

2.8.2.1 Scope and Structure

The scope of the ISO 14001 certification will cover the receipt, handling and combustion of waste derived fuels and the transfer of residues off-site.

Where applicable, documented procedures will detail specifically how each activity is to be controlled. These will be contained in the 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 "How to comply with your Environmental Permit" EPR1.00. This will be in the form of an accident management plan that will be developed before the plant is commissioned.

2.8.2.2 General Requirements

ISO 14001 certification will require PCEL to maintain the EMS in accordance with the standard. The EMS objectives and scope will ensure that PCEL meets these requirements by:

- 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.

2.8.3 Personnel

Operation and maintenance of the plant will be undertaken by the applicant's own staff. Sufficient numbers of staff, in various grades, will be provided 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:

- The **General Manager** will have overall responsibility for management of the Teesside REP and compliance with the operating permit. He or she will also be responsible for waste management and scheduling. The general manager will have extensive experience relevant to their responsibilities.
- The **Production Foreman** 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.
- The **H&S, QMS and EMS Manager** will be responsible for the development and management of the EMS, for the monitoring of authorised releases and for interaction with the Environment Agency.
- The **Maintenance & Procurement 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.

2.8.4 Competence, Training and Awareness

PCEL will 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.

The 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.

PCEL will comply with the relevant industry standards or codes of practice for training, where they exist. The EMS will contain an archiving procedure to ensure all training is recorded and all associated records are retained.

2.8.4.1 Competence

Line Managers 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. Particular attention will be paid to potential candidate's experience, qualifications, knowledge and skills.

2.8.4.2 Induction and Awareness

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

- The Environmental Policy;
- The Health and Safety Policy and Procedures; and
- The EMS Awareness Training.

2.8.4.3 Training

Staff training will be completed during commissioning of the Installation and before the plant is operational. Line Managers will identify and monitor staff training needs as part of the appraisal system. The training needs of employees will be addressed using on-the-job training, mentoring, internal training and external training courses/events.

Training records will be maintained onsite. The operation of the Installation will comply with the relevant industry standards or codes of practice for training (e.g. WAMITAB), where they exist.

2.9 Closure

2.9.1 Introduction

The Installation is designed for an operational life of approximately 30 years but its actual operational lifetime is dependent on a number of factors including the cost of the fuel and the cost of operating the facility.

When the Installation has reached the end of its operational life, it may be adapted for an alternative use or demolished as part of a redevelopment scheme and cleared and left in a fit-for-use condition.

2.9.2 General

At the end of the economic life of the plant, the development site and buildings may be converted to other uses or form part of an appropriate landscape restoration plan. The responsibility for this may well rest with other parties if the Installation is sold. However, the Applicant 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 achieve this aim a site closure plan will be prepared. The following is a summary of the measures to be considered within the closure plan to ensure the objective of safe and clean decommissioning.

2.9.2.1 General Requirements

1. Underground tanks and pipework to be avoided except for supply and discharge utilities such as towns water, sewerage lines and gas supply;
2. Safe removal of all chemical and hazardous materials;
3. Adequate provision for drainage, vessel cleaning and dismantling of pipework;
4. Disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, dust or hazard;
5. The use of recyclable materials where possible;
6. 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;
7. Soil sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report).

2.9.2.2 Specific Details

1. A list of recyclable materials/components and current potential outlet sources;
2. A list of materials/components not suitable for recycle and potential outlet sources;
3. A list of materials to go to landfill with current recognised analysis, where appropriate;
4. A list of all chemicals and hazardous materials, location and current containment methods;
5. A Bill of Materials detailing total known quantities of items throughout the facility such as:

- Steelwork;
- Plastics;
- Cables;
- Concrete and Civils Materials;
- Oils;
- Chemicals;
- Consumables;
- Contained Water and Effluents; and
- Bottom Ash and APC Residues.

2.9.2.3 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, dealer to collect and disposal by container.

2.10 Improvement programme

2.10.1 Pre-operational conditions

PCEL would propose that the following conditions, which are typically included for this type of installation, as follows:

1. Submit a written report to the Environment Agency on the commissioning of the Installation. The report will summarise the environmental performance of the plant as installed against the design parameters set out in the Application.
2. Submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non-Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report will also confirm and justify the selection of the reagent to be used within the SNCR system. This will include provision of procedures for the safe handing and management of the reagent.

The report will include an assessment of the level of NOx and N_2O emissions that can be achieved under optimum operating conditions.

1. 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.
2. Submit a report which confirms whether FGR has been included within the final design of the Installation.

2.10.2 Commissioning conditions

Prior to commissioning of the Facility, PCEL will comply with the typical Pre-operational Conditions which will be included for this type of installation, as follows:

1. Submit to the Environment Agency for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazardous status. Sampling and testing shall be carried out in accordance with the protocol as approved.
2. Provide a written commissioning plan, including timelines for completion, for approval by the Environment Agency. The commissioning plan shall 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 Environment Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.

2.10.3 ISO14001 accreditation

PCEL will ensure that a management structure and a site specific EMS accredited to ISO 14001 is adopted for the Installation. This EMS will be required to be in place before the start of operation, but cannot be accredited until the plant is operation. PCEL therefore suggests an improvement condition which requires the O&M contractor's environmental management system to be independently accredited to ISO 14001 within 18 months of the start of full operation.

2.10.4 Post Commissioning

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

- 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 PM10 and PM2.5 ranges. The report will detail a timetable for undertaking the tests and producing a report on the results.

B Response to Schedule 5 Notice dated 09/02/2015

1 Emissions to Sewer

1. **Please provide an assessment using H1 methodology of the likely impacts of emissions to sewer on the receiving controlled waters.**

   This is no longer applicable, as the emissions to sewer were removed in the 2016 EP Variation.

2. **Provide details of your proposals (if appropriate) for sampling and testing process effluents prior to discharge to sewer.**

   This is no longer applicable, as the emissions to sewer were removed in the 2016 EP Variation.

2 Containment

3. **With reference to the containment bunding described in the application, please confirm if they will be constructed in line with relevant Environment Agency How to Comply Guidance. Also confirm to what construction standard they will be built e.g. CIRIA C736.**

   It can be confirmed that the containment bunding described in the application will be constructed in line with relevant Environment Agency How to Comply Guidance.

   The auxiliary fuel storage tanks and filling systems will be designed in accordance with the relevant and latest British and European standards, codes of practice, regulations and laws applicable to fuel oil tanks and filling systems, including but not limited to:

   - BS 799-5: Oil burning equipment. Specification for oil storage tanks;
   - PPG2: Pollution Prevention Guideline above ground oil storage tanks;
   - PD 5500 (2009);
   - Dangerous Substances and Explosive Atmosphere Regulation 2002;
   - Directive 99/92/EC ('ATEX Workplace Directive');
   - Directive 94/9/EC ('ATEX Equipment Directive');
   - Control of Pollution (Oil storage) (England) Regulations 2001;
   - Pressure Systems Safety Regulations 2000; and
   - Pressure Equipment Regulations 1999.

4. **With regards to the tanker off loading area (described in section 6.2.1) please clarify whether the area will have a sealed drainage system. If it does not have sealed drainage explain how you will contain a significant spillage of a raw material.**

   It can be confirmed that the tanker offloading area will be designed with a sealed drainage system to contain any significant spillages of liquid raw materials.

3 Emissions to Surface Water

5. **Explain how you will ensure surface water runoff from storage areas cannot be become contaminated by the raw materials and wastes stored in these areas.**

   There will not be any materials stored in external areas, so there is very little risk of contamination of surface water from storage areas.

As explained in response to Q4, the drainage from raw material unloading areas will be sealed to contain any leaks and spills.

The surface water drainage system will collect water from the proposed buildings (via rainwater pipes) and hardstanding (via channels and gullies) and discharge the surface water to the River Tees, via a new outfall. All surface water discharges from hardstandings shall be treated through Class 1 petrol interceptors prior to discharging to the River Tees. The petrol interceptors will be fitted with an automatic oil level monitoring alarm system to ensure safe and economic operation of the separators.

Run-off from internal process plant areas will be designed to ensure any run-off or spillages are contained and captured by the process water drainage system. Areas such as the flue gas treatment area and ash storage will be designed with adequate falls so that process liquids drain into the trade effluent water system for treatment and will not contaminate the surface water.

6. **Please clarify if you are proposing to continually discharge surface water or will surface water be discharged periodically.**

   Also confirm whether you will be carrying out any testing of the surface water prior to release to the River Tees, if not, provide justification why you are not? If you are testing, provide details of the testing.

   Surface water run-off will be collected on-site within the surface water drainage system. As explained in response to question 5, the surface water drainage system will be designed to prevent potential contamination of the surface water drainage system.

   The surface water drainage system will discharge directly into the River Tees.

   The surface water system is subject to detailed design. However, at this stage it is anticipated that there will be a continuous discharge of surface water run-off from the site during periods of rainfall. It is proposed that the details of the drainage design are confirmed to the Environment Agency by way of a Pre-operational Improvement Condition.

   Periodic visual inspections will be undertaken of the surface water discharge to ensure that it is free of any visible oils and greases.

4 Waste Storage Areas

7. **With regards to your proposal to unload some of the waste fuel outside. Provide BAT justification for doing this against unloading all waste inside particularly as you are also proposing a covered waste reception area.**

   All incoming waste/fuel deliveries will be unloaded and deposited within the waste bunker within the enclosed waste reception and storage building. The proposed arrangements are considered to represent BAT.

8. **Provide details of the control measures you will put in to place to minimise emissions of dust resulting from the unloading and storage of waste fuel, particular when outside. Provide justification that the measures are BAT and in accordance with the control measures detailed in Environment Agency guidance S5.06 & How to comply with your environment permit.**

   As detailed in response to questions 7, it is no longer proposed to unload waste fuels in external areas. All waste fuels will be unloaded within an enclosed fuel reception area. These proposed arrangements are considered to represent BAT.

5 Fire Risk

9. Provide a thorough fire risk assessment and structured fire accident plan including, but not limited to, the following:

- **Proposals for prevention of fires**
- **Proposals for detecting and suppressing fires**
- **Proposals for containing and mitigating the effect of fires (including measures to contain firewater water runoff and justification that there is sufficient containment capacity).**
- **Proposals for managing waste stacks**

This assessment and plan should demonstrate that the necessary measures are in place to minimise fire risk on site; and should be written in accordance with How to comply with your environmental permit: Reducing fire risk on sites storing combustible materials.

A Fire Prevention Plant for the Facility is provided with the Application Pack.

C Ammonia storage

10. You are proposing to store significant amounts of ammonia on site for use in the SNCR NOx abatement system. Provide details of your techniques for ensuring any potential leaks from the storage of ammonia are promptly detected.

The ammonia storage facility shall be provided with all facilities to enable safe filling and leak detection.

The ammonia storage facility shall be provided with sufficient valves to enable safe isolation of all necessary sections and utilise duty and standby pump systems in case of a leak or failure.

The ammonia storage facility will be subject to detailed design. It is proposed that all of the controls associated with the ammonia storage facility are confirmed to the Environment Agency by way of a Pre-operational Improvement Condition.

6 Boiler Design

11. Describe your control methods for preventing the build up of deposits of sodium and potassium sulphates/chlorides in the boiler.

A hydro-jet cleaning system will be installed in the first pass of the boiler and a soot blower will be installed in the second pass. These cleaning methods are both considered to represent BAT for the prevention of depositions within the boiler.

7 Feedstock

12. Provide examples of waste that you would consider ‘unsuitable’ for your process.

Prior to commencement of operation, documented waste pre-acceptance and waste acceptance procedures will be developed as part of the management systems for the installation. These procedures will include the identification of unsuitable wastes.

These will be fully implemented upon the commencement of the delivery of fuel at the installation. As noted in response to Q7, both the Operator and the fuel supplier have an interest in ensuring that the criteria for accepting or rejecting any deliveries are clear.

Whilst these procedures have not been developed yet, it is anticipated that this will include the following examples:

- Wastes which are not in accordance with the descriptions provided in the waste transfer notes;
- Wastes which are not in the list of EWC codes which the facility is permitted to receive;
- Large bulky items which are not suitable for the fuel handling process and outside the agreed specification;
- Any wastes which are potentially considered to be hazardous.

13. Will the site operatives be trained in identification of unsuitable wastes?

It can be confirmed that site operatives will be trained in the documented waste pre-acceptance and waste acceptance procedures.

14. Provide further details of the designated storage area for unsuitable wastes - including location, containment, storage capacity and storage times.

The details of the designated storage area for unsuitable wastes will be subject to detailed design. However, it can be confirmed that a quarantine area will be located within the waste reception and storage building.

8 Acid Gas abatement

15. Will you be recirculating the alkaline flue gas treatment residues back into the flue gas treatment plant? If not, please provide justification for your decision.

It can be confirmed that the flue gas treatment system will include for recirculation of the residues from the acid gas abatement system.