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Consulting Engineers Limited

Thornton Energy Recovery Centre

Sesona Hill House Ltd

EP Application Supporting Information

ENGINEERING + CONSULTING

Document approval

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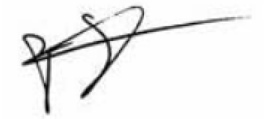
Checked by:	James Sturman		Lead Consultant	26/01/2023

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
00	22/12/2022	For Client	KLH	JRS
01	26/01/2023	Update Applicant name and responses to comments	KLH	JRS

Contents

1 Introduction

Sesona Hill House Ltd (Sesona) is applying to the Environment Agency (EA) under the Environmental Permitting Regulations (EPRs) for an Environmental Permit (EP) to operate the Thornton Energy Recovery Centre (the Facility). The Facility will comprise a twin-line waste incineration plant to incinerate pre-processed refuse derived fuel (RDF) / solid recovered fuel (SRF) (herein collectively referred to as RDF). The Facility will be located at the Hillhouse Business Park, Thornton-Cleveleys, Lancashire, approximately 2.6km east of Cleveleys, 2.9km west of Stalmine, 3.9km south of Fleetwood and 8.2km northeast of Blackpool.

This document and its appendices contain the supporting information for the application for an Environmental Permit (EP) for the Facility. They should be read in conjunction with the formal application forms. An overview of the activities to be undertaken at the Facility is provided in section 1.3. Further information and detail on each component at the Facility is provided is provided in sections 2 and 3, mostly in response to specific questions raised in the application forms.

1.1 The Applicant

Sesona is the developer of the project. The technical solution for the project is being provided by Novalux Energy Solutions Ltd, who work in the design and installation of sustainable energy systems. With over 12 years of experience in the renewables industry, Novalux has significant experience in the design and installation of Energy from Waste systems, including those of a similar design to the Facility, utilising thermal oil boilers alongside an Organic Rankine Cycle (ORC) system.

1.2 The Site

The Facility will be located at the Hillhouse Business Park, Thornton-Cleveleys, Lancashire. The Site is located on the northern edge of Thornton, approximately 2.6km east of Cleveleys, 2.9km west of Stalmine, 3.9km south of Fleetwood and 8.2km northeast of Blackpool. The approximate National Grid Reference (NGR) for the centre of the site is SD 34399 44026. The A585 is around 1.5km to the east of the Site and connects Thornton with the M55 motorway which runs west to east from Blackpool to Preston, where it ultimately meets the M6 motorway.

The Site covers an area of land which previously had an industrial use – a former chemicals manufacturing facility was located on the site which was decommissioned by 2000. The previous operations/activities have been removed, and the site is vacant and consists largely of hardstanding and internal roadways remaining from the industrial use.

The Site is bound by an access track and scrub vegetation to the east, beyond which lies the Wyre Way coastal footpath and River Wyre. The site is surrounded by industrial development which forms part of the wider Hillhouse Business Park. The closest residential properties to the Site are located off Butts Road, approximately 360m to the southwest.

Access to the Hillhouse Business Park is via a manned security gatehouse on Bourne Street.

A site location plan and Installation Boundary drawing are presented in Appendix A.

1.3 The Activities

The Facility will consist of a combination of Schedule 1 installation activities (as defined in the Environmental Permitting Regulations) (EPR) and directly associated activities. The activities to be undertaken at the site include the following:

1. A twin-line Energy Recovery Centre (ERC) to recover energy from RDF, incorporating:
   a. RDF reception and storage facilities prior to incineration;
   b. generation of power for export to the local electricity distribution network, and the potential to export heat to local users;
   c. production of an inert bottom ash material that will be transferred off-site for processing or disposal;
   d. generation of an air pollution control residue that will be transferred off-site to a suitably licensed hazardous waste facility for recovery or disposal;
   e. storage facilities for raw materials consumed and residues generated by the Facility;
   f. a flue gas treatment facility; and
   g. control room(s) plus welfare and office spaces.

Incoming RDF and raw materials will be delivered and residues will be transferred from the site via road. Weighbridge(s) will be installed at the entrance to the Facility to record the quantity of RDF being delivered. The internal roadways provides a one-way circulation route around the perimeter of the Facility, with direct access to the tipping hall, raw material and residue storage areas respectively.

The Schedule 1 activities (as defined in the Environmental Permitting Regulations), and the Directly Associated Activities (DAA's) which will be undertaken at the Facility are listed in Table 1.

Table 1: Scheduled and directly associated activities

Type of Activity	**Schedule 1 Activity**	**Description of Activity**	**Limits of specified activity**
Installation	Section 5.1 Part A(1) (b)	The incineration of non-hazardous waste in a waste incineration plant with a capacity of 3 tonnes per hour or more	From receipt of waste to treatment and emission of exhaust gas and disposal of any residues arising, including the storage of incinerator bottom ash and air pollution control residues.
Directly associated activities			
Directly Associated Activities		Energy generation	Energy generation and export of electrical power using an Organic Rankine Cycle turbine, with the potential to export heat to local users.
Directly Associated Activities		Back up electrical generator	For providing emergency electrical power to the plant in the event of supply interruption.

1.4 The Facility

The main activities associated with the operation of the Facility will be the combustion of RDF, operation of thermal oil boilers, generation of electricity using an ORC turbine, and the potential to export heat subject to commercial and economic viability.

The Facility will include the following key components/infrastructure:

- RDF reception and storage areas;
- reagent and raw material tanks and silos;
- residue silos and storage areas;
- water, auxiliary fuel and air supply systems;
- two incineration lines;
- two thermal oil boilers;
- Organic Rankine Cycle (ORC) turbine/generator set;
- facilities for the treatment of exhaust or flue gases;
- air cooled condenser unit;
- flues with associated stacks; and
- devices and systems for controlling combustion operations and recording and monitoring conditions.

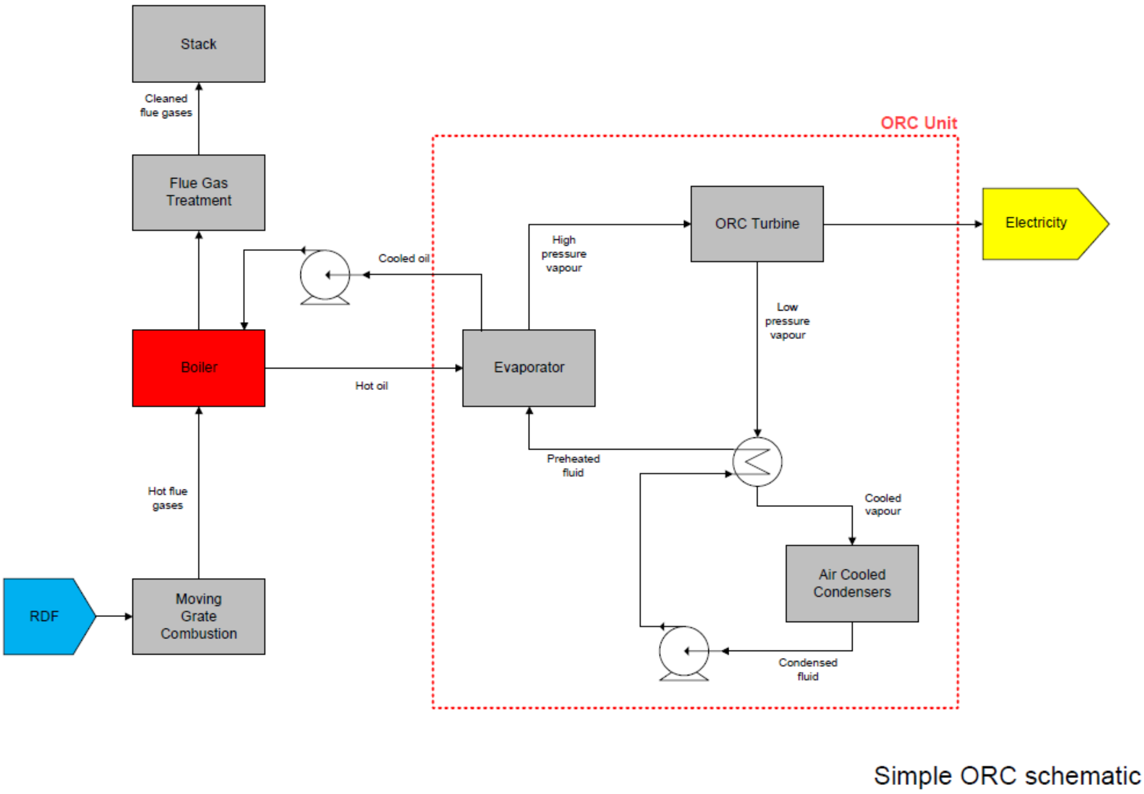
In addition to the following ancillary equipment/infrastructure:

- offices, control room and staff welfare facilities;
- gatehouse, weighbridge(s) and landscaping;
- drainage infrastructure;
- lighting and CCTV;
- external hard standing areas for vehicle manoeuvring/parking;
- internal access roads and car parking;
- grid transformer; and
- foul water treatment plant.

Assuming a design NCV of 10.11 MJ/kg, the Facility will process approximately 100,000 tonnes of waste per year (at a design capacity of 6.33 tph per line, and assuming 7,900 hours availability). However, the Facility will be capable of processing waste with a range of NCVs. The maximum throughput for the Facility will be up to 120,000 tpa of RDF.

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

Figure 1: Indicative Process Schematic



1.4.1 Raw materials

The Facility will receive deliveries of RDF by road. The Facility will also use consumables including sodium bicarbonate, activated carbon, urea, auxiliary fuel (fuel oil), water treatment chemicals and various maintenance materials as required (oils, greases, insulants, antifreezes, welding and firefighting gases etc).

RDF will be stored within dedicated RDF deposit areas, in addition to small quantities present in the stockpile bays and the areas directly adjacent to the RDF deposit areas. The bays and RDF deposit areas will have the capacity to store approximately 4 days of waste processing capacity. However, allowing for extended periods of shutdown, the maximum period of time that RDF will be stored at the Facility is 4 weeks.

Consumables (sodium bicarbonate, urea, and activated carbon) will be delivered to the Facility by road.

The thermal oil cycle is a closed loop; therefore, under normal operating conditions, additional thermal oil will not be required. However, during planned shutdown and maintenance, the thermal oil may need to be "topped up".

Further detail on the storage arrangements for reagents and raw materials at the Facility are presented in section 2.1.2.

1.4.2 Combustion process

The combustion process will utilise a conventional moving grate technology which will agitate the fuel bed to promote a good burnout of the RDF and a uniform heat release. The moving grates will enable the RDF to be moved from the feed inlet along the grate to the ash discharge.

The combustion chambers 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. This temperature will ensure the destruction of dioxins, furans, PAHs and other organic compounds. An adequate air supply will be maintained to give the correct volume of oxygen for optimum combustion. The primary source of airflow will be controlled through the grates, with secondary and tertiary air distribution systems also in place. Gas temperatures will be monitored and recorded using retractable probe systems at critical points. Audible and visible alarms will trigger in the control panel if the temperature starts to fall towards 850°C, with the auxiliary burners fired accordingly to maintain temperature. The combustion control system will regulate combustion conditions and control the boilers.

Primary combustion air will be drawn from the RDF deposit areas using an induced draft (ID) fan to maintain negative pressure in this area. The extracted air will be fed into the combustion chambers beneath the grates, divided into series of 'zones' for better distribution of air flow. Air flow will be controlled and adapted depending on the energy demand of the boilers, to optimise the combustion process.

Secondary combustion air will be preheated using hot flue gas and will be injected above the grate to improve the chemical reaction of the oxidation process and to ensure the complete combustion of the RDF. The supply of secondary combustion air will be regulated to adjust to the combustion process.

The combustion chamber (furnace) will be fitted with an air intake zone for the injection of tertiary air to assist in the oxidation of volatiles in the flue gases.

Flue gas recirculation will be incorporated into the combustion process – an oxygen probe located in the flue will modulate the contribution of recirculated gases. The flue gas recirculation will reduce NOx formation as the recirculated gases will have a lower oxygen concentration and therefore lower flue-gas temperature.

A NOx abatement reagent (urea solution) will be injected into the high temperature region of the boiler, as part of the SNCR system to abate NOx emissions. The reagent will react with the oxides of nitrogen formed in the combustion process forming water, carbon dioxide and nitrogen. By controlling the dosing rate of the reagent introduced into the gas stream, the concentration of NOx will be reduced to achieve the emission limits.

The combustion chamber will be provided with fuel oil auxiliary burners. The auxiliary burners will raise the temperature within the combustion chamber to the 850°C prior to feeding RDF. The auxiliary burners will typically operate for up to 16 hours during a start-up event and 1 hour during a shutdown event. It is anticipated that there will be around 2 start-ups per year per line due to planned maintenance activities. Interlocks will prevent the feed of RDF until the temperature within the combustion chamber has reached 850°C. During normal operation, if the temperature falls below 850°C, the low NOx auxiliary burners will be initiated to maintain the temperature above this minimum. Air flow for combustion is controlled by the combustion control system and is based on measuring oxygen content in the flue gas and/or monitoring the energy demand of the boilers.

1.4.3 Energy recovery

The heat released by the combustion of the RDF will be recovered by means of thermal oil boiler, which is integral to the furnace. The closed thermodynamic cycle will follow the principle of the Organic Rankine Cycle (ORC). In the ORC, the organic working medium (thermal oil) is pre-heated in a regenerator, then heated and vaporized through a heat exchanger with a thermal oil loop. The vapour is expanded in a turbine which drives an electric generator to generate electricity. Once the vapour has passed through the turbine, it passes through the regenerator that is used to initially pre-heat the organic working medium, increasing the overall efficiency of the process through internal heat recovery. The vapour is then condensed back to liquid form to be pumped back into the cycle, using air-cooled condensers. A simplified diagram of the process is presented within Figure 1.

As the Facility comprises a twin-line incineration process, it includes two thermal oil boilers working in parallel, feeding a single turbine. The turbine is designed to generate approximately 9.284 MWe of electricity assuming no heat export, with 7.784 MWe available for export, resulting in a parasitic load of 1.5 MWe.

As described within the CHP assessment presented within Appendix G, the Facility will have the capacity to export up to approximately 20 MWth of heat, subject to technical and economic feasibility. The CHP assessment (refer to Appendix G) has identified that there are opportunities to export an annual average load of approximately 3.65 MWth and a peak load of 7.69 MWth, subject to commercial and economic viability.

1.4.4 Flue gas treatment

The flue gas treatment system will consist of the following:

- selective non-catalytic reduction (SNCR);
- sodium bicarbonate and activated carbon injection (dry system); and
- a ceramic filter impregnated with a catalyst.

The abatement of oxides of nitrogen (NOx) will be achieved by careful control of combustion air, including flue gas recirculation, and an SNCR system. An adequate supply of air will be maintained to give the correct volume of oxygen for optimum combustion. Oxygen will be monitored, alongside the temperature in the primary combustion chamber. The combustion control systems will maintain stable combustion conditions within the boilers; therefore, optimising the combustion process.

Within the SNCR system, a NOx abatement reagent (urea solution) will be injected into the high temperature region of the boiler to further reduce the amount of NOx in the gas stream. The NOx abatement reagent will be injected into the combustion chamber through a bank of nozzles installed at different places to provide flexibility of dosing, directly into the hot flue gases above the flame. The SNCR process will chemically reduce the NOx to nitrogen, carbon dioxide and water.

The temperature window at which the SNCR system operates will be selected based on the effectiveness of abatement – when urea is used as a reagent, reactions effectively take place between 750 – 1,000°C. It is expected that injection will be undertaken between 850 – 1000°C. Secondary air will be preheated to help maintain a high temperature level in the secondary combustion zone, with the control systems maintaining the required temperatures. Furthermore, flue gas recirculation will be employed which will further reduce NOx generation due to lower oxygen concentrations. Air injection and distribution is optimised to ensure that the SNCR system is operating at optimal temperatures.

Sodium bicarbonate and powdered activated carbon (PAC) will be injected into the flue gases in a reaction chamber following the boiler to abate acidic gases, heavy metals and any remaining dioxins and furans. The sodium bicarbonate will abate the emission of acidic compounds, including hydrogen fluoride, hydrogen chloride and sulphur dioxide, via neutralisation reactions. The activated carbon will abate emissions of volatile metals (mercury), organic compounds and dioxins and furans. The sodium bicarbonate and activated carbon will be stored in separate silos adjacent to the FGT system. Dosing rates will be adjusted as required depending on upstream acid gas concentration measurements taken by the continuous emissions monitoring system (CEMS).

A ceramic filter impregnated with a catalyst will abate particulates. A ceramic filter has been chosen over a bag filter as it is able to handle higher flue gas temperatures. The ceramic filter will be impregnated with a catalyst and will also provide additional NOx abatement.

The resulting residues from flue gas treatment including particulates, reaction products and unreacted reagent solids are collectively known as Air Pollution Control residues (APCr). These will be collected and stored separately from bottom ash.

The cleaned flue gas will be monitored for pollutants and discharged to atmosphere via two 45 m stacks.

1.4.5 Emissions monitoring and stacks

The cleaned flue gas will be monitored for pollutants and discharged to atmosphere via the stacks.

A Continuous Emission Monitoring System (CEMS) will be installed to monitor concentrations of the following pollutants in the flue gas:

- Particulates (dust);
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- carbon monoxide (CO);
- oxides of nitrogen (Nitric Oxide NO, Nitrogen Dioxide NO2 & Nitrous Oxide, N2O);
- ammonia; and
- VOCs, expressed as total organic carbon.

In addition, periodic sampling and measurement will be carried out for:

- hydrogen fluoride;
- Group 3 heavy metals: antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V);
- cadmium (Cd) and thallium (Tl);
- mercury (Hg);
- dioxins and furans;
- dioxin-like PCBs; and
- PAHs.

The Continuous Emission Monitoring System (CEMS) will be MCERTS approved. There will be a duty CEMS on each line and also one back-up CEMS which will be capable of operating on either line. This will ensure that there is continuous monitoring data available even in the event of a problem with the duty CEMS.

Periodic measurements will be carried out once every 6 months. In the first year of operation, monitoring may be carried out more frequently as required by the EP.

1.4.6 Site drainage

An indicative water flow diagram for the Facility is presented within Figure 2. Further details on the surface water, foul water and process water drainage systems are presented in section 2.3.

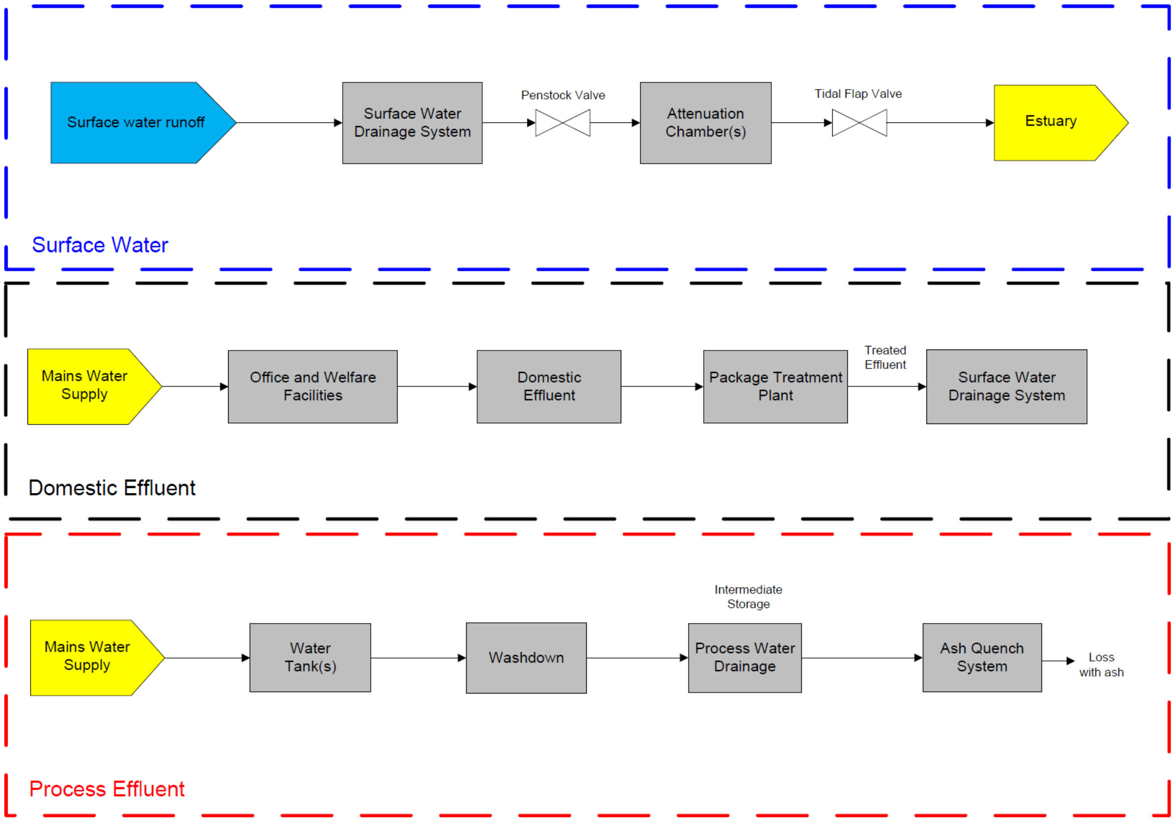


Figure 2: Indicative water flow diagram

1.4.7 Ancillary operations

The primary requirement of mains water will be for washdown purposes and welfare facilities. In the event of a fire, water for firefight purposes will be provided by the mains supply.

An emergency diesel generator will be provided to enable safe shut-down of the Facility in the event of a loss in grid connection. The diesel generator would only be expected to operate for short-term periods (i.e. <50 hours per year) for testing purposes. It is expected that the diesel generator will have a thermal capacity of around 5 MWth. The exact thermal capacity of the diesel generator will be confirmed following detailed design. The use of an emergency diesel generator will ensure that, in the case of a breakdown, operations are closed down as soon as practicable until normal operations can be restored.

An alternating current (AC) uninterruptible power supply (UPS) will be provided for essential functions (such as the primary control systems) that require continuous electricity supply even for a very short period of time (such as the starting-up of the emergency diesel generators).

2 The Facility

2.1 Raw materials

2.1.1 Types and amounts of raw materials

The main raw materials anticipated to be stored at the Facility are presented in Table 2. The quantities and storage capacities should be considered indicative prior to completion of detailed design of the Facility. Information on the potential environmental impact of the raw materials is included in Table 3.

The thermal oil cycle is a closed loop, however it may be topped up annually as required during service shutdowns. Top up amounts are expected to be small, so thermal oil has not been included in the table below as it is not considered to be a primary raw material.

Table 2: Types and amounts of primary raw materials

Schedule 1 Activity	Material	Estimated storage capacity	Estimated annual consumption (tpa)	Description
Section 5.1 Part A (b)	Fuel oil	40,000 litres (20 m^3) (split between 2 tanks)	65	Fuel for auxiliary burners
	Urea	120,000 L split between 4 tanks	354	Urea solution, $CO(NH2)_2 + H_2O$
	Sodium Bicarbonate	16,000 L split between 2 silos	1,650*	$NaHCO_3$, powdered
	Activated carbon	2,000 L split between 2 silos	49	Powdered

**Estimated consumption is based on an hourly consumption of 210kg/hour and assumes 90% availability.*

Table 3: Primary raw materials and their effect on the environment

Product	Chemical Composition	Estimated annual consumption (tpa)	Relative impact (%)			Impact Potential	Comments
			Air	Land	Water		
Fuel oil	Mixture of hydrocarbons	65	100	0	0	Low impact	Auxiliary fuel for start-up and shutdown of the Facility.
Urea (solution)	$CO(NH2)_2 + H_2O$	354	100	0	0	Low impact	Reacts with oxides of nitrogen to form nitrogen, carbon dioxide and water vapour. Any unreacted ammonia (a chemical intermediate) is released to atmosphere at low concentrations.
Sodium bicarbonate	$NaHCO_3$	1,617	0	100	0	Low impact	Sodium bicarbonate is injected and removed with the APC residues following flue gas treatment and disposed of as hazardous waste (or alternatively treated and recovered) at a suitably licensed facility.
Activated Carbon	C	49	0	100	0	Low impact	Injected carbon is removed with the APC residues following flue gas treatment and disposed of as hazardous waste (or alternatively treated and recovered) at a suitably licensed facility.

Various other materials may be used in small quantities for the operation and maintenance of the Facility. These could include, but not be limited to, the following:

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

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

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

Sesona will maintain a detailed inventory of raw materials used on-site and ensure that procedures are implemented for the regular review of the development in new raw materials.

2.1.2 Reagent unloading and storage

A range of chemical substances and hazardous materials associated with the process will be delivered to the site via road.

2.1.2.1 Urea

Urea solution will be delivered in sealed tankers and off-loaded to a urea storage tank via a standard hose connection. Urea solution will be stored within a tank in a dedicated storage area, with secondary containment such as bunding. The urea storage tank itself will be well-designed and be bunded to 110% of the tank's capacity; therefore, minimising the risk of any fugitive emissions from leaks whilst the urea is stored within the tank. Good design of pipework and regular preventative maintenance will allow for the safe transfer of urea into the SNCR system.

The delivery of urea will be supervised by site operatives trained in unloading practices. Regular inspection of the unloading equipment will be undertaken. Spillages will be prevented by good operating procedures such as high tank level alarms or trips. In addition, unloading activities will only be undertaken on areas of hardstanding with contained drainage. These measures will ensure that fugitive emissions of urea are contained.

The tanker offloading area at the site will be constructed from an impermeable concrete hardstanding, to create an impermeable layer to the underlying ground and prevent contamination in the event of a spill/leak from the tanker. It can be confirmed that sealed construction joints (water stop joints) will be installed between each concrete slab to ensure the integrity of the hardstanding, reducing the risk for contamination of the underlying ground/groundwater. The material from which the joints will be constructed is subject to detailed design but could include synthetic rubber or bentonite, for example. The tanker offloading area will be constructed in accordance with the requirements of CIRIA 736 and in accordance with recognised standard '*Eurocode 2 – Design of Concrete Structures – Part 3: Liquid retaining and containment structures*'. Quality assurance checks will be undertaken during construction to confirm the integrity of the hardstanding (and drainage systems). A regular preventative maintenance scheme will ensure the integrity of the tanker offloading area is maintained throughout the lifetime of the Facility. Preventative maintenance will include for periodically emptying any sumps in the tanker unloading area and undertaking visual inspections of the concrete or other material from which the sumps are constructed. The exact drainage arrangements are subject to detailed design but sumps/contained drainage will be provided as required for raw material unloading areas. Visual inspections of the hardstanding will also be undertaken. In the event that the visual inspection identifies that the integrity of the sumps or hardstanding has been compromised, additional pressure tests, leak tests and material thickness checks would be undertaken.

Should it be identified that damage has occurred to any of the structure, repairs will be undertaken to ensure that integrity is suitably maintained. These measures will ensure that liquids do not leak from the tanker unloading area and contaminate the underlying groundwater.

The tanker offloading area will have contained drainage which will ensure that any fugitive emissions are contained. Tanker off-loading of liquid chemicals will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery – this is expected to be achieved by the use of sumps to the urea and auxiliary fuel unloading areas (i.e. they will drain to a blind collection point). The drainage is subject to detailed design, but it can be confirmed that any sumps would be:

- Designed to be impermeable and resistant to the liquids collected within them.
- Subject to regular visual inspection, with any contents removed accordingly after checking for contamination.
- Should any concerns regarding the integrity of sumps be raised following programmed visual inspection or maintenance, this will be extended to water testing.

Sub-surface tanks and sumps, where identified appropriate following detailed design, will be designed with leak detection systems. Preventative maintenance will be implemented for all subsurface structures. This could include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc.

2.1.2.2 Sodium bicarbonate and activated carbon

The sodium bicarbonate and activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo. Exhaust air will be de-dusted using a fabric filter located at the top of the silo with air vented back into the tanker – cleaning of the filter will be done automatically with compressed air after filling operations, with the filter inspected regularly for leaks. Silos will also be fitted with high-level alarms.

Sodium bicarbonate and activated carbon, used within the flue gas treatment process, will be stored within separate storage silos located to the south of the flue gas treatment system. There are expected to be 2 silos per line to store these reagents, so 4 silos in total. The reagents will be stored in dedicated steel silos with equipment for filling from a tanker through a sealed pipe work system. The reagents will be pre-mixed using a 'big bag feeder system' before being fed into the flue gas treatment process.

2.1.2.3 Fuel oil

Fuel oil will be used on site for the start-up and auxiliary support burners and will be stored in two dedicated storage tanks with suitable secondary containment.

Measures to prevent pollution from the tanker offloading area are presented within section 2.1.2.1 above.

2.1.2.4 Additional raw materials.

Various maintenance materials (oils, greases, insulants, antifreezes, welding and firefighting gases etc.) will be stored in an appropriate manner. Any gas bottles on-site will be kept secure in dedicated area(s).

Reagents and raw materials will be stored in accordance with current guidance. All liquid chemicals and raw materials will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the stored capacity, in accordance with industry best practice. Further detail on the containment measures for raw material and reagent storage is presented within the Site Condition Report – refer to Appendix B.

Adequate quantities of spillage absorbent materials will be made available at easily accessible location(s) where chemicals are either stored or unloaded. These may be in the form of 'spill kits'. The measures outlined above are considered to be sufficient to prevent in the first case, or mitigate, any leaks from tanker offloading of materials.

2.1.3 Raw materials and reagents selection

2.1.3.1 Acid gas abatement

There are several reagents available for acid gas abatement. Sodium hydroxide (NaOH) or lime (CaO) can be used in a wet FGT system. Quicklime (CaO) can be used in a semi-dry FGT system. Sodium bicarbonate ($NaHCO_3$), lime (CaO) or hydrated lime ($Ca(OH)_2$) can be used in a dry FGT process.

The reagents for wet scrubbing and semi-dry abatement are not considered, since these abatement techniques have been identified as not representing BAT, refer to Appendix F. Therefore, the two alternative reagents for a dry system – sodium bicarbonate and lime – have been assessed.

The level of abatement that can be achieved by both reagents is similar. However, different quantities of reagents will be required resulting in different quantities of residues being generated.

A full assessment following the methodology in Horizontal Guidance Note H1 has been undertaken. Whilst it is noted that this guidance has been subsequently withdrawn by the EA, the replacement guidance is not as prescriptive in the methodology required. Therefore, the BAT assessment has been undertaken using the H1 methodology. The assessment is detailed in Appendix F, with the conclusions of the acid gas BAT assessment summarised in Table 4.

Table 4: Acid gas abatement BAT data

Item	Unit	$NaHCO_3$	$Ca(OH)_2$
Mass of reagent required	kg/h	109.0	67.0
Mass of residue generated	kg/h	84.0	85.0
Cost of reagent	£/tonne	155	110
Cost of residue disposal	£/tonne	186	155
Overall Cost	£/op.hr/kmol	32.5	20.5
Ratio of costs		1.58	

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

The use of sodium bicarbonate has a number of advantages:

- The quantity of residues produced using sodium bicarbonate is smaller.

- Handling of sodium bicarbonate requires much less health and safety considerations/controls than handling of lime. Lime is a corrosive material and requires strict COSHH controls for handling and transfer. Furthermore, sodium bicarbonate is easier to pump than lime.
- Sodium bicarbonate abates more efficiently than lime at higher temperatures, as is proposed at the Facility.
- The use of a lime system with the proposed design is anticipated to lead to higher risk of corrosion, compared to using a sodium bicarbonate system.

Hence, the use of sodium bicarbonate is considered to represent BAT for the Facility.

2.1.3.2 NOx abatement

NOx abatement systems can be operated with urea or ammonia solution. There are advantages and disadvantages with both options:

- urea is safer to handle than ammonia – the handling and storage of ammonia can introduce additional safety and environmental risks;
- ammonia tends to give rise to lower nitrous oxide formation than urea;
- when using urea, the SNCR system can operate in a wider effective temperature range; and
- ammonia emissions (or 'slip') can occur with both reagents, but good control will limit this.

The EA's Sector Guidance on Waste Incineration (EPR5.01) considers all options as suitable for NOx abatement. It is proposed to use urea solution as a reagent in the SNCR system. The urea will be delivered and stored as liquid urea. Ammonia is a highly toxic chemical and the transport and handling of ammonia can introduce additional risks and increase capital costs. Sesona considers that the risks associated with the storage and handling issues associated with ammonia solution outweigh the additional nitrous oxide formation associated with urea, which can be minimised through good process monitoring and reagent dosing. Taking this into consideration, the use of urea solution in the NOx abatement system is considered to represent BAT for the Facility. In addition to urea solution, it is proposed to use catalyst-impregnated ceramic filters for particulate abatement, with the catalyst providing further NOx abatement in addition to that which the urea SNCR system provides.

2.1.3.3 Abatement of volatiles

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

2.1.3.4 Auxiliary fuel

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

> *"The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (1) OJ L 121, 11.5.1999, p. 13., liquefied gas or natural gas."*

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

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

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

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

Natural gas can be used for auxiliary firing and is safer to handle than LPG. However, as stated previously, auxiliary firing will only be required intermittently. Auxiliary firing on natural gas requires large volumes of gas which would be needed to be supplied from a gas main within a reasonable distance from the Facility. Due to the costs associated with securing a sufficient gas supply for auxiliary firing purposes, and minimal consumption at all other times, the use of natural gas is not considered to represent BAT for the Facility.

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

Taking the above into consideration, fuel oil is considered to represent BAT for auxiliary firing at the Facility.

2.2 Incoming waste management

2.2.1 EWC codes

The Facility will be used to recover energy from RDF, with European RDF Catalogue (EWC) Codes as presented in Table 5. A small number of additional EWC codes are also proposed to allow flexibility in operation. These are justified further below.

Table 5: Waste to be processed in the Facility

EWC code	Description of waste
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING**
02 02	**wastes from the preparation and processing of meat, fish and other foods of animal origin**
02 02 02	animal-tissue waste
02 02 03	materials unsuitable for consumption or processing
02 03	**wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation**
02 03 04	materials unsuitable for consumption or processing
15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**

EWC code	Description of waste
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 01	paper and cardboard packaging
15 01 03	wooden packaging
15 01 06	mixed packaging
15 01 09	textile packaging
16	**WASTES NOT OTHERWISE SPECIFIED IN THE LIST**
16 02	**wastes from electrical and electronic equipment**
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15
16 03	**off-specification batches and unused products**
16 03 06	organic wastes other than those mentioned in 16 03 05
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 02	**wood, glass and plastic**
17 02 01	wood
18	**WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (except kitchen and restaurant wastes not arising from immediate health care)**
18 01	**wastes from natal care, diagnosis, treatment or prevention of disease in humans**
18 01 04	wastes whose collection and disposal is not subject to special requirements in order to prevent infection(for example dressings, plaster casts, linen, disposable clothing, diapers)
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 01	paper and cardboard
19 12 07	wood other than that mentioned in 19 12 06
19 12 08	Textiles
19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**separately collected fractions (except 15 01)**
20 01 01	paper and cardboard
20 01 08	biodegradable kitchen and canteen waste

EWC code	Description of waste
20 01 10	Clothes
20 01 11	Textiles
20 01 38	wood other than that mentioned in 20 01 37
20 01 39	Plastics
20 01 99	other fractions not otherwise specified (hygiene waste collected from domestic facilities that is not classified as clinical waste)
20 02	**garden and park wastes (including cemetery waste)**
20 02 01	biodegradable waste
20 03	**other municipal wastes**
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues
20 03 07	bulky waste

The majority of the waste received at the Facility will be RDF. The pre-processed nature of the RDF will ensure that calorific value is relatively homogeneous. The majority of recyclates will have been extracted and the waste shredded during the RDF production process. Furthermore, the Facility has been designed to process a range of NCVs. Therefore, CV spikes are not expected to be an issue in the combustion process. Taking this into consideration, the resulting emissions will be within the capability of the flue gas treatment system, therefore maintaining emissions to within the limits prescribed by the EP.

A small number of additional EWC codes have been included to allow some flexibility in the operation and design of the Facility. The additional EWC codes are justified as follows:

- Recyclate materials (e.g., 15 01 01, 19 12 01, 20 01 01, 20 01 39):
  - These may initially appear suitable for recycling. It can be confirmed that wastes received under these EWC codes would be contaminated or otherwise unsuitable for recycling. The Facility will provide an energy recovery solution for these waste types to avoid disposal of these wastes in a landfill. Furthermore, the quantity of these wastes is anticipated to be small compared to other wastes processed at the Facility.
- Biodegradable materials (e.g., 02 02 02, 02 02 03, 02 03 04, 16 03 06, 20 02 01):
  - Waste received under these codes will be otherwise unsuitable for composting or treatment in an anaerobic digestion facility. If this waste is rejected from treatment (for example, due to contamination or other issues), an alternative recovery/disposal solution will be required. The Facility will provide that alternative treatment method in accordance with the waste hierarchy, to avoid the wastes otherwise going to landfill for disposal. Furthermore, the quantity of these wastes is anticipated to be small compared to other wastes processed at the Facility.
- MSW (e.g., wastes under the 20 03 category):
  - Includes local authority collected waste (LACW) and waste from the commercial and industrial (C&I) sector of a similar nature to LACW.
  - As described above, the majority of the waste received at the Facility will be RDF. However, small quantities of MSW may also be accepted at the Facility to allow some flexibility in the operation and design of the Facility. MSW would be fed into the furnace in combination

with RDF to ensure a relatively homogeneous fuel feed is maintained, thereby avoiding any upset in combustion conditions.

- WEEE (e.g., 16 02 16):
  - Wastes accepted under this code may include rejected material from materials recycling facilities or waste transfer stations. The waste will be unsuitable for recycling or reprocessing. Processing this waste at the Facility to recover energy will avoid the wastes otherwise going to landfill for disposal. The quantity of these wastes is anticipated to be small compared to other wastes processed at the Facility.
- Healthcare wastes (e.g., 18 01 04):
  - These are non-hazardous and non-clinical wastes and as such do not require any specific storage, handling or processing requirements. The quantity of waste received under these codes is expected to be small. These will comprise wastes that are not subject to special requirements in order to prevent infection; and therefore, will be suitable for incineration on a conventional moving grate. For example, waste received under 18 01 04 is expected to comprise typical healthcare wastes also found in household municipal waste (for example dressings, plaster casts, linen, disposable clothing, diapers).
- Wastes under 99 codes (e.g., 20 01 99):
  - This is expected to comprise hygiene waste collected from domestic facilities that is not classified as clinical waste. The waste will be classed as non-hazardous and not require any specific storage, handling or processing requirements to prevent infection – therefore, it will be suitable for incineration on a conventional moving grate. The quantity of waste received under these codes is expected to be small.

2.2.2 Waste handling

2.2.2.1 Waste acceptance and pre-acceptance procedures

Supply contracts will be held with RDF suppliers that will supply RDF directly to the Facility. The contracts will ensure that the RDF suppliers provide the RDF in accordance with the required specifications for the Facility. This will ensure that only waste under the permitted EWC codes is delivered to the Facility.

Documented procedures for pre-acceptance and acceptance of RDF will be developed prior to the commencement of operation, in accordance with the documented management systems for the Facility. Sesona would propose to provide the EA with a summary of the documented procedures via pre-operation condition.

The pre-acceptance and acceptance checks on RDF being delivered to the Facility will include audits of RDF producers and/or suppliers to review their operations to confirm that the RDF which they are transferring to the Facility is in accordance with the required descriptions, specifications and EWC codes that will be provided by Sesona.

Procedures will be implemented for the on-site review of wastes received at the weighbridge (i.e. a review of the relevant documentation accompanying the RDF) and for periodic sampling of waste against the agreed specifications.

The pre-acceptance and acceptance procedures will comply with the Indicative BAT requirements in section 2.1 of EA guidance EPR5.01, including:

- Pre-treatment of waste (to form RDF) to reduce variations in feed-composition, control emissions within ELVs and prevent unnecessary waste production.

- A high standard of housekeeping will be maintained in all areas and spill kits will be available in suitable locations.
- Vehicles will be loaded and unloaded in designated areas provided with impermeable hard standing. These areas will have appropriate falls to the process water drainage system.
- Storage of RDF in enclosed buildings with suitable odour control measures (refer to section 2.4.4).
- Suitable firefighting measures designed in accordance with the requirements of Local Fire Officers. Particular attention will be paid to RDF storage areas. Refer to the Fire Prevention Plan (Appendix H) for further details.
- Storage of fuels/chemicals in tanks or silos, with suitable controls to prevent fugitive emissions (refer to section 2.1.2 for further details).
- Separation of uncontaminated surface water from other water streams to prevent contamination. Provision of sufficient attenuation capacity and containment measures in the event of contamination to prevent discharge off-site.

Additional measures will include the following:

- Delivery and reception of RDF will be controlled by a site environmental management system that will identify all risks associated with the reception of RDF and shall comply with all legislative requirements, including statutory documentation.
- RDF will be:
  - delivered in enclosed vehicles or other appropriate containers; and
  - unloaded in the enclosed tipping hall.
- Design of equipment, buildings and handling procedures will ensure there is insignificant dispersal of litter.
- Inspection procedures will be employed to ensure that any wastes which would prevent the thermal treatment process from operating in compliance with its EP are segregated and placed in a designated storage area pending removal.

Further visual inspection will take place by the plant operatives during vehicle tipping/RDF unloading.

2.2.2.2 Receiving RDF

RDF will be delivered to the Facility in enclosed delivery vehicles, delivered from off-site RDF suppliers. Checks will be made on the paperwork accompanying each delivery from external sources to ensure that only wastes under the correct EWC code will be accepted. Vehicles will be weighed at a weighbridge where the tonnage of the RDF delivered will be recorded, prior to proceeding to the enclosed RDF reception and tipping hall area (herein referred to as the tipping hall). Periodic sampling of waste against agreed specifications will be undertaken.

Once within the tipping hall, manually operated ‘rapid closing’ vertical folding doors would close behind the delivery vehicles. The delivery vehicles will discharge RDF directly into one of the following locations:

1. the walking floor RDF deposit areas;
2. the floor adjacent to the RDF deposit areas; or
3. potentially into a stockpile bay.

Once a delivery has been made, the waste delivery vehicle will exit the site via the weighbridge to determine the tonnage of RDF that has been delivered to the Facility.

The tipping hall will incorporate multiple areas for depositing the incoming waste, and will be fitted with manually operated 'rapid closing' vertical folding doors, which will be kept closed when RDF deliveries are not occurring. For RDF which is not discharged directly into the RDF deposit areas, a front end loading shovel will load the RDF into the RDF deposit areas. All RDF handling activities will be undertaken within the main RDF reception building, which will have contained drainage with links to the process drainage system.

The RDF deposit areas will be fitted with a walking floor which will operate continuously except for plant-wide shutdown periods. The walking floor will transfer the RDF from the RDF deposit areas to the RDF feed conveyors. The RDF feed conveyors will transfer the RDF to feed hoppers, which then feed the waste into the combustion chamber.

A loading shovel will be used to back-load/remove RDF from the RDF deposit areas back into the storage bays or onto road vehicles in the event of unplanned periods of prolonged shutdown.

The loading shovel can also be used to remove any unsuitable or non-combustible items which can then be transferred to the quarantine area for further inspection of RDF, prior to transfer offsite to a suitable disposal/recovery facility, if required.

The Environmental Management System (EMS) will include procedures to control the inspection, storage and onward disposal of unacceptable wastes. Certain wastes may require specific actions for safe storage and handling. Unacceptable or unsuitable wastes would be loaded onto road vehicle for transfer off-site either to the producer of the RDF or to a suitably licensed waste management facility.

The RDF deposit areas will be constructed of reinforced concrete and will be designed as a water retaining structure. During construction and commissioning, quality assurance checks will be undertaken to verify the structural integrity of the RDF deposit areas. This will minimise the potential for damage of the RDF deposit areas during the operational phase of the Facility.

Regular preventative maintenance, as part of documented management systems, will ensure that the integrity of the RDF deposit areas is maintained throughout the lifetime of the Facility. Preventative maintenance may include for periodically emptying the RDF deposit areas and undertaking visual inspections of the materials from which they are constructed. Should it be identified that damage has occurred to any part of the structure, repairs will be undertaken to ensure that integrity is suitably maintained. These measures will ensure that any liquids do not leak from the RDF deposit areas and contaminate the underlying groundwater.

2.2.3 Waste minimisation audit (Minimising the use of raw materials)

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

1. feedstock homogeneity;
2. dioxin & furan reformation;
3. furnace conditions;
4. flue gas treatment control; and
5. waste management.

All of these techniques meet the Indicative BAT requirements from EPR5.01 and the RDF Incineration BREF.

2.2.3.1 Feedstock homogeneity

Improving feedstock homogeneity can improve the operational stability of the Facility, leading to reduced reagent use and reduced residue production. The use of a pre-processed fuel (RDF) will ensure a relatively homogeneous input to the furnaces.

2.2.3.2 Dioxin & Furan reformation

As identified within EPR5.01 and the Waste Incineration BREF, there are a number of BAT design considerations required for the boilers. The boilers will be 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 to avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans. The boilers will be designed so that the external heat transfer surface temperature will be above a minimum of 170°C, where the flue gas is in the de novo synthesis temperature range.
- The residence time and temperature profile of flue gas will be considered during the detailed design phase to ensure that dioxin formation is minimised.
- It is reported in the guidance that the injection of ammonia compounds into the furnaces – i.e. an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction. An SNCR system to abate emissions of NOx is considered to represent BAT for the Facility, refer to section 2.6.2.
- 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 EA prior to commencement of commissioning. It is proposed that this is allowed for via pre-operational condition.
- Minimising the flue gas volume 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.
- Design features will be optimised to maintain critical surface temperatures below the ‘sticking’ temperatures. The arrangement of cooling surfaces will be optimised, and peak combustion temperatures will be avoided through acceptance of a relatively homogeneous fuel (RDF), uniform RDF feed and good primary and secondary air control. This will reduce the level of boiler deposits which would otherwise catalytically enhance dioxin formation.

Taking the above into consideration, it is understood that the Facility will meet the requirements as detailed in EPR5.01.

2.2.3.3 Furnace conditions

Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal. In accordance with Article 50(1) of the Industrial Emissions Directive, burnout in the furnace will either reduce the Total Organic Carbon (TOC) content of the bottom ash to less than 3%; or Loss on Ignition (LOI) of the bottom ash to less than 5%, by optimising the RDF feed rate and combustion air flows.

2.2.3.4 Boiler conditions

The configuration of the boiler will be a horizontal self-cleaning design which allows for online boiler cleaning. Online cleaning will be undertaken by means of compressed air reverse jets, whereby pulses of compressed air dislodge particulates which have adhered to the surface of the boiler.

Additional off-line boiler cleaning will also be undertaken as part of scheduled maintenance activities.

2.2.3.5 Flue gas treatment control – acid gases

A powder injection system will be employed whereby different rates of powder are injected into the flue gas treatment process. The powder injection system will utilise pre-mixed activated carbon and sodium bicarbonate in a 'big bag' feeder system. The activated carbon and sodium bicarbonate will be stored in separate silos prior to mixing and feed into the process. Dosing rates will be able to be adjusted as required, e.g., based on upstream acid gas concentration measurements. Initial rates will be calculated based on stoichiometric values and reaction formulas.

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the amount of APCr generated.

Furthermore, the plant preventative maintenance regime will include regular checks and calibration of the reagent dosing system to ensure optimum operation.

2.2.3.6 Flue gas treatment control – NOx and particulates

The SNCR system will require the injection of urea solution into the radiation zone of the boilers at several levels. A bank of nozzles will be provided at different places to provide flexibility of dosing. The configuration will make it possible to achieve full-area coverage of the injection medium across the entire cross section of the radiation zone. The system will be optimised to ensure maximal NOx reduction.

A ceramic filter will also be provided in the flue gas treatment system to abate particulates. The ceramic filter is more suitable for the proposed design than a bag filter, as it is able to operate at higher flue gas temperatures. The ceramic filter will also be impregnated with a catalyst to provide additional NOx abatement.

2.2.3.7 Residue management

The arrangements for the management of residues produced by the installation are presented in section 2.9. In particular, bottom ash from the combustion process and APCr from the flue gas treatment system will be transferred, stored and disposed of separately, i.e. there will be no mixing of these residues.

The procedures for handling of wastes generated by the Facility will be in accordance with the Indicative BAT requirements in EPR5.01 and the Waste Incineration BREF, refer to section 2.2.2.

2.2.3.8 Waste charging

The Facility will comply with the BAT requirements outlined in EPR5.01 and the Waste Incineration BREF for waste charging and the specific requirements of the IED:

- The combustion control and feeding system will be fully in line with the requirements of the IED. The conditions within the furnaces will be continually monitored to ensure that optimal conditions are maintained and that the proposed emission limits are not exceeded. This will be achieved by the use of an advanced control system. The RDF feed rate to the furnaces will be controlled by the combustion control system. Auxiliary burners fired with fuel oil will be installed and will be used to maintain the temperature in the combustion chamber if needed.

- The RDF charging and feeding systems will be interlocked with furnace conditions so that charging cannot take place when the temperatures drop below 850°C during operation, or during start-up prior to the temperature being raised to 850°C within the furnaces.
- In the event that emissions to atmosphere are in excess of an emission limit value, other than under abnormal operating conditions, the operators will be required to prohibit the RDF charging system (i.e., RDF into the hopper) using locks. If a period of abnormal operation exceeds 4 hours, the operators will be required to prohibit the RDF charging system.
- There will be a fire extinguishing system in the event of a fire in the pre-chamber (i.e., prior to RDF entering the combustion chambers). The system will be equipped with water inlet pipes, discharge solenoid valves and thermal detection sensors.
- An ignition door will be provided at the beginning of the grate, made of cast iron and protected internally with two layers (one of insulating concrete and the other of refractory concrete on the fire side). This serves to prevent fire burning back up the chute and igniting RDF in the hopper.
- Following loading into the feeding system, the RDF will be transferred onto the grates by hydraulic powered feeding units.
- A fuel detection system (rotation detectors) will be employed in the feeding system to monitor the level of RDF and prevent blockages due to overfilling.
- Secondary combustion air preheated using hot flue gas will be injected above the grate to improve the chemical reaction of the oxidation process and facilitate complete combustion of the RDF. The supply of secondary combustion air will be regulated to adjust to the combustion process.
- In a breakdown scenario, operations will be reduced or closed down as soon as practicable until normal operations can be restored.

2.3 Water use and drainage

The main use of water at the Facility will be for washdown purposes and to supply welfare facilities. The following key points regarding water use at the site should be noted.

- The water system has been designed to minimise the generation of process waters, and to minimise the consumption of mains water.
- The Facility is designed as a zero-discharge process, with process effluents re-used within the ash quench. Accordingly, there will be no requirement to discharge process effluents off-site.
- Water use will be minimised where possible, e.g., by using trigger controls on hoses for washdown.
- Water for firefighting will be provided by mains water.
- The Facility will have separate process water, foul water and surface water systems.
- Water for drinking supplies for the offices and welfare facilities will come from a potable water supply. The quantity of this water is expected to be small.
- Foul and domestic effluents from showers, toilets, and other mess facilities will be treated in an on-site package treatment plant prior to discharge to the surface water drainage system.

An indicative water flow diagram is presented below.

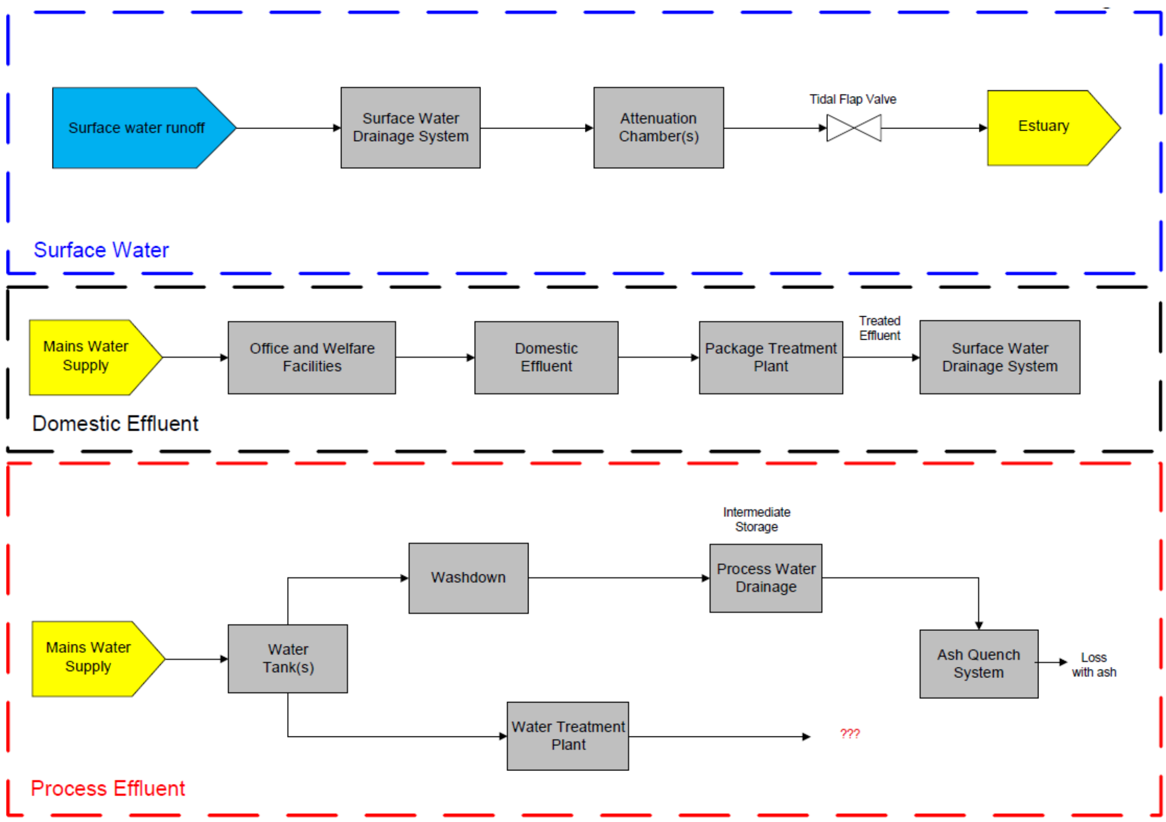


Figure 3: Indicative water flow diagram

2.3.1.1 Surface water

The site is served by an existing surface water drainage system which comprises a network of gullies, pipework and confluence or holding chambers. The chamber(s) provide surface water attenuation during high tides and are controlled with flap valves preventing tidal ingress during high tide. It is proposed to connect the Facility to the existing surface water drainage system. The system has a discharge to the adjacent Wyre Estuary.

A class 2 oil/petrol interceptor will treat surface water prior to discharge. An isolation valve will also be in place to prohibit surface water discharge from the site if required.

During construction and commissioning, any new or upgraded pipework would be subject to quality assurance checks to prove structural integrity. This will minimise the potential for damage during operation of the Facility. Regular preventative maintenance of site drainage systems will be undertaken as part of documented management systems to ensure integrity is maintained throughout the lifetime of the Facility. Preventative maintenance could include periodically emptying drainage systems including tanks and/or attenuation systems, undertaking visual inspections of drainage infrastructure, etc.

2.3.1.2 Foul water

Foul drainage will be provided for staff welfare facilities. A package treatment plant will be installed at the Facility which will discharge treated effluent to the surface water drainage system. Sesona commits to following the permit conditions within Standard Rules SR2010No3 – '*Discharge to surface water: Secondary treated domestic sewage with a maximum daily volume between 5 and 20 cubic metres per day*'. A standard rules permit is already in place for the discharge of treated sewage from the wider site. Therefore, no additional consent or monitoring requirements are proposed as part of this EP application for the Facility.

2.3.1.3 Process effluents

The Facility is designed as a 'zero-discharge' process. Process areas will have contained drainage, with process effluents re-used within the ash quench. Process drainage may include grated drains in process areas to collect process effluents prior to re-use. Therefore, there will be no discharge off-site of process effluents.

The exact type of structures will be confirmed during the detailed design of the Facility; however, any temporary pits or storage facilities for process effluents prior to re-use will be designed and constructed to be impermeable to the liquids that are being stored within them. Therefore, there will be negligible risk of process effluents leaking to the underlying groundwater or surrounding environment. During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of any process effluent storage facilities. This will minimise the potential for damage of the structure during operation of the Facility.

Regular preventative maintenance as part of documented management systems at the site will ensure that integrity of process drainage systems is maintained throughout the lifetime of the Facility. Preventative maintenance may include for periodically emptying pits/tanks and undertaking visual inspections of the concrete or other material from which the pit/tank is constructed. Should it be identified that damage has occurred to the structure, repairs will be undertaken to ensure that integrity is suitably maintained. These measures will ensure that liquids do not leak from the process drainage system and contaminate the underlying groundwater.

2.3.1.4 Contaminated firewater

Details on the proposed containment measures for contaminated firewater are presented within section 15 of the Fire Prevention Plan (refer to Appendix H). To summarise, in the event of a fire, contaminated water used for fighting fires will be collected through the site drainage systems. Although the site drainage systems are subject to detailed design, it is anticipated that there will be sufficient attenuation capacity to contain contaminated firewater in the event of a fire. A penstock valve or similar isolation measure will be fitted to prevent contamination of flow during an emergency fire event. Site kerbing may also provide additional attenuation as required.

2.4 Emissions

The source of point source emissions from the Facility are presented in the table below. Non-regulated point source emissions include the emergency diesel generator exhaust – these are used for emergency purposes only and should not be subject to any emission limits.

Table 6: Proposed emission points

Emission Point Reference	Source
Regulated	
A1	Air emissions stack – Line 1 Facility
A2	Air emissions stack – Line 2 Facility
W1	Surface water drainage to River Wyre estuary
Non-regulated	
A3	EDG exhaust (*location TBC*)

The location of A3 is subject to the detailed design of the Facility and selection of a suitable EDG model. It is expected that the EDG will have a thermal capacity of approximately 5 MWth – to be confirmed following detailed design.

The Facility is designed as a 'zero-discharge' process, and so there is not expected to be any discharge of process effluents off-site.

Treated domestic effluents will be discharged to the surface water drainage system. As described, depending on the quantity of treated domestic effluents discharged, they may fall under the EA's General Binding Rules which would mean they are not required to be regulated. The quantity of treated domestic effluents that are discharged are subject to detailed design and selection of a suitable package treatment plant model. Should the treated domestic effluents not fall under the EA's General Binding Rules, they will be subject to a separate permit application for a discharge consent.

If required, the emissions point drawing in Appendix A will be updated to reflect the 'true' emissions points and any changes upon completion of detailed design of the Facility.

The following sections provide further detail on both point source and fugitive emissions to air and water, as a result of the operation of the Facility.

2.4.1 Point source emissions to air

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

Table 7: Proposed air emission limit values (ELVs) – Facility

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
Particulate matter	mg/Nm^3	30	5	
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10	
Hydrogen chloride	mg/Nm^3	60	6	
Carbon monoxide	mg/Nm^3	150*	50	
Sulphur dioxide	mg/Nm^3	200	30	
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	100	
Ammonia	mg/Nm^3		10	
Hydrogen fluoride	mg/Nm^3			1
Cadmium & thallium and their compounds (total)	mg/Nm^3			0.02
Mercury and its compounds	mg/Nm^3			0.02
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3			0.3
Dioxins & furans	ng I-TEQ $/Nm^3$			0.04
Dioxin & furan-like PCBs	ng WHO-TEQ$/Nm^3$			0.06

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
All expressed at 11% oxygen in dry flue gas at standard temperature and pressure. **Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.*				

The BAT Reference Document on Waste Incineration (herein referred to as the Waste Incineration BREF or the 'BREF') and the European Union Commission Implementing Decision (EU) 2019/2010 dated 12 November 2019 (establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) were published in December 2019. Therefore, in accordance with the BREF, the Facility is required to comply with the BAT-AELs for a 'new' facility, from commencement of operation. The emission limits being applied for are in accordance with the upper end of the BAT-AEL ranges for a 'new' facility, with the exception of the daily average ELV for NOx, where it is proposed to apply for an ELV of 100 mg/Nm^3 in accordance with the requirements of the EA's BREF implementation plan for new plants.

2.4.2 Fugitive emissions to air

2.4.2.1 RDF handling and storage

RDF reception, handling and storage will be undertaken in enclosed areas, with the RDF reception area held under negative pressure, to prevent the release of litter and dusts. Manually operated 'rapid closing' vertical folding doors will be in place at the entrance to the tipping hall of the Facility. Good housekeeping will also be employed at the Facility to minimise the build-up of dust and litter (such as regular washdown activities).

Primary combustion air will be drawn from the RDF deposit areas using an ID fan to maintain negative pressure in this area. The extracted air will be fed into the combustion chambers beneath the grate. Additional management procedures for RDF storage areas, and the inclusion of regular clean downs of the tipping hall, will minimise the release of litter and dust.

Bottom ash will be dampened and cooled using a water quench prior to transfer to IBA storage skips by enclosed conveyor. The use of a quench highly reduces the likelihood of dust being generated from bottom ash handling.

Mobile plant and vehicle operators at the site will be provided with suitable training for the equipment they are operating. Supervision of mobile plant operation and regular site inspections will ensure that any leaks, trailing or tracking of residues from vehicles are quickly identified and suitably addressed. During prolonged periods of dry weather, the site roads would be damped down / washed if the potential for fugitive dust impacts resulting from traffic movements are identified by the site 'general manager'.

2.4.2.2 Silos

All silos will be fitted with bag filter protection to prevent the uncontrolled release of dusts during refilling activities. Maintenance procedures will be developed for routine inspection and testing of the bag filters.

Loading/unloading of materials stored in silos will be using a chute system. All loading/unloading operations will be supervised by site operatives. Dusty air from the loading/unloading of silos will be extracted and vented to atmosphere via bag filters fitted to prevent the release of dusts from silo unloading operations. Site operatives would assist drivers in positioning tankers underneath silo chutes, and the delivery driver will be responsible for connecting the loading/unloading chute to the tanker. Site operatives will be responsible for checking that the loading/unloading chute is closed following completion of loading/unloading, and will be required to clear up any spilled material. Cleaning of the tanker is prohibited outside loading/unloading areas (which will have contained process drainage).

2.4.3 Point source emissions to water and sewer

Further detail on the site drainage is presented within section 1.4.6. However, the following provides a summary of the proposed containment and drainage measures at the Facility.

The Facility is designed as a zero-discharge process, with process effluents re-used within the ash quench. Accordingly, there will be no requirement to discharge process effluents off-site. RDF handling, raw material handling and residues handling will be undertaken on areas of hardstanding with contained drainage. In addition, RDF handling and the initial quenching and handling of bottom ash will be undertaken within enclosed buildings. These measures will prevent the release of any process water from the Facility to the site surface water drainage system.

Uncontaminated surface water run-off will be discharged into the surface water drainage system. The surface water drainage system comprises a network of gullies, pipework and confluence or holding chambers. The chamber(s) provide surface water attenuation during high tides and are controlled with flap valves preventing tidal ingress during high tide.

Foul drainage will be treated in an on-site package treatment plant before treated effluent is discharged to the surface water drainage system. Sesona commits to following the permit conditions within Standard Rules SR2010No3 – '*Discharge to surface water: Secondary treated domestic sewage with a maximum daily volume between 5 and 20 cubic metres per day*'. A standard rules permit is already in place for the discharge of treated sewage from the wider site. Therefore, no additional consent is required as part of this EP application for the Facility.

2.4.4 Odour

The storage and handling of RDF has the potential to give rise to odour. The Facility will be designed in accordance with the requirements of EA Guidance Note '*H4: Odour*' and will include a number of controls to minimise odour during normal and abnormal operation, as set out in the following sections.

2.4.4.1 Delivery and storage of RDF

A number of waste pre-acceptance and acceptance measures will be in place at the Facility – refer to section 2.2.2.1. Furthermore, a number of measures will be in place for the receipt and handling of RDF – refer to section 2.2.2.2. These will ensure that fugitive emissions of odour and litter are prevented.

Primary combustion air will be drawn from the RDF deposit areas using an ID fan to maintain negative pressure in this area. The extracted air will be fed into the combustion chambers beneath the grates – any odorous compounds in the air will be destroyed by the high temperatures in the combustion chambers. The negative pressure within the RDF storage areas will minimise odorous emissions (as well as dust and litters) from escaping the Facility.

Prior to periods of planned maintenance, management procedures for RDF storage will reduce the amount of material stored before shutdown. It is not expected that both incineration lines will be shut down at the same time at any point during the year, as planned maintenance of each line will be undertaken in succession. However, in the very unlikely event that both lines are shutdown due to an unplanned event, RDF will be backloaded from the RDF deposit areas using loading shovels and transferred off-site should odour be deemed a potential issue.

2.4.4.2 Inspections and monitoring

During normal operation of the Facility, periodic inspections will be undertaken to monitor for odour and would include, but not be limited to, the following:

- olfactory checks for odour in the RDF reception areas and external installation boundary;
  - staff undertaking olfactory surveys will do so upon arrival to site (i.e. before being exposed to odour at the site for a prolonged period of time).
- monitoring the positions of louvres (e.g. ensuring doors are kept shut when no RDF deliveries are occurring); and
- monitoring combustion air flow, with odorous air extracted via the boilers and the stacks.

During periods of shutdown, the frequency of the above inspections would be extended, including monitoring air flow if the ID fan operation can be maintained, for instance during periods of maintenance. Doors to the RDF reception hall would be kept closed. In addition, during shutdown, additional 'sniff test' and inspection around the boundary of the Facility would be conducted. In the unlikely event that odour is detected outside the building or if odour complaints are received from neighbours, full odour surveys would be undertaken. If it is deemed appropriate, operating procedures would be amended to deal with any issues identified at the site.

2.4.4.3 Other measures

BAT 21 and section 4.2.2.3 of the Waste Incineration BREF list various methods and techniques as representing BAT to prevent or reduce diffuse emissions (including odour emissions) from a waste incineration plant. These have been reviewed as follows:

- The Facility will not receive/store 'pasty' wastes which are odorous and/or prone to releasing volatiles, as the Facility will only accept pre-processed RDF.
- The Facility will not receive or give rise to odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to the Facility.
- Odour during shutdown periods will be controlled by minimising the amount of waste in storage prior to periods of planned shutdown.
- Primary combustion air will be drawn from the RDF deposit areas using an ID fan to maintain negative pressure in this area. Odorous compounds will subsequently be destroyed by the high temperatures in the combustion chambers.

As concluded in the Environmental Risk Assessment (refer to Appendix D), the overall risk of odour emissions at the site is considered to be low due to the control and mitigation measures proposed. Therefore, it is understood that an Odour Management Plan is not required in support of this application.

2.5 Monitoring methods

2.5.1 Emissions monitoring

Sampling and analysis of all pollutants will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards) and in accordance with the Environment Agency's MCERTS scheme. This ensures the provision of data of an equivalent scientific quality and compliance with the requirements of the EP in relation to emissions monitoring.

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

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

The purpose of monitoring has three main objectives:

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

2.5.1.1 Monitoring emissions to air

The following parameters for the emissions from the Facility will be monitored and recorded continuously using a Continuous Emissions Monitoring System (CEMS):

1. Carbon monoxide;
2. Hydrogen chloride;
3. Sulphur dioxide;
4. Nitrogen oxides;
5. Ammonia;
6. Total Organic Carbon (TOC); and
7. Particulates.

In addition, the oxygen and 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 (IED).

There will be two CEMS systems; one per RDF incineration line. There will also be one back-up CEMS which will be capable of operating on either line, in the event of a CEMS failure.

In addition to the CEMS system, the following emissions from the Facility will also be monitored by means of periodic spot sampling at frequencies agreed with the Environment Agency:

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

The Waste Incineration BREF requires the continuous monitoring of mercury. However, it states that for plants incinerating wastes with a proven low and stable mercury content, continuous monitoring may be replaced by periodic monitoring once every six months. The EA's BREF implementation document makes reference to a protocol which requires operators to demonstrate consistent performance below a threshold limit of 10 µg/m^3 in order not to require mercury CEMS. The EA's EP permit templates for waste incineration plants, provided through its consultation with the waste incineration sector, includes improvement conditions requiring a programme of monitoring to be undertaken to demonstrate a low and stable mercury content. Taking this into consideration, it is proposed to apply for periodic monitoring of mercury within the EP with this subsequently demonstrated via an improvement condition.

Similarly, BAT 4 requires emissions to air of dioxins and furans to be monitored using a continuous sampler, unless emissions can be proven to be 'sufficiently stable'. The EA has produced a PCDD/F monitoring protocol. This states that accelerated testing must be undertaken (two tests per month) until six consecutive results are obtained. If these six results are under the relevant ELV (refer to section 5.1), then continuous monitoring will not be required. Sesona can confirm that attempts will be made to demonstrate, via the PCDD/F monitoring protocol, that emissions to air of PCDD/F are low and stable and that a continuous sampler is not required. The PCDD/F monitoring protocol requires this monitoring to be completed within six months of successful plant commissioning, but acknowledges that an extension may be agreed in writing with the EA (e.g. in the event of intermittent operation following commissioning).

In addition to the above, BAT 4 requires monitoring of PBDD/F if waste streams are known to contain brominated flame retardants (BFRs). The EA has recently issued an information note for operators of waste incineration plants regarding PBDD/F monitoring. The note states that all plants which burn municipal solid waste are required to carry out periodic PBDD/F monitoring quarterly in the first year of operation and then twice per year thereafter. At the time of writing, the EA is in the process of updating its method implementation document for monitoring PCDD/F in accordance with EN 1948 to incorporate the method for PBDD/F sampling. Furthermore, there are currently no laboratories in the UK which hold UKAS or MCERTS accreditation for sampling and analysis of PBDD/F. Accordingly, Sesona will commit to undertaking periodic monitoring of PBDD/F in accordance with the requirements of the EP. However, the accreditation status of monitoring results will be dependent on the development of EA guidance, and UKAS granting accreditation to sampling and analysis laboratories.

The Waste Incineration BREF also requires continuous monitoring of hydrogen fluoride; however, it is stated that this may be replaced by periodic monitoring if hydrogen chloride levels are proven to be sufficiently stable. With the proposed measures for the control of the abatement of acid gases (refer to section 2.2.3.5), periodic monitoring of hydrogen fluoride is proposed.

The frequency of periodic measurements will comply with the IED as a minimum. Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations. The flue gas sampling techniques and the sampling platform will comply with the following EA guidance (formerly called 'M1' and 'M2'):

- Monitoring stack emissions: measurement locations
- Monitoring stack emissions: environmental permits
- Monitoring stack emissions: techniques and standards for periodic monitoring.
- Monitoring stack emissions: guidance for selecting a monitoring approach

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

Reliability

IED Annex VI Part 8 allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. IED Annex VI Part 8 also requires that no more than 10 daily averages are discarded per year. These reliability requirements will be met primarily by selecting MCERTS certified equipment.

Calibration of the CEMS will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN 14181 and the BS EN 15267-3. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier. Therefore, the installation and functioning of the CEMS is subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.

As previously stated, there will be a CEMS system per incineration line, and also one back-up CEMS capable of operating on either line in the event of a CEMS failure. This will ensure that there is continuous monitoring data available even if there is a problem with either of the duty CEMS.

Start-up and shut-down

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

Start-up is any period, where the plant has been non-operational, until waste has been fed to the plant in a sufficient quantity to initiate steady-state conditions. Shutdown is any period where the plant is being returned to a non-operational state. The definitions for start-up and shutdown will be refined and agreed with the EA prior to the commissioning of the Facility (e.g., as part of the commissioning plan). However, the following conditions are expected to be met:

- Start-up ends when all the following conditions are met:
  1. the feed chute damper is open, and the feeder ram, grate and ash extractors are all running;
  2. exhaust gas O_2 is less than 15% (wet measurement); and
  3. the combustion grate is fully covered with waste.
- Shutdown begins when all the following conditions are met:
  1. the feed chute damper is closed;
  2. the auxiliary burner is in service; and
  3. exhaust gas oxygen is equal or above 15% (wet measurement).

2.5.2 Monitoring of process variables

An advanced control system will be in place to monitor the conditions within the furnaces, to ensure that optimal conditions are maintained and that the proposed emission limits are not exceeded. The system will control and/or monitor the main features of the plant operation including, but not limited to, the following:

- Pressure in the furnace;
- combustion air;
- RDF feed rate;
- SNCR system;
- flue gas oxygen concentration at the boiler exits;

- flue gas composition at the stacks;
- combustion process;
- flue gas control;
- power generation; and
- turbine pressure.

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

The following process variables have particular potential to influence emissions:

1. RDF throughput will be recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput will be recorded.
2. Combustion temperature will be monitored at a suitable position to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C.
3. The concentration of pollutants 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.

Incoming mains water usage will be monitored to help highlight any abnormal usage.

In addition, electricity and auxiliary fuel consumption will be monitored to highlight any abnormal usage. Annual reports of process variables (such as water and raw material consumption) will be submitted to the EA in accordance with the requirements of the EP.

2.5.2.1 Validation of combustion conditions

As described in Section 1.4.2, the Facility will be designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of at least 850°C. This criterion will be demonstrated using Computational Fluid Dynamic (CFD) modelling during the design stage and confirmed by the recognized measurements and methodologies during commissioning in accordance with Guidance Note EPR5.01.

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

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

Urea solution will be injected into the flue gases at a temperature of between 750 – 1,000°C. This temperature range is required to efficiently reduce NOx and avoid unwanted secondary reactions. This means that multiple levels of injection points will be required in the radiation zone of the furnace. During detailed design of the Facility, the SNCR system will be optimised to achieve a balance between high reaction rates, low NOx emission concentrations and low reagent consumption, and it will be designed to operate within the temperature range stated in the Waste Incineration BREF. Secondary air will be preheated to help maintain a high temperature level in the secondary combustion zone, with the control systems maintaining the required temperatures. Furthermore, flue gas recirculation will be employed which will further reduce NOx generation due to lower oxygen concentrations. Air injection and distribution is therefore optimised to ensure that the SNCR system is operating at optimal temperatures.

2.5.2.2 Measuring oxygen levels

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

2.6 Technology selection (BAT)

This section presents qualitative and quantitative BAT assessments for the following:

- combustion technology;
- NOx abatement;
- acid gas abatement;
- particulate matter abatement; and
- cooling technology.

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

2.6.1 Combustion technology

The waste treatment/energy recovery technology will be a moving grate furnace. This is the leading technology in the UK and Europe for the combustion of non-hazardous residual wastes. The moving grate will comprise of inclined fixed and moving bars that will move the RDF from the feed inlet to the residue discharge. The grate movement turns and mixes the RDF along the surface of the grate to ensure that all of the RDF is exposed to the combustion process.

The Waste Incineration BREF and the BREF for Large Combustion Plants identify a number of alternative technologies for the combustion of waste. The suitability of these technologies among others has been considered, as follows:

1. **Grate furnaces**

   As stated in the EPR5.01, these are designed to handle large volumes of waste.

   Grates are the leading technology in the UK and Europe for the combustion of biomass and non-hazardous waste (including RDF), such as that proposed to be treated at the Facility. The moving grate comprises an inclined fixed and moving bars (or rollers) or a vibrating grate that will move the waste/RDF from the feed inlet to the residue discharge. The grate movement turns and mixes the waste/RDF along the surface of the grate to ensure that all RDF is exposed to the combustion process.

   Grate systems are designed for large quantities of municipal waste (including heterogeneous waste).

2. **Fixed hearth**

   These are not considered suitable for larger volumes of waste. They are best suited to low volumes of consistent waste whose combustion has a low pollution potential. Fixed hearth incinerators are often used for animal carcass incineration, where the containment offered by the fixed hearth may help to ensure that unburned liquids such as fat do not leak out. The design may have difficulty in meeting Waste Incineration Directive (WID) standards, due to the semi-batch nature of the waste travel on the grate and de-ashing operations. Taking this into consideration, these systems are not considered suitable for the proposed Facility and have not been considered any further.

3. **Pulsed hearth**

   Pulsed hearth technology has been used for refuse-derived fuels, as well as other solid wastes. However, there have been difficulties in achieving reliable and effective burnout of the waste/RDF and it is considered that the burnout criteria required by Article 50(1) of the IED would be difficult to achieve. Therefore, these systems are not considered practical and have not been considered any further for the Facility.

4. **Rotary and oscillating kilns**

   Rotary kilns are used widely within the cement industry which uses a consistent fuel feedstock and they have been used widely within the healthcare sector in treating clinical or hazardous wastes, but they have not been used in the UK for large volumes of non-hazardous waste derived fuels such as RDF.

   An oscillating kiln is used for the incineration of municipal waste at only two currently known sites in England and some sites in France. The energy conversion efficiency in these systems is lower than that of other thermal treatment technologies due to the large areas of refractory lined combustion chamber. Careful attention needs to be paid to the seals between the rotating kiln and the end plates to prevent leakage of gases and unburnt waste. Tumbling of the waste may generate fine particles requiring secondary combustion and good particulate abatement.

5. **Fluidised bed combustor**

   Fluidised beds are designed for the combustion of a relatively homogeneous fuel. Therefore, fluidised beds are appropriate for waste which has been pre-processed such as RDF. However, the use of fluidised waste to treat RDF and non-hazardous in practice has resulted in significant operational problems which has led to significant downtime.

   While fluidised bed combustion can lead to slightly lower NOx generation, the injection of a NOx reagent is still required to achieve the relevant emission limits.

   Fluidised beds can have elevated emissions of nitrous oxide, a potent greenhouse gas. Some fluidised beds have been designed to minimise the formation of nitrous oxide.

6. **Pyrolysis/Gasification**

   In pyrolysis, the waste/RDF is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be from the combustion of part of the syngas.

   Various suppliers are developing pyrolysis and gasification systems for the incineration of waste fuels. However, the facilities which have been constructed have suffered issues with reliability and availability. Taking this into consideration, Sesona does not consider pyrolysis and gasification systems to be a robust and proven technology for the treatment of RDF. Therefore, these systems have not been considered any further.

A quantitative BAT assessment for grate, fluidised bed and rotary kiln combustion technologies has been undertaken and is presented in Appendix F, section 5. The conclusions of the assessment are summarised in Table 8.

Table 8: BAT assessment – combustion techniques

Parameter	Units	Grate	Fluidised bed	Rotary kiln
Global warming potential	t CO2 eq p.a.	-22,700	-22,300	-16,000

Parameter	Units	Grate	Fluidised bed	Rotary kiln
Urea consumption	t.p.a.	400	400	500
Residues (total ash)	t.p.a	25,000	26,170	25,000
Annual total materials cost (reagents plus residues)	p.a.	£1,650,000	£1,790,000	£1,670,000
Annual power revenue	p.a.	£3,477,000	£3,420,000	£2,508,000

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

The material costs are approximately 8% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue, but it is acknowledged that it is marginal. The grate system will be able to process a varying waste composition compared to a fluidised bed system which requires a consistent and homogenous fuel and therefore possibly requiring additional treatment of the waste.

Grate systems are proven to process large quantities of municipal waste, whereas fluidised bed systems are more sensitive to inconsistencies within the fuel. Due to the robustness of grate combustion systems, they are considered to represent BAT for the Facility.

2.6.2 NOx abatement systems

As stated within EPR5.01, there are three recognised technologies available for the abatement of emissions of NOx:

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

1. **FGR**

   Some suppliers of grates have designed their combustion systems to operate with FGR and these suppliers can gain benefits of reduced NOx generation from the use of FGR. Other suppliers of grates have focussed on reducing NOx generation through the control of primary and secondary air and the grate design, and these suppliers gain little if any benefit from the use of FGR. Even when FGR is implemented, additional NOx abatement is required to reduce NOx emissions to required levels under the IED and Waste Incineration BREF.

   It can be confirmed that flue gas recirculation will be incorporated into the combustion process – an oxygen probe located in the flue will modulate the contribution of recirculated gases. The flue gas recirculation will reduce NOx formation as the recirculated gases will have a lower oxygen concentration and therefore lower flue-gas temperature.

2. **SNCR**

   SNCR involves distributing a spray containing an aqueous SNCR reagent (urea solution) into the flue gas flow path at an appropriate location, typically the high temperature region of the boiler. The urea will react with the NOx formed in the combustion process to produce a combination of nitrogen, water and carbon dioxide. NOx levels are primarily controlled by monitoring the flow of combustion air.

   Extensive dosing of reagent or low reaction temperatures can lead to ammonia slip, resulting in the formation of ammonia salts downstream in the flue gas path and discharge to atmosphere of unreacted ammonia. Ammonia slip may be controlled by employing systems to control the rate of reagent dosing to ensure that it is kept to a minimum.

SNCR is widely deployed across waste (including RDF), biomass and coal power plants in the UK and Europe. It is proposed to use SNCR for the Facility to control NOx levels, in combination with controlling the combustion air through the combustion control system. Urea will be used as the reagent within the SNCR system.

3. **SCR**

In an SCR system the SCR 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.

A quantitative BAT assessment of the available technologies has been undertaken and is presented in Appendix F, section 4. This assessment uses data obtained by Fichtner from a range of different projects using the technologies proposed in this application.

Table 9: BAT assessment – NOx abatement

Parameter	Units	SNCR	SCR	SNCR + FGR
NOx released after abatement	t p.a.	34	27	34
NOx abated	t p.a.	85	92	73
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq p.a.	-1,300	-1,000	-1,300
Global Warming Potential	t CO2 p.a.	300	1,100	400
Urea used	t.p.a.	380	180	330
Total Annualised Cost	£ p.a.	£149,000	£658,000	£190,000
Cost per tonne NOx abated	£ p.t NOx.	£1,750	£7,150	£2,600

As can be seen, incorporating SCR into the design of the Facility to abatement emissions of NOx:

1. increases the annualised costs by approximately £500,000;
2. abates an additional 7 tonnes of NOx per annum;
3. reduces the benefit of the Facility in terms of the global warming potential by approximately 800 tonnes of CO_2;
4. reduces reagent consumption by approximately 200 tonnes per annum; and
5. costs an additional ~£73,000 per additional tonne of NOx abated, compared to SNCR.

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

Including FGR to the SNCR system to abate NOx increases the cost per tonne of NOx abated by approximately 49%. It has no effect on the direct environmental impact of the plant, but it increases the impact on climate change by approximately 100 tonnes of CO_2 per annum. However, it reduces reagent consumption by approximately 50 tonnes per annum. This is based on the assumption that FGR reduces the NOx generation within the furnace.

Therefore, taking the above into consideration, the use of SNCR either with or without FGR is considered to represent BAT for the abatement of NOx within the Facility. The proposed designs currently include FGR, due to the anticipated benefits in reduced NOx generation within the furnace.

2.6.3 Acid gas abatement system

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

1. Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.
2. Semi-dry, involving the injection of quick lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the quick lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boilers, making the steam cycle less efficient. The quick lime and reaction products are collected on a bag filter, where further reaction can take place.
3. Dry, involving the injection of lime or sodium bicarbonate into the flue gases as a powder. With lime systems, the reagent is typically collected on a bag filter to form a cake and most of the reaction between the acid gases and the reagent takes place as the flue gases pass through the filter cake. Using sodium bicarbonate, as is proposed for the Facility, results in decomposition of the sodium bicarbonate to carbonate, with the diffusion of carbon dioxide producing a highly porous, high surface area sodium bicarbonate which is very efficient at absorbing acid gases. The efficiency increases with higher flue gas temperatures, as is proposed at the Facility.

Wet scrubbing is not considered to be suitable for the Facility, due to the production of a large volume of hazardous liquid effluent and a reduction in the power generating efficiency of the plant.

Dry and semi-dry systems can easily achieve the BAT-AEL emission limits required by the Waste Incineration BREF and operational records from plants in the UK and Europe have been demonstrated to achieve the proposed emission limits. Furthermore, both are considered to represent BAT by EPR5.01. Table 10 compares the two options.

Table 10: BAT assessment – acid gas abatement

Parameter	Units	Dry	Semi-dry
SO_2 abated	t.p.a.	150	150
Photochemical Ozone Creation Potential (POCP)	t-ethylene eq	50	50
Global Warming Potential	tn-CO_2 eq p.a.	1,100	2,100
Additional water required in a semi-dry system	t.p.a.	-	5,071
APC residues	t.p.a.	5,000	4,500
Annualised cost	£ p.a.	£2,431,000	£2,457,000

The performance of the two options is very similar.

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

The dry system has a lower global warming potential and annualised cost compared to the semi-dry system. In addition, within a semi-dry system recycling of reagent within the process is not proven, but it is proven in a dry system.

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

2.6.4 Particulate matter abatement

The Facility will use a ceramic filter impregnated with a catalyst for the abatement of particulates, and additional polishing of NOx emissions to achieve the proposed emission limit. A ceramic filter has been chosen for the abatement of particulates at the Facility due to its capability of withstanding high temperatures. Due to the use of thermal oil boilers in an ORC system, the resulting flue gas temperatures at the boiler exits prior to entry into the flue gas treatment system will be significantly higher than those in a steam cycle system as seen on other UK waste incineration plants.

Other options for particulate matter abatement have been reviewed (and discounted) as follows:

1. Depending on the material that is used, bag (fabric) filters can operate at flue gas temperatures of between 80 – 260°C. However, as the flue gas entering the flue gas treatment system will be at temperatures of between approximately 220 – 330°C. Therefore, fabric filters are not suitable for the high temperatures proposed at the Facility.
2. Wet scrubbers are typically not capable of meeting the same emission limits as fabric or ceramic filters.
3. Electrostatic precipitators are also not capable of abating particulates to the same level as fabric or ceramic filters. They could be used to reduce particulate loading on fabric/ceramic filters, but the benefit is marginal and would not justify the additional expenditure and the increase in power consumption are not considered to represent BAT.

Taking the above into consideration, ceramic filters are considered to represent BAT for the removal of particulates for this Facility.

2.6.5 Cooling technology

The purpose of the condenser would be to cool/condense the organic working medium (thermal oil in the case of the Facility) whilst it is in vapor form after passing through the ORC turbine, before it is 're-cycled' back into the system. This is proposed to be achieved by discharging low-temperature heat back to the atmosphere using air cooled condensers. However, it is acknowledged that there are a number of potential BAT solutions considered in EPR 5.01 for condensers:

- Air Cooled Condenser (ACC);
- Once-Through Cooling (OTC); and
- Evaporative Condenser.

Water cooling can be achieved through once-through cooling systems or by a recirculating water supply to condense the organic working medium. Both cooling systems require significant quantities of water, and a receiving watercourse for the off-site discharge of cooling water. In addition, a water abstraction source is needed, with mains water not an economically viable option.

The closest watercourse to the site is the River Wyre estuary to the northeast. This is designated as a habitats site (Wyre Estuary SSSI) due to the presence of a number of important features, including birds and vegetation. Due to the sensitivity of the River Wyre, water cooling systems are not considered to be ‘available’ for the Facility.

ACCs do not require significant quantities of water. It is acknowledged that ACC’s can have noise impacts, but mitigation measures can be applied to the design to ensure that the noise impacts associated with the ACC’s are at an ‘acceptable’ level – refer to the noise assessment (Appendix C) for further detail. Furthermore, ACC’s do not create a visual impact (visible plume), unlike that from evaporative cooling.

Taking the above into consideration, an ACC is considered to represent BAT for the Facility.

2.7 The Legislative Framework

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

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

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

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

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

Table 11: Summary table for IED compliance – Facility

Article	Requirement	How met or reference
15(3)	The competent authority shall set emission limit values that ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques as laid down in the decisions on BAT conclusions referred to in Article 13(5) through either of the following.	Refer to section 2.4 and 2.7.2.

Article	Requirement	How met or reference
22(2)	Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for under paragraph 3. The baseline report shall contain at least the following information: (a) information on the present use and, where available, on past uses of the site; (b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned. Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.	Refer to Appendix B – Site Condition Report.
44	An application for a permit for a waste incineration plant or waste co-incineration plant shall include a description of the measures which are envisaged to guarantee that the following requirements are met: (a) the plant is designed, equipped and will be maintained and operated in such a manner that the requirements of this Chapter are met taking into account the categories of waste to be incinerated or co-incinerated;	Refer to Section 2.2.1of the Supporting Information which lists the categories of waste to be incinerated at the Facility.
	(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable through the generation of heat, steam or power;	Refer to Appendix G – CHP assessment.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to Section 2.9 of the Supporting Information.
	(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law.	Refer to Section 2.9 of the Supporting Information.

Article	Requirement	How met or reference
46 (1)	waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Refer to Appendix E – Air Quality Assessment.
46 (2)	Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex.	Refer to section 2.4 of the Supporting Information.
46 (5)	waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater. Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.	Refer to Appendix B – Site Condition Report, Appendix D – Environmental Risk Assessment and Appendix H – Fire Prevention Plan.
46 (6)	Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded. The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours. The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	Refer to Appendix E – Abnormal Emissions Assessment.
47	In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.	Refer to Section 1.4.7 of the Supporting Information.
48 (2)	The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Refer to Section 2.5.1.1 of the Supporting Information.
48 (4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Refer to Section 2.5.1 of the Supporting Information.

Article	Requirement	How met or reference
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	There will be no emissions from flue gas treatment systems to water/sewer from the waste incineration plant.
50 (1)	waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3% or their loss on ignition is less than 5% of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used.	Refer to Section 2.2.3.3 – TOC or LOI testing.
50 (2)	waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850oC for at least two seconds.	Refer to Section 2.2.3.8 of the Supporting Information.
50 (3)	Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas.	Refer to Sections 2.2.3.8 and 2.1.3.4 of the Supporting Information.
50 (4)	waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached;	Refer to Section 2.2.3.8 of the Supporting Information.
	(b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained;	Refer to Section 2.2.3.8 of the Supporting Information.

Article	Requirement	How met or reference
	(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Refer to Section 2.2.3.8 of the Supporting Information.
50 (5)	Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable.	Refer to Appendix G – CHP assessment.
50 (6)	Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.	This requirement will not apply as the Facility will not receive infectious clinical waste.
52 (1)	The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health.	Refer to Section 2.4 of the Supporting Information and Appendix D.
52 (2)	The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	Refer to Section 2.2.1 of the Supporting Information.
53 (1)	Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	Refer to Section 2.9 of the Supporting Information.
53 (2)	Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment.	Refer to Section 2.9 of the Supporting Information.
53 (3)	Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	Refer to Section 2.9 of the Supporting Information.

2.7.2 Requirements of the Final Waste Incineration BREF

The Final Waste incineration (WI) BREF BAT conclusions were published by the European IPPC Bureau in December 2019. New waste incineration plants are required to demonstrate that they meet the requirements of the BREF when applying for an EP. As such, the table below identifies the requirements of the Best Available Techniques (BAT) conclusions as set out in the BREF and explains how the Facility will comply with them.

Table 12: Summary table for WI BREF BAT conclusions compliance – Facility

#	BAT Conclusion	How met or reference
1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the features as listed in BAT 1 of the BREF.	A general summary of the proposed EMS is presented in section 3 of the Supporting Information. The EMS will be developed throughout the development stage of the project. It is proposed that a pre-operational condition is included within the EP which requires Sesona to provide a summary of the proposed EMS prior to commencement of operation. The summary will demonstrate how the proposed EMS complies with the requirements as set out in BAT 1 of the BREF.
2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the combined boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.	As stated in section 2.8, the gross electrical efficiency of the plant is calculated to be approximately 25%. Therefore, Sesona understand that this is in accordance with the requirements of BAT 2.
3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF.	As set out in section 2.5 of the Supporting Information, the process parameters for monitoring of emissions to air are as follows: • water vapour content; • oxygen content; • temperature; and • pressure. Temperature will be monitored in the combustion chamber. There will be no emissions of water from FGC systems. Furthermore, there will be no IBA treatment undertaken at the Facility. Taking the above into consideration, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply. Sesona can confirm that the Facility will include for monitoring of the key process parameters relevant for emissions to air in accordance with BAT 3.
4	BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international	It is anticipated that emissions to air will be monitored with the following frequency: <u>Continuous Monitoring</u> • Carbon monoxide;

#	BAT Conclusion	How met or reference
	standards that ensure the provision of data of an equivalent scientific quality.	• Hydrogen chloride; • Sulphur dioxide; • Nitrogen oxides (including nitrous oxide); • Ammonia; • Volatile organic compounds (VOCs) as Total Organic Carbon (TOC); and • Particulates. Periodic Monitoring • Hydrogen fluoride; • Group 3 heavy metals (Sb, As, Pb, Cr, Co, CU, Mn, Ni, V) – once every six months; • Cadmium and thallium – once every six months; • Mercury – once every six months; • Dioxins and furans - once every six months (except long-term sampling of PCDD/F once every month); and • Dioxin-like PCBs (once every six months for short-term sampling, once every month for long-term sampling). As set out in section 2.5.1.1 of the Supporting Information, the methods and standards used for emissions monitoring will be in compliance with EPRS5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit. Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality which also meets the monitoring requirements of the EP. Sesona consider that the proposals for monitoring of emissions to air are in accordance with the requirements of BAT 4.
5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).	The EA recently published its BREF implementation plan, which states how monitoring of PCCD/F and dioxin-like PCB mass emissions during a planned start-up and shut-down should be carried out following the successful commissioning of the plant. It is also stated that the test should be

#	BAT Conclusion	How met or reference
		repeated once every 3 years. However, it is acknowledged that monitoring of PCCD/F and dioxin-like PCB mass emissions should be done on 'best endeavours' basis, bearing in mind the challenges of coinciding a visit by the monitoring company with the exact time when the plant is starting up or shutting down. Specifically, the implementation document states that no plant will be required to start up or shut down specifically for the purposes of testing, and that where reasonable attempts to monitor fail due to the challenges described above, operators will be expected to attempt to repeat the exercise at the next available opportunity. Taking the above into consideration, Sesona will apply a 'best endeavours' basis to the monitoring of PCCD/F and dioxin-like PCB mass emissions during start-up / shutdown periods. It is understood that this is in compliance with the requirements of BAT 5 and the EA's implementation plan.
6	BAT is to monitor emissions to water from Flue Gas Cleaning (FGC) and/or bottom ash treatment with at least the frequencies set out in BAT 6 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	As explained in section 1.4.4 of the Supporting Information, the Facility will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGC systems. Furthermore, there will be no IBA treatment undertaken at the Facility. Therefore, it is understood that the requirements of BAT 6 are not applicable to the Facility.
7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards.	As explained in section 2.2.3.3 of the Supporting Information, Total Organic Carbon (TOC) will be measured in the bottom ash to confirm that it is less than 3%, and/or Loss on Ignition (LOI) will be measured to confirm it is less than 5%. Measurements will be taken at least once every 3 months and will be in accordance with EN standards. Sesona considers that the proposals for monitoring of slags and bottom ashes are in accordance with the requirements of BAT 7.
8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, wastewater) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	The Facility will not incinerate hazardous waste. Therefore, the requirements of BAT 8 do not apply.

#	BAT Conclusion	How met or reference
9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f).	As described in further detail in Section 2.2 of the Supporting Information, the Facility will employ the following techniques as required by BAT 9: (a) Determination of the types of waste that can be incinerated. The Facility will incinerate waste in accordance with the list of EWC waste codes that will be listed in the EP, and waste that falls into the range of calorific values in accordance with the design of the Facility. The list of EWC codes will characterise the physical state, general characteristics and hazardous properties of the waste. (b) Implementation of waste pre-acceptance/characterisation procedures. These may include audits of suppliers. (c) Implementation of waste acceptance procedures. This will ensure that only the wastes which the Facility is permitted to receive are received at the Facility. Paperwork accompanying each delivery will be checked. Periodic inspections of the RDF will be undertaken as part of the scope where practicable, prior to transfer into the RDF deposit areas, to confirm that it complies with the specifications of any waste transfer notes (WTN). The waste acceptance procedures will be used to identify any unacceptable wastes which are not suitable for processing within the Facility and require quarantine and/or transfer off-site. Technique (d) does not apply (waste tracking), as the same waste types will be received at the Facility (pre-processed RDF) and will be stored together in the RDF deposit areas. Technique (e) does not apply, as only pre-processed RDF will be accepted at the Facility; accordingly, waste will not require separation/segregation from each other, as it should not differ significantly in its physical properties. It is understood that technique (f) of BAT 9 does not apply as the Facility will not incinerate hazardous waste. Sesona considers that the proposed arrangements complies with the requirements of BAT 9.
10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	There will be no bottom ash treatment undertaken at the Facility. Therefore, the requirements of BAT 10 do not apply.

<table>
<tr><th>#</th><th>BAT Conclusion</th><th>How met or reference</th></tr>
<tr><td>11</td><td>In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk posed by the waste, the elements as listed in BAT 11 of the BREF.</td><td>As described in section 2.2.2.1 of the Supporting Information, and explained in relation to BAT 9 above, periodic monitoring of RDF deliveries will be undertaken at the Facility. This will include the following elements in accordance with BAT 11:
Weighing of the RDF deliveries by use of a weighbridge where delivery vehicles enter/exit the Facility.
Periodic visual inspection of RDF either prior to being tipped into the RDF deposit areas, or where this is not practicable, as it is tipped into the RDF deposit areas.
Periodic sampling of RDF deliveries and analysis of key properties, such as calorific value and metal content.
Sampling will be undertaken when accepting a new RDF stream at the Facility (e.g. from a new RDF supplier), or to determine the NCV of RDF sources accepted should the plant be operating outside the permitted range shown on the firing diagram.
It is expected that RDF sampling and characterisation would be carried out in accordance with BS EN 14899:2005 ‘Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan’, and will be consistent with any additional requirements imposed by the EP.
It is expected that the RDF delivery load to be sampled would be tipped onto the tipping hall floor. Sampling will typically be undertaken based on a nominal vehicle load (expected to be around 20 tonnes). Averaging over a larger quantity will not be permitted, as this would not be representative of the load delivered to the site.
A number of separate increments would be taken randomly from the RDF delivery load. These would then be combined into a pile. Two representative samples of equal weight would then be taken from the combined pile. One sample would be sent on for laboratory analysis, whilst the other would be kept as a reserve sample.
The Facility will not undertake radioactivity detection tests as it is not anticipated that any radioactive waste will be received.
Sesona considers that the proposed arrangements for monitoring the RDF deliveries as part of the waste acceptance procedures complies with the requirements of BAT 11.</td></tr>
</table>

#	BAT Conclusion	How met or reference
12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the following techniques: Use impermeable surfaces with an adequate drainage infrastructure; and Have adequate waste storage capacity.	The surfaces of the RDF reception, handling and storage areas have been designed and will be constructed as impermeable structures. Adequate drainage infrastructure will be fitted to areas where receipt, handling and storage of RDF takes place – these areas will have appropriate falls to the process water drainage system. The integrity of areas of hardstanding will be periodically verified by visual inspection. Regular maintenance of the drainage systems will be undertaken in accordance with documented management procedures to be developed for the Facility. Adequate RDF storage capacity will be available on site – the maximum RDF storage capacity of the RDF deposit areas will be established and not exceeded. The quantity of RDF will be visually monitored against the maximum storage capacity. During periods of planned maintenance, quantities of RDF within the RDF deposit areas will be run down where possible. Sesona considers that the proposed arrangements for environmental risks associated with the reception, handling and storage of RDF comply with the requirements of BAT 11.
13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques as listed in BAT 13 of the BREF.	The Facility will not process clinical or hazardous waste. Therefore, Sesona considers that the requirements of BAT 13 are not applicable to the Facility.
14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below:	The Facility will receive pre-processed (i.e. pre-blended and mixed) RDF, which will improve the homogeneity of the fuel feed to the furnaces. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in Section 2.5.2 of the Supporting Information, the system will control and/or monitor the main features of the plant operation, to optimise the incineration process. Water, electricity and auxiliary fuel usage will also be monitored to highlight any abnormal usage. Sesona considers that the proposed arrangements for ensuring the overall environmental performance of the incineration plant, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of RDF comply with the requirements of BAT 14.

#	BAT Conclusion	How met or reference
15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste.	An advanced control system will be in place to monitor the conditions within the furnaces, to ensure that optimal conditions are maintained and that the proposed emission limits are not exceeded. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system: for example, urea dosing will be optimised and adjusted to minimise the ammonia slip. Sodium bicarbonate/PAC usage will be optimised by adjusting reagent dosing depending on the results of upstream acid gas monitoring. Sesona considers that the proposed control systems will ensure that the Facility is designed to allow for the adjustment of the plant's settings to comply with the requirements of BAT 15.
16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	The Facility will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable (it is expected that each line would be shut down for maintenance in succession – i.e., it would be very unlikely for both lines to be shut down at once). RDF will be kept at suitable levels in the RDF deposit areas to maintain operation during periods when RDF is not delivered. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations. Sesona considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations to comply with the requirements of BAT 16.
17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the wastewater treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability.	The FGC system will be appropriately designed and operated within the design range. The FGC system will be subject to regular maintenance through the implementation of documented management procedures. There will be no process water treatment plant at the Facility. Sesona considers that the design and operation of the FGC system will ensure that emissions to air are reduced, and will ensure optimal availability, to comply with the requirements of BAT 17.
18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management	The EA's BREF implementation document sets out a definition of OTNOC, and lists general requirements for OTNOC management plans. It is acknowledged in the implementation document that further work is required by the EA in relation to the production of guidelines for plant start-up and shut-downs, update of abnormal operation guidance, and clarification of the EAs position on

#	BAT Conclusion	How met or reference
	plan as part of the EMS that includes the elements as identified in BAT 18 of the BREF.	emergency/uncontrolled shutdowns and temporary shutdowns. At the time of writing, the status of these actions is uncertain. Upon finalisation of the EA's position and completion of the actions above, Sesona would propose to develop an OTNOC based management plan which is in line with the EA's requirements and the elements outlined within the BREF. It is expected that this would be achieved by either a pre-operational or improvement condition in the EP. This is a similar approach that the EA has applied on recent applications. Sesona considers that the incorporation of a risk-based OTNOC management plan will ensure the Facility's compliance with BAT 18.
19	In order to increase resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	The Facility will use heat recovery boilers to produce electricity. The Facility will also have the provision to export heat to local users. Sesona considers that the use of heat recovery boilers is in direct compliance with the requirements of BAT 19.
20	In order to increase energy efficiency of the incineration plant, BAT is to use an appropriate combination of techniques as listed in BAT 20 of the BREF.	The Facility will use the following techniques to increase energy efficiency from its operation: (b) Reduction of the flue gas flow – primary and secondary air distribution will be optimised, and flue gas recirculation will be employed; (c) Minimise heat losses via the use of integral furnace boilers – heat will be recovered from the flue gases by means of boilers integral with the furnaces; (d) Optimisation of the boiler design to improve heat transfer – the boilers will be equipped with economisers to optimise thermal cycle efficiency; (g) Cogeneration of heat and electricity – the Facility has been designed as a combined heat and power plant and will have the capacity to provide heat to local users. Subject to commercial agreements with heat users, a scheme for the export of heat will be implemented. Technique (a) is not applicable as the Facility will not accept sewage sludge, and technique (f) is not applicable as the Facility is not a steam cycle design. Technique (h) is not applicable as the Facility will not export heat from the offset (refer to Appendix G).

#	BAT Conclusion	How met or reference
		Sesona considers that the techniques listed above will increase the energy efficiency of the plant and ensure that the Facility will comply with the requirements of BAT 20. Notwithstanding this, a review of techniques (e) (low temperature flue gas heat exchangers) and (i) (dry bottom gas handling) within BAT 20 has been undertaken and is presented below. Technique (e) Technique (e) is to use low-temperature flue gas heat exchangers to recover additional energy from the flue gas at the boiler exit, after an ESP or after a dry sorbent injection system. The recovered heat could then be used for heat export purposes and/or internal heating. It is acknowledged that the use of this technique must be applicable within the constraints of the operating temperature profile of the flue gas treatment (FGT) system. The FGT system has been designed to work at high temperatures, with the efficiency of the acid gas abatement system using sodium bicarbonate increasing at higher temperatures. Using flue-gas heat exchangers at the boiler exit will result in lower temperature flue gases entering the FGT system, reducing the overall efficiency of the system. Additionally, lower flue gas temperatures at the stack exit, resulting from the use of additional heat exchangers, would affect plume buoyancy and the dispersion of emissions, resulting in a more visible condensed plumes and potentially result in stack corrosion. Another alternative would be to use a post-abatement heat exchanger (i.e. once the flue gas has undergone treatment); however, this would also introduce low temperatures at the stack exit, resulting in the same problems outlined above. Furthermore, the use of post abatement heat exchangers is only relevant if the extracted heat can be put to use. The heat plan submitted with the application has identified that, at this stage, the Facility will be constructed as 'CHP-ready', and will not export heat from the offset. Furthermore, the installation of a post abatement heat exchanger would also introduce a high associated capital cost. Taking the above into consideration, the use of a low-temperature heat exchanger is not considered to represent BAT due to the potential to increase capital costs, potential to affect the efficiency and operation of the FGT system, potential to affect dispersion and introduce a visible plume, and taking into account the fact that the Facility is not expected to export heat from the offset. Technique (i)

#	BAT Conclusion	How met or reference
		Technique (i) relates to dry handling of bottom ash using ambient air for cooling, with useful energy subsequently recovered by using the cooling air for combustion. It is acknowledged that this technique is applicable to grate furnaces, such as proposed for the Facility, and can improve energy efficiency and reduce water consumption. However, dry bottom ash handling can introduce a risk of fugitive dust emissions compared to a wet bottom ash handling system which is proposed for the Facility. Overall water use at the Facility will be minimised by the re-use of process effluent (including any leachate or effluent from bottom ash treatment) within the process; thereby minimizing the amount of 'raw' water required. Furthermore, in a dry bottom ash handling system, the bottom ash discharger may be required to be flooded with water occasionally to prevent fire hazards. The additional abatement required for fugitive dust emissions arising as a result of dry bottom ash handling also has the potential to increase the capital costs associated with bottom ash handling. Taking the above into consideration, the use of a dry bottom ash system is not considered to represent BAT for the Facility.
21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to use the methods as stated in BAT 21 of the BREF.	In accordance with the BREF, the Facility will employ the following measures to reduce odour emissions: • RDF in the Facility will be stored in an enclosed building, in RDF deposit areas held under negative pressure. The extracted air will be used as combustion air for incineration. • The operation of the Facility will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to the Facility. • Odour will be controlled during shutdown periods by minimising the amount of RDF in storage. RDF will be run-down prior to periods of planned maintenance. In addition, doors to the tipping hall will be kept shut during periods of shutdown. The measures listed above to reduce odour emissions will ensure that the Facility will comply with the requirements of BAT 21.
22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile	Gaseous wastes and liquid wastes will not be accepted at the Facility. Therefore, the requirements of BAT 22 do not apply to the Facility.

#	BAT Conclusion	How met or reference
	substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	
23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the EMS the following diffuse dust emission management features:	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 23 do not apply.
24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as given in BAT 24 of the BREF.	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 24 do not apply.
25	In order to reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 25 of the BREF.	The following techniques will be utilised at the Facility to reduce channelled emissions to air: (f) Ceramic filters – to reduce particulate content of the flue gas. (g) Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of sodium bicarbonate to abate acid gases. The concentrations of metals and metalloids will be monitored in accordance with the EP for the Facility. It is considered by Sesona that the techniques listed above to reduce channelled emissions to air will ensure that the Facility will comply with the requirements of BAT 25.
26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air, BAT is to treat the extracted air with a bag filter.	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 26 do not apply.
27	In order to reduce channelled emissions of HCl, HF and SO2 to air from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 27 of the BREF.	BAT 27 of the BREF states that BAT is to use one or a combination of the following techniques: (h) Wet scrubber; (i) Semi-wet absorber; (j) Dry sorbent injection; (k) Direct desulphurisation (only applicable to fluidised beds); and (l) Boiler sorbent injection.

#	BAT Conclusion	How met or reference
		In a dry sorbent injection system, the reagent is injected into the flue gas stream within the flue gas treatment system, located after the boilers. In direct boiler sorbent injection, the reagent is injected directly into the flue gas stream within the boilers. This only achieves partial abatement of the acid gases and does not eliminate the need for additional flue gas cleaning stages. It is acknowledged that using a combination of both boiler sorbent injection and the additional acid gas abatement system would provide a higher level of abatement than either system alone; however, the operating and maintenance costs and also reagent consumption would be higher. Due to the additional costs and reagent consumption associated with the use of direct boiler injection, this is not considered to represent BAT for the Facility. As stated in section 2.6.3, it is considered BAT for the Facility to utilise a dry sorbent injection system to abate acid gases. The dry system will be designed to ensure that the Facility will operate in accordance with the relevant ELVs, assumed to be the BAT-AELs, without the requirement for any additional abatement measures. Reagent dosing rate will be easily controlled within the flue gas treatment system to ensure optimisation, depending on upstream acid gas measurements. It is considered by Sesona that the use of dry sorbent injection to reduce channelled emissions to air of acid gases is in compliance with the requirements of BAT 27.
28	In order to reduce channelled peak emissions of HCl, HF and SO2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use optimised and automated reagent dosage, or both the previous technique and the recirculation of reagents.	In accordance with the BREF, the following techniques will be employed at the Facility to reduce peak emissions of HCl, HF and SO_2 whilst limiting reagent consumption and residue generation from dry sorbent injection: (a) Optimised reagent dosage – the reagent dosing rate will be easily controlled within the flue gas treatment system, depending on upstream acid gas measurements. The technique listed above to reduce channelled peak emissions to air of acid gases will ensure that the Facility will comply with the requirements of BAT 28.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	The following elements have been incorporated into the design of the Facility: (a) Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14); (b) Flue gas recirculation; (c) An SNCR system;

#	BAT Conclusion	How met or reference
		(d) Catalytic filters – ceramic filters impregnated with a catalyst; and (e) Optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip). The design elements listed above to reduce channelled NOx emissions to air (whilst limiting emissions of CO, N_2O and NH_3) will ensure that the Facility will comply with the requirements of BAT 29. Therefore, the Facility will comply with the requirements of BAT 29.
30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below to reduce channelled emissions to air of organic compounds: a) Optimisation of the incineration process; b) Control of the waste feed; c) On-line and off-line boiler cleaning; d) Rapid flue-gas cooling; e) Dry sorbent injection; f) Fixed-or-moving bed adsorption; g) SCR; h) Catalytic filter bags; and i) Carbon sorbent in a wet scrubber.	The Facility will employ the following techniques to reduce channelled emission to air of organic compounds: (a) Optimisation of the incineration process – the boilers will be designed to minimise the formation of dioxins and furans. (b) Control of the waste feed – pre processed RDF will be accepted at the Facility which will ensure optimal and, as far as possible, homogeneous and stable incineration conditions. (c) On and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boilers, thus reducing PCDD/F formation in the boilers. (e) Dry sorbent injection using activated carbon. (h) Catalytic ceramic filters. The concentrations of dioxins and furans released from the Facility will comply with BREF limits. As described above, it can be confirmed that the Facility will use a combination of techniques to reduce channelled emissions to air of organic compounds. Therefore, the Facility will meet the requirements of BAT 30.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility. It is considered by Sesona that the use of this technique will ensure that the Facility will comply with the requirements of BAT 31.
32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase	There will be separate foul/domestic water, process water and surface water drainage systems at the site. Further information on the drainage arrangements is presented within section 1.4.6. It is

#	BAT Conclusion	How met or reference
	resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	considered by Sesona that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility will comply with the requirements of BAT 32.
33	In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce water usage and prevent wastewater generation: (a) Waste water free FGC techniques – by utilising dry sorbent injection of sodium bicarbonate and PAC. (c) Water reuse/recycling – Where practicable process effluents will be re-used within the process. It is considered by Sesona that the techniques listed above to reduce water usage and prevent/reduce the generation of wastewater will ensure that the Facility will comply with the requirements of BAT 33.
34	In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 34 of the BREF, and to use secondary techniques as close as possible to the source in order to avoid dilution.	There will be no emission to water from FGC. However, it can be confirmed that, in accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above. The risk of emissions to water from the storage of bottom ash at the site will be minimised. Any overflow from the ash quench will be contained and reused within the process and hence there will not be any release of effluent from the ash quench system. Furthermore, drainage at the IBA facility will be contained with links to the process drainage system, resulting in negligible risk of emissions to water from IBA storage. Taking the above into consideration, secondary techniques are not considered to be necessary, as there will be negligible risk of any emissions to water from FGC or bottom ash handling. Therefore, it is considered by Sesona that the requirements of BAT 34 are not applicable.
35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	It can be confirmed that bottom ash and APCr will be handled and disposed of separately at the site. Therefore, Sesona considers that the Facility will comply with the requirements of BAT 35.
36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 36 do not apply.

#	BAT Conclusion	How met or reference
	BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	
37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques as listed in BAT 37 of the BREF.	In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the site to prevent or reduce noise emissions: (d) Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. (e) Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. RDF deliveries will take place primarily during daytime hours. (f) Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level. (g) Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. (h) Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. Refer to the Noise Assessment presented in Appendix C for further details on noise mitigation measures proposed for the site. It is considered by Sesona that the techniques listed above to reduce noise emissions will ensure that the site will comply with the requirements of BAT 37.

2.8 Energy efficiency

2.8.1 General

The Facility will utilise thermal oil boilers which will generate oil vapour used to supply an ORC turbine to generate electricity. The Facility will generate power for export to the local electricity distribution network via a transformer which increases the voltage to the appropriate level.

The Facility also has the potential to export heat off-site to local users.

In case of failure of the electricity supply, an emergency diesel generator will be provided to safely shut down the Facility and to provide an emergency supply to the rest of the Facility

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

2.8.2 Basic energy requirements

An indicative Sankey Diagram for the plant for the 'No heat export' case is presented in Figure 4.

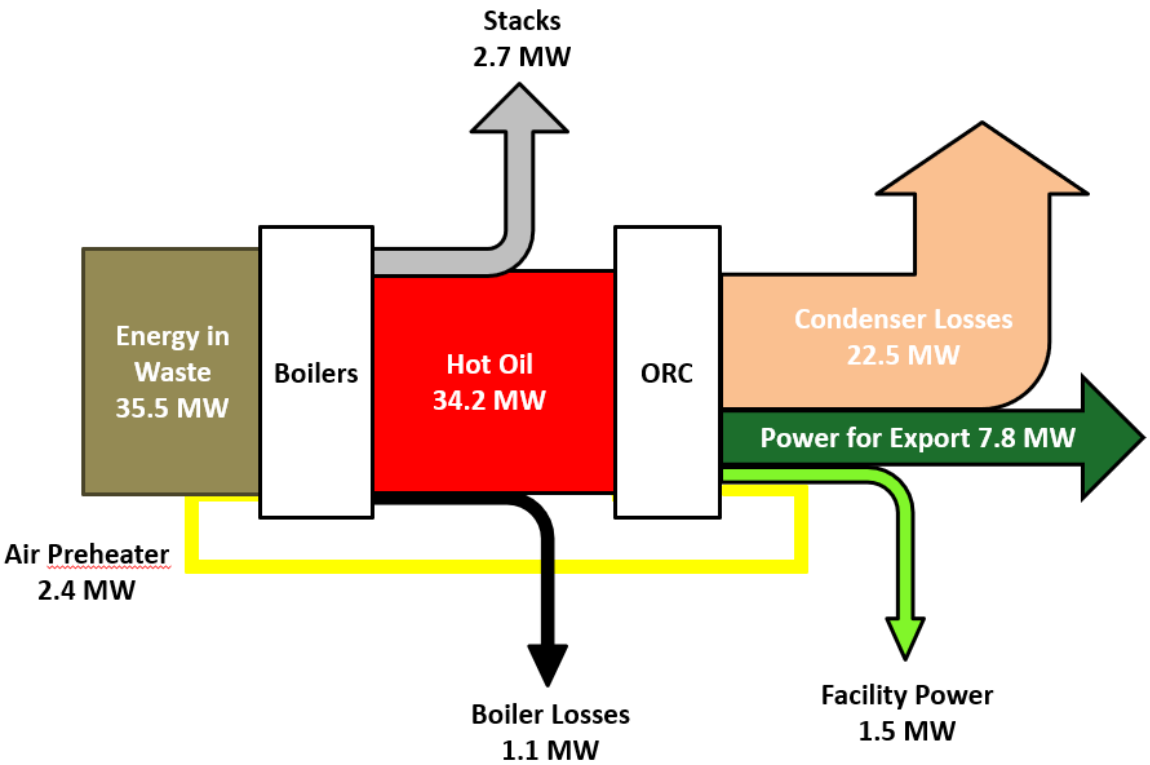


Figure 4 - Indicative Sankey Diagram - No heat export case

As described within the CHP assessment (Appendix G), the Facility will have the capacity to export up to approximately 20 MWth of heat. The CHP assessment has identified that there are opportunities to export an annual average load of approximately 3.65 MWth and a peak load of 7.69 MWth, subject to commercial and economic viability. The export of heat would reduce the electrical output of the Facility but increase the overall thermal efficiency.

The combined thermal capacity of the Facility is approximately 35.5 MWth. Assuming electricity-only mode, the Facility will generate approximately 9.284 MWe of electricity. The Facility will have a parasitic load of approximately 1.5 MWe. Therefore, the export capacity of the Facility is approximately 7.784 MWe. Taking this into consideration, the gross electrical efficiency of the Facility will be approximately 26.1%.

As stated previously, the Facility will process approximately 100,000 tpa of waste, assuming an NCV of 10.11 MJ/kg and an availability of 7,900 hours per annum. This equates to an approximate hourly throughput of 12.7 tph for both lines. Assuming this availability, the Facility will annually generate approximately 73,300 MWh and export approximately 61,500 MWh of electricity.

As presented in Table 13, the design figures are compared with the benchmark data for MSW incineration plants, given in the Environment Agency Sector Guidance Note EPR5.01 and in the BREF for Waste Incineration (WI BREF). As can be seen, the design of the Facility is in accordance with the benchmark values provided in the BREF and EPR5.01.

Table 13: Facility design parameters comparison table

Parameter	Unit	The Facility	Benchmark	Source
Net power generation, design capacity (100,000 tpa, 7,900 hours)	MWh/t RDF	0.69	0.6 – 0.9	BREF
Internal power consumption, design capacity (100,000 tpa, 7,900 hours)	MWh/t RDF	0.13	0.06 – 0.19	BREF
Power generation (assumed gross) for 100,000 tpa of RDF	MWe	9.284	5 – 9	EPR5.01

Appendix 1 of the UK regulators WI BATC Interpretation Document sets out the EA BAT position on energy efficiency at incinerators. The document states that plants will need to meet the following minimum gross electrical efficiencies, depending on their throughput:

- Plants 200 kt/year or greater: 30%
- Plants below 200 kt/year: 25%

The Facility will have a capacity of up to 120,000 tpa of waste and will have a gross electrical efficiency of approximately 26.1%.

2.8.2.1 Energy consumption and thermal efficiency

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

- primary and secondary combustion air fans;
- Induced Draft fans;
- ACC fans;
- oil circulation pumps;
- RDF loading systems; and
- residue conveying systems.

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

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

- secondary combustion air will be preheated using exhaust fumes;
- primary and secondary air distribution will be optimised;
- heat will be recovered from the flue gases by means of boilers integral with the furnaces;
- the boilers will be arranged to minimise flue gas exit temperature to optimise thermal cycle efficiency; and
- boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

Due consideration will be given to the recommendations given in the relevant Sector Guidance Notes.

2.8.2.2 Operating and maintenance procedures

An O&M manual will be developed for the Facility (refer to section 3.1.3). 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.

2.8.2.3 Energy efficiency measures

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

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

2.8.3 Further energy efficiency requirements

In accordance with Article 44 of the Industrial Emissions Directive, heat generated during incineration should be recovered as far as practicable, through the generation of heat, steam or power. In order to demonstrate this, the following points should be noted:

1. The boilers will be equipped with economisers to optimise thermal cycle efficiency.
2. The Facility generate electricity and will have the potential to export heat to local users – refer to the CHP assessment presented within Appendix G.

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

2.9 Residue recovery and disposal

The main residue streams which will arise from the operation of the Facility are:

1. Incinerator Bottom Ash; and
2. APCr.

As described in sections 2.9.1 and 2.9.2, the proposed waste recovery and disposal techniques for the residues generated by the Facility, will be in accordance with the indicative BAT requirements.

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

Waste Acceptance Criteria (WAC) testing – leachability tested – will be undertaken of any residues which are to be transferred to landfill from the Facility to ensure that they meet the relevant WAC for the landfill that they are to be transferred to.

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

2.9.1 Incinerator Bottom Ash

Incinerator Bottom Ash (IBA) is the inert burnt-out residue from the combustion process, which comes off the end of the grate. IBA is normally a non-hazardous waste which can be recycled for use as secondary aggregate. IBA has been used for at least 20 years in Europe as a substitute for valuable primary aggregate materials in the construction of roads and embankments. Sesona intend to transfer IBA from the Facility to an off-site IBA processing facility.

The bottom ash will be quenched when it falls from the end of the grate. The purpose of the ash quench is to cool and moisten the bottom ash to limit particulate emissions (dust generation), reduce fire risk or damage to the conveying equipment.

The initial handling and quenching of the IBA at the Facility will be undertaken in an enclosed building. In addition, any overflow from the ash quench will be contained in the process effluent drainage system, reused and hence will not be released off-site. Therefore, there is little to no risk of contaminated runoff from IBA handling entering nearby watercourses and/or polluting the ground.

Following quenching, the ash would be fed onto a chain and flight conveyor for transfer to and storage in RoRo skips, prior to transfer off-site for processing.

2.9.2 Air Pollution Control residues

Air Pollution Control residues (APCr) comprises fine particles of ash and residue from the flue gas treatment process. The APCr will be transferred via enclosed conveyor to contained Ro-Ro skips adjacent to the flue gas treatment process. The Ro-Ro skips will be fully enclosed to prevent fugitive emissions of APCr.

APCr is classified as hazardous (due to its elevated pH) and requires specialist landfill disposal or treatment. Sesona will examine options for the treatment or re-use of APCr at a specialist facility off-site. Alternatively, if a suitable option for the recovery of APCr cannot be identified, then it would be sent to a suitably licensed hazardous waste storage facility or landfill for disposal as a hazardous waste. The reuse of APCr is an evolving market and Sesona will continue to explore alternative options for the treatment of APCr throughout the lifetime of the Facility.

2.9.3 Summary

The expected quantities and properties of the main residue streams generated from the operation of the Facility are summarised in Table 13 below.

Table 14: Key residue streams from the Facility

Source/ Material	Properties of Residue	Storage location/ expected storage capacity	Estimated quantity of residue generated (tpa)	Disposal Route and Transport Method
IBA	Grate ash. This ash is relatively inert, classified as non-hazardous.	2 x 40 yd skips	Approximately 20% of annual waste throughput, or 24,000 tpa*	To be transferred off-site for processing and recycling into secondary aggregate.
APCr	Ash from flue gas treatment, may contain some unreacted sodium bicarbonate.	2 x 40 yd Ro-Ro skips	Approximately 5% of annual waste throughput, or 6,000 tpa*	To be transferred off-site for reprocessing or disposal in a licensed site for hazardous waste.
*Conservatively assuming operation at maximum capacity of 120,000 tpa of RDF.				

3 Additional information

3.1 Management

3.1.1 Introduction

Sesona will demonstrate environmental and social responsibility by operating the site to high environmental, health and safety and professional standards. The site will be designed and constructed following the latest international and national regulations, standards and guidance. In the case of the Facility, this will incorporate risk management techniques such as HAZOP studies prior to construction and thorough commissioning and testing before full plant operation.

In accordance with EA requirements for installations, and as part of its ongoing commitment to sustainable and responsible development and to regulatory compliance, Sesona will develop and implement a documented EMS at the site. Measures will be undertaken to ensure that this is communicated, understood and effectively maintained throughout the organisation.

The site-specific EMS will be developed following detailed design and will contain a set of procedures describing how pollution risk will be minimised from the activities to be undertaken at the site. Sesona will certify the EMS to an internal standard. The EMS will form part of the site's integrated management system that establishes an organisational structure, responsibilities, practices, procedures and resources for achieving, reviewing and maintaining the company's commitment to environmental protection. The EMS will serve as an assurance to the local authority, regulator, neighbours, and others alike that operations are undertaken in strict compliance with the regulations in force and with the management seeking continual improvements. It requires the company to work in a transparent way, to maintain and improve the confidence of regulators and neighbours, and to have a proactive approach to environmental improvement.

Section 3.1.2 below provides a general summary of the proposed site EMS in accordance with Environment Agency (EA) guidance '*Develop a management system: environmental permits*'.

In addition to the EMS, an operating and maintenance (O&M) manual(s) will be developed for the site. The O&M manual(s) will contain the key information required for the operation, maintenance and eventual decommissioning of the site over its lifetime. A summary of the key aspects to be included in the O&M manual is presented within section 3.1.3.

3.1.2 Summary of EMS and management systems

The EMS will clearly define the management structure as well as setting out roles and responsibilities of all staff. The EMS will also include an Environmental Policy, and a number of procedures including those relating to environmental risk and compliance, and operation in both standard and emergency/abnormal scenarios. In addition, management will undertake inspections and reviews for quality control, performance measurements, and staff appraisals.

3.1.2.1 Scope and structure

The scope of the EMS for the site will cover the operations undertaken at the Facility, from pre-acceptance checks for incoming RDF, to disposal of residues produced by the Facility.

Where applicable, documented procedures will detail specifically how each activity will be controlled. These will be contained in an Environmental Procedures Manual or similar and identified related documents.

The EMS will also contain procedures for accident management that comply with the EA's requirements (these are set out in EPR5.01 and the WI BREF). This will be in the form of an accident management plan or similar that will be developed for the site.

3.1.2.2 General requirements

The scope of the EMS will include, but not be limited to, the following:

(a) an environmental policy;
(b) identification of potential environmental impacts;
(c) documented procedures to control operations that may have an adverse impact on the environment;
(d) ensuring adequate responsibility, authority and resources to management necessary to support the EMS;
(e) defined procedures for identifying, reviewing and prioritising items of plant and equipment for which preventative maintenance regimes are appropriate;
(f) establishing preventative maintenance programmes (and associated auditing) to cover all plant and equipment whose failure could lead to environmental impacts (including infrastructure such as pipework, drainage, bunds etc);
(g) documented procedures for monitoring relevant emissions or environmental impacts;
(h) establishing performance indicators to measure the effectiveness of the procedures;
(i) monitoring, measuring and analysing the procedures for effectiveness; and
(j) implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

3.1.2.3 Site operations

The Facility will operate as a CHP plant, with the main activity to be undertaken being the incineration of RDF to recover energy. Up to 120,000 tonnes of RDF will be processed each year.

All permitted activities will take place within the Installation Boundary. The activities to be undertaken at the site are listed in section 1.3.

Steps to be taken to prevent or minimise risks to the environment from each activity/process – these are described within the Environmental Risk Assessment (presented in Appendix D). The environmental risks will be expanded on and incorporated into the final EMS document upon completion of detailed design.

3.1.2.4 Site plan(s)

Following completion of detailed design, the EMS will include for detailed plan(s) of the site which highlight where permitted activities are undertaken. The plan(s) will also show the location of the following, in accordance with EA guidance '*Develop a management system: environmental permits*':

(a) buildings and any other main constructions such as security fences;
(b) storage facilities for hazardous materials (oil or fuel tanks), chemical stores, waste materials;
(c) the location of items for use in accidents and emergencies, such as spill kits;

(d) entrances and exits for use by emergency services;

(e) any points designed to control pollution (e.g., containment facilities or penstock valves);

(f) effluent or water discharge points;

(g) areas vulnerable to pollution such as watercourses, adjacent industrial premises etc;

(h) drainage facilities; and

(i) utilities supplies (water, gas, electric) including stop taps, isolating valves, routes etc.

Preliminary site plans (including emissions points and installation boundary drawings) are presented within Appendix A. A number of drawings have also been produced in support of the Fire Prevention Plan – refer to Appendix H – which include waste/materials storage areas, access points etc.

3.1.2.5 Storage of RDF and other residues/wastes

Upon completion of detailed design of the site, an RDF/wastes/residues storage plan will be incorporated into the EMS, in accordance with the requirements of EA guidance '*Develop a management system: environmental permits*'. A preliminary drawing is provided in support of the Fire Prevention Plan – refer to Appendix H – which shows RDF storage areas. General information in relation to RDF storage at the site is set out as follows:

(a) RDF will be stored within the main building, in 2 walking floor RDF deposit areas, or on the floor adjacent to the RDF deposit areas, or potentially in stockpile bays. The bays and RDF deposit areas will have approximately 4 days storage. However, allowing for extended periods of shutdown, the maximum amount of time that RDF will be stored in the RDF deposit areas is approximately 4 weeks. The capacity of the RDF deposit areas will be approximately 250 tonnes per RDF deposit area. The capacity of the bays will be up to $450m^3$ per bay.

(b) Comprehensive waste acceptance procedures will identify RDF to be stored and processed at the site. Paperwork accompanying RDF deliveries to the site will identify RDF by its correct EWC code.

(c) APCr will be stored in 2 x 40 yd skips.

(d) IBA would be stored in 2 x 40 yd skips.

3.1.2.6 Site and equipment maintenance plan

Upon completion of detailed design of the site, a site equipment and maintenance plan will be incorporated into the EMS, in accordance with the requirements of EA guidance '*Develop a management system: environmental permits*'. Preliminary information in relation to this plan is set out as follows:

(a) Plant and machinery (including any mobile plant) will be maintained in accordance with the manufacturers or supplier's recommendations. A preventative maintenance regime will be in place at the site.

(b) Records will be kept of any maintenance carried out on plant and machinery.

3.1.2.7 Personnel

Sesona will ensure that sufficient numbers of staff, in various grades, are provided to manage, operate and maintain the site on a continuous basis, seven days per week throughout the year.

It is anticipated that the key environmental management responsibilities will be allocated as described below. The exact job roles and titles will be confirmed/allocated prior to the commencement of operations.

(a) A 'Plant' or 'General' Manager will have overall responsibility for management of the Facility and compliance with the EP. They will have extensive experience relevant to their responsibilities.
(b) An 'Operations' Manager(s) will have day-to-day responsibility for the operation of the Facility, to ensure that the Facility is operated in accordance with the EP and that the environmental impact of operations is minimised. In this context, they will be responsible for designing and implementing operating procedures which incorporate environmental aspects.
(c) An 'Engineering' or 'Maintenance' Manager will be responsible for the management of maintenance activities, for maintenance planning and for ensuring that the Facility continues to operate in accordance with its design.
(d) An Environment, Health and Safety (EHS) manager will be responsible for environmental and health and safety at the site, including compliance with the EP.

The majority of employees would be skilled operatives or technical engineers. Roles could include security officers, engineers, technicians, administrators, shift leaders, site operatives etc.

3.1.2.8 Competence, training and awareness

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

Systems to assess competence and provide training for relevant staff will be provided. These may cover, but not be limited to, the following:

(a) awareness and importance of regulatory implications of the EP for the activities and operations undertaken at the site;
(b) awareness of potential environmental effects from operation under normal and abnormal circumstances (e.g., periods of shutdown);
(c) awareness of the need to report any significant deviations from the EP;
(d) prevention of accidental emissions and action to be taken when accidental emissions occur; and
(e) roles and responsibilities in achieving conformity with the requirements of the EMS.

Skills, competencies and training requirements for staff will be documented and recorded as part of the internal management systems at the site. Sesona will comply with 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.

Competence

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

Induction and awareness

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

(a) the Environmental Policy;
(b) the requirements of the EP;
(c) Health and Safety Policy and Procedures; and
(d) EMS Awareness Training.

Staff will have access to the EMS via internal computer systems and will be required to understand any sections of the EMS relevant to the activities they carry out.

Training

Sesona will be required to train staff during the commissioning of the site and prior to the site becoming operational. Line Managers will be required to 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. As stated above, records of training will be documented and recorded, with industry standards or codes of practice for training complied with where relevant. Training records will be maintained onsite. The operation of the site will comply with industry standards or codes of practice for training where they exist.

For any contractors working on-site, potential environmental risks will be identified where relevant and instructions provided to the contractors.

3.1.2.9 Accident management

As indicated within section 3.1.2.1, the scope of the EMS will include for an 'accident prevention and management plan' or similar in accordance with the requirements of EA guidance '*Develop a management system: environmental permits*', which will identify the likelihood and consequences of any accidents and identify actions or measures to prevent accidents and mitigate any consequences (such as environmental pollution). The accident plan will include for written procedures and forms for recording, handling, investigating, communicating and reporting actual or potential non-compliance (e.g. complaints) with operating procedures/emission limits. Any incidents will be investigated thoroughly and documented, with the regulatory authorities informed if the incident is significant. Near misses will be reported and suitable corrective action/mitigation measures implemented and followed up.

For each potential accident or incident, the following will be identified:

(a) the likelihood of the accident happening;
(b) the consequences of the accident happening;
(c) proposed measures to be taken to avoid the accident happening; and
(d) proposed measures to be taken to minimise the impact if the accident does happen.

A list of substances stored at the site, and storage facilities, will also be incorporated into the accident management plan (either linked to part of the wider EMS or listed specifically within the accident management plan itself).

The accident plan will be regularly reviewed, no less than once per year, with records kept of the dates that reviews have occurred and planned future review dates. Furthermore, a list of emergency contacts will be included within the accident plan (such as the local fire service, EA etc.)

3.1.2.10 Climate change and flood risk

The potential impacts of climate change (including flood risk) have been and will continue to be considered in the context of the design and operation of the site. The proposed accident management and contingency plans presented within the sections above will include for relevant climate change impacts.

A climate change risk assessment is presented with the Application Forms submitted with the EP application. The risk assessment will be incorporated into the scope of the EMS for the site and will continue to be monitored and updated regularly throughout the lifetime of the site.

3.1.2.11 Keeping records

Any records required by the EP will be kept in accordance with the relevant timescales indicated within the EP. Should the EP not identify timescales for certain records, these will be defined within the EMS. Records will be kept as part of the EMS for the site.

The records that will be kept will include, but not be limited to, the following:

(a) the EP for the site;
(b) other legal requirements for the site;
(c) environmental risk assessments;
(d) environmental management plans;
(e) EMS plans;
(f) operating procedures;
(g) staff competence and training (such as qualifications, courses attended);
(h) emissions and any monitoring undertaken as required by the EP;
(i) compliance checks, findings of investigation and actions taken;
(j) complaints made, findings of investigation and actions taken;
(k) audits of management system, findings (reports) and actions taken;
(l) management reviews and changes made to the management system;
(m) where applicable, certification audit reports and any actions carried out;
(n) records of pre-acceptance and acceptance checks on RDF delivered to the site (including quantity, EWC codes, origin, producer, date of arrival, any unacceptable wastes);
(o) records to show that the duty of care requirements are being met.

Copies of any approved plans (such as the fire prevention plan) will be kept with the EMS and records will be maintained of any updates to these plans. Furthermore, the Site Condition Report will be kept with the EMS and records will be maintained of any updates to the Site Condition Report.

Electronic copies of the EMS and supporting documents (including records) will be accessible to staff via internal computer systems.

3.1.2.12 Review of management systems

The EMS will be reviewed and updated regularly in response to changing internal and external factors, with records kept on any checks carried out and updates made. Updates may be made, for example, when changes are made to operations and activities carried out at the site, if new equipment is installed, if the EP is varied, following any accidents or complaints, or if a new environmental risk is identified. As a minimum, the EMS will be reviewed once per year.

3.1.2.13 Contingency

A contingency plan will be developed as part of the EMS following completion of detailed design. This will incorporate measures and procedures for the following scenarios in order to minimise environmental risk:

(a) breakdown scenarios;
(b) enforced shutdowns;
(c) planned shutdowns;
(d) any other abnormal operation (e.g. due to flooding or extreme weather).

The EA will be provided with a copy of the EMS (or relevant parts thereof) for the site if requested.

3.1.2.14 Contact information for the public

A notice board will be displaced at (or near) the entrance for the Facility which tells the public key information about the site. This will include, but not be limited to, the following:

(a) the EP holder's name;
(b) an emergency contact name and telephone number;
(c) a statement that the site is permitted by the Environment Agency;
(d) the EP number;
(e) the Environment Agency telephone number 03708 506506 and the incident hotline 0800 807060.

3.1.2.15 Complaints

A complaints procedure will be in place and will form part of the EMS to record any complaints received in relation to activities covered by the EP. The procedure will include details on how complaints will be investigated, and any actions to be taken following complaints.

3.1.3 Operating and maintenance procedures

In addition to the EMS described above, an operating and maintenance (O&M) manual(s) or similar will be developed for the site. The O&M procedures will include, but not be limited to the following aspects:

(a) comprehensive description of each component at the site including operating hours and design details;
(b) as-built drawings of the site;
(c) maintenance and service plans;
(d) staffing and staff responsibilities;
(e) waste acceptance and pre-acceptance procedures;
(f) waste storage and handling procedures;
(g) copies of any guaranties/warranties/certificates; and
(h) health and safety procedures.

3.2 Closure

3.2.1 Introduction

The site is designed for an operational life of approximately 25 years. However, the operational lifetime of these type of facilities can be (and often is) extended. The actual operational lifetime is dependent on a number of factors including:

(a) the level of planned and lifecycle maintenance;

(b) the continued supply of RDF; and

(c) the development of alternative methods competing for the same RDF fuels.

When the site has reached the end of its operational life, it could be adapted for an alternative use or demolished as part of a redevelopment scheme and cleared and left in a fit-for-use condition. It is possible that each component of the site may have different lifetimes respectively.

3.2.2 Outline Site Closure Plan

At the end of the economic life of the site, the development site and buildings may be redeveloped for extended use or returned to an alternative status. The responsibility for this may well rest with other parties if the site is sold. However, Sesona recognise the need to ensure that the design, the operation and the maintenance procedures facilitate decommissioning in a safe manner without risk of pollution, contamination or excessive disturbance to noise, dust, odour, groundwater and surface waters. Therefore, the site will be designed with consideration for eventual site decommissioning and demolition. The operation of the Facility will be undertaken in a manner as not to lead to deterioration of the site.

To achieve this 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.

3.2.2.1 General requirements

The general requirements associated with the implementation of the Site Closure Plan will include, but not be limited to, the following:

(a) underground pipework to be avoided except for supply and discharge utilities such as towns water, sewerage lines and gas supply;

(b) safe removal of all chemical and hazardous materials;

(c) adequate provision for drainage, vessel cleaning and dismantling of pipework;

(d) disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, release of dust or other hazardous substance;

(e) where practicable, the use of construction material which can be recovered (such as metals);

(f) methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater; and

(g) soil and groundwater sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report and any ongoing monitoring undertaken during operation of the installation).

3.2.2.2 Specific details

The specific details associated with implementation of the Site Closure Plan will include, but not be limited to, the following:

(a) a list of recyclable materials/components and current potential outlet sources;
(b) a list of materials/components not suitable for recycle and potential outlet sources;
(c) a list of materials to go to landfill with current recognised analysis, where appropriate;
(d) a list of all chemicals and hazardous materials, location and current containment methods; and
(e) A Bill of Materials detailing total known quantities of items throughout the site such as:
    a. steelwork;
    b. plastics;
    c. cables;
    d. concrete and civils materials;
    e. oils;
    f. chemicals;
    g. consumables;
    h. contained water and effluents; and
    i. residues/wastes including IBA and APCr.

3.2.2.3 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.

3.3 Improvement programme

Sesona is committed to continual environmental improvement of the Facility, and is therefore proposing that a small number of improvement conditions be incorporated into the final EP. These have been set out below. It is understood that the proposed conditions are consistent with EPs which the EA has granted for other waste incineration facilities in England.

3.3.1 Prior to commissioning

Prior to commencement of commissioning of the Facility, Sesona proposes to comply with the typical Pre-Operational Conditions which the EA require for this type of installation. These may include, but not be limited to, the following:

(a) Submit a written report to the EA, on the details of the computational fluid dynamic (CFD) modelling used in the design of the boilers. The report will demonstrate whether the BAT design stage requirements, stated in EPR5.01, have been completed. In particular, the report will demonstrate whether the residence time and temperature requirements will be met.
(b) Submit to the EA for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.

(c) Provide a written commissioning plan, including timelines for completion, for approval by the EA. 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 EA in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.

(d) Provide the EA with a summary of the site EMS and also a copy of the proposed OTNOC management plan in accordance with the BREF.

3.3.2 Post commissioning

Following commissioning of the Facility, Sesona proposes to comply with the typical Post-Commissioning Conditions which the EA require for this type of installation. These may include, but not be limited to, the following:

(a) Submit a written report to the Environment Agency describing the performance and optimisation of the flue gas treatment systems.

(b) Carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnaces whilst operating under the anticipated most unfavourable operating conditions. Results will be submitted to the EA.

(c) Provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the PM_{10} and $PM_{2.5}$ ranges from the Facility. The report will detail a timetable for undertaking the tests and producing a report on the results.

(d) Submit a written summary report to the EA to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified in Table EPR3.1 and Table EPR3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.

(e) Submit a written report to the EA on the commissioning of the Facility. The report will summarise the environmental performance of the Facility as installed against the design parameters set out in the Application.

Appendices

A Plans and drawings

B Site condition report

C Noise assessment

D Environmental risk assessment

E Air quality assessment

F BAT assessment

G CHP assessment

H Fire prevention plan

I Planning application

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