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Consulting Engineers Limited

Medway Energy Recovery Limited

EP Application Supporting Information

ENGINEERING + CONSULTING

Document approval

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1 Introduction

Medway Energy Recovery Limited is applying to the Environment Agency (EA) under the Environmental Permitting Regulations (EPR's) for an Environmental Permit (EP) to operate the MedwayOne Energy Hub (the Facility). The Facility will comprise a twin line waste incineration plant and associated infrastructure (including battery storage), and will be located within the MedwayOne development[1], Kent.

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

Medway Energy Recovery Limited (company number: 12790514) has a registered address of Stirling Square, 5-7 Carlton Gardens, London, SW1Y 5AD, and is an SPV of Low Carbon.

Low Carbon is a renewable energy developer of and investor in large scale renewable energy projects, including solar, onshore wind, offshore wind, energy-from-waste (EfW) and battery storage. Low Carbon has an EfW portfolio consisting of a number of UK assets at varying stages of development, including the Redcar Energy Centre (REC) – the EP application for the REC is currently being determined by the EA. Low Carbon has also developed the Facility at Irvine under the 'Doveryard' company name, which is currently going through the PPC Permit determination process with SEPA. Low Carbon enables the deployment of capital at scale into renewables, investing across the full life cycle from concept, through to development, construction and operation.

1.2 The Site

The Site is located within the wider MedwayOne development which is being developed on the site for the former Kingsnorth Power Station. Access to the Site is via Eschol Road to the west.

The Site is located on the Hoo Peninsula in Medway, Kent, immediately south of the Damhead Creek CCGT power station. The Site is located approximately 4 km east of Hoo St Werburgh, and approximately 15km northeast of Chatham.

The Damhead Creek Gas-fired Power Station is located to the north of the site, with the Kingsnorth industrial estate lying to the northeast of the site. Damhead Creek runs to the east of the Site and connects with the estuary for the River Medway.

The MedwayOne site is a mix of brownfield and greenfield land on which the former Kingsnorth coal-fired power station was located prior to demolition, and has a varied topography. The plot which the MedwayOne Energy Hub is being developed on has been subject to very limited development and was farmland prior to it being developed as a sports field for the former Kingsnorth Power Station.

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

[1] The former Kingsnorth Power Station site.

1.3 The Activities

The Facility will consist of a combination of a Schedule 1 installation activity (as defined in the Environmental Permitting Regulations) (EPR) and other directly associated activities. The MedwayOne Energy Hub will comprise two incineration lines to recover energy from waste, enabling:

1. generation of power for export to the National Grid and the potential to export heat;
2. production of an inert bottom ash material that will be transferred off-site to an IBA processing facility; and
3. generation of an air pollution control residue that will be transferred off-site to a suitably licensed hazardous waste facility for disposal or recovery.

It is also proposed for a battery energy storage system (BESS) to be installed at the site, although it is acknowledged that this is not a regulated activity under the EPR. The BESS is expected to have a peak discharge capacity of 10 MWe and a storage duration of 2 hours, resulting in a total capacity of 20 MWhe.

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 two stream 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 and processing of incinerator bottom ash. Waste types for the Facility as specified in Table 5.
Directly associated activities			
Directly associated activities		Energy generation	Generation of up to 49.9 of electrical power using a steam turbine, with electricity exported to the National Grid, and the potential to export heat to local heat users from energy recovered from the flue gases
Directly associated activities		Back-up diesel generator	For providing emergency electrical power to the plant in the event of supply interruption. Operation for no more than 50 hours per year for testing purposes (unless in emergency situations).
Directly associated activities		Surface water management	2.4.52.8

1.4 The MedwayOne Energy Hub

The MedwayOne Energy Hub will incinerate refuse-derived fuel (RDF), sourced primarily from commercial waste contracts.

The MedwayOne Energy Hub will have a thermal capacity of 166 MWth (83 MWth per incineration line). The design fuel will have a net calorific value (NCV) of 10.5 MJ/kg, but the Facility will be designed to process waste with a range of NCVs between 8 – 14 MJ/kg without reducing load. At the design point, the Facility will have an hourly waste processing throughput of 28.5 tonnes per hour (tph) per line. Assuming an operational availability of 8,000 hours per annum, the Facility will process 456,000 tonnes per annum of waste.

However, the Facility will be capable of processing waste with an NCV of 8 MJ/kg without reducing load. Assuming an availability of 8,000 hours, the Facility can process up to 606,000 tpa of waste.

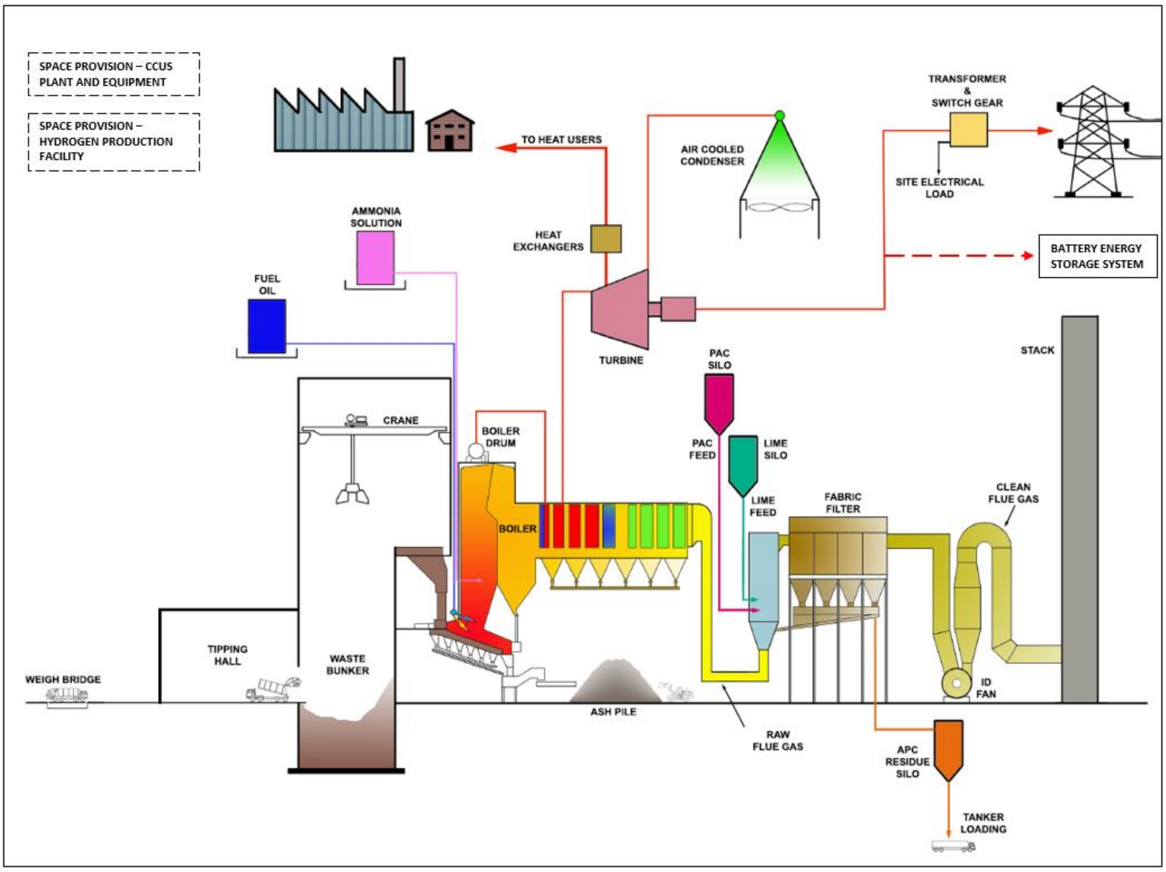
The Facility will generate up to 49.9 MWe of electricity with a parasitic load of approximately 5 MWe. Therefore, the Facility will be designed to export up to 44.9 MWe of electricity.

The electrical connection is to be at the UKPN substation, situated within the wider MedwayOne development. In addition, the Facility will be designed to allow for private wire connections for the export of power to energy users within the MedwayOne development.

The Facility will be designed as carbon-capture ready and combined heat and power (CHP) ready with provision of space for future installation of CCUS and/or CHP equipment if required.

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

Figure 1: Indicative Process Schematic



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1.4.1 Raw materials

The MedwayOne Energy Hub will receive deliveries of waste and raw materials by road. The primary raw materials to be used at the Facility include lime, activated carbon, ammonia solution, auxiliary fuel, water treatment chemicals and various maintenance materials (oils, greases, insulants, antifreezes, welding and firefighting gases etc).

Waste will be stored in a dedicated bunker, sized to store up to approximately 5.2 days fuel supply (or 20,400 m^3) without closing tipping bays. Additional storage up to 6.3 days storage (or 24,900 m^3) can be provided via waste stacking should some tipping bays be closed (this assumes at least 4 bays remain open). To allow for extended periods of shutdown, the maximum period of time that waste is expected to be stored in the bunker is 4 weeks.

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

Conventional moving grate technology will be utilised which will agitate the fuel bed to promote a good burnout of the waste and a uniform heat release. The moving grates will enable the waste to be moved from the feed inlet along the grates to the ash discharge.

As required by the Industrial Emissions Directive (IED), the boilers will be designed to ensure that exhaust gases are raised to a minimum temperature of 850°C and kept at this temperature for a minimum of 2 seconds (flue gas residence time), to ensure the sufficient destruction of dioxins, furans, PAHs and other organic compounds. Gas temperatures will be continually monitored and recorded via the distributed control system (DCS). Audible and visible alarms will trigger in the control room (and the auxiliary burners will fire) if the temperature starts to fall towards 850°C.

Primary combustion air will be extracted from the waste bunker area, maintaining negative pressure in this area. The primary combustion air will then be fed into the combustion chambers beneath the grate to create turbulence and ensure complete combustion. Secondary combustion air will be injected into the flame body above the grate to create turbulence and facilitate the complete combustion of waste on the grates whilst minimising levels of oxides of nitrogen (NOx) emissions. A combustion control system will regulate both primary and secondary air flows.

A Selective Non-Catalytic Reduction (SNCR) system will be employed to reduce NOx emissions. As part of this, a NOx abatement reagent will be injected into the high temperature region of the boilers. The reagent will react with oxides of nitrogen (NOx) formed in the combustion process and produce water, carbon dioxide and nitrogen. The dosing rate of the reagent will be controlled to achieve NOx concentrations below the proposed emission limits.

To achieve and maintain the required 850°C in the combustion chamber both prior to waste charging and at any time when waste is on the grate, low-NOx auxiliary burners will be provided which will be fuelled using low sulphur fuel oil. The burners will typically operate for around 22 hours total during each start-up and shutdown event. Within the Greenhouse Gas Assessment (refer to Appendix E), it is conservatively assumed that there will be 8 start-up/shutdown events each year due to planned maintenance activities. In reality, there is likely to be less.

Interlocks will prevent waste charging until the temperature in the combustion chamber has reached the required 850°C. Furthermore, should the temperature fall below 850°C during normal operation, the burners will operate to maintain the required temperature.

Combustion air flow will be controlled and optimised by measuring excess flue gas oxygen content, and will be set to maximise the efficiency of both the heat recovery process and the combustion process.

1.4.3 Energy recovery

Steam boilers will recover heat released by the combustion of waste. The boilers will be integral to the furnaces and will, in combination with superheaters, produce high pressure superheated steam at approximately 430°C and 60 bar(a).

The steam generated by the boilers will feed a steam turbine which will generate electricity. The remainder of the steam left after the turbine will be condensed back to water; this generates the pressure drop to drive the turbine. A fraction of the steam will condense at the exhaust of the turbine in the form of wet steam; however, the majority will be condensed and cooled using an air-cooled condenser. The condensed steam will be returned as condensate to the feedwater tank – the water is re-circulated into the process as boiler feedwater within the closed-circuit pipework system to the boilers.

The Facility will have the capacity to export heat to local heat users (anticipated to be the wider MedwayOne development). Dependent on the requirements of the heat users, either hot water or high-pressure steam could be exported. High-pressure steam could be extracted from the turbine and piped directly to the heat users. Alternatively, low-pressure steam exiting the turbine would pass through an onsite heat exchanger to heat up water for use in a heat network. The CHP assessment undertaken for the Facility (refer to Appendix G) identifies that a pre-insulated buried hot water pipeline would be appropriate for the heat users identified.

1.4.4 Flue gas treatment

NOx levels will primarily be managed by careful control of the combustion air. An adequate supply of primary air will be maintained (and monitored) to provide the correct volume of oxygen for optimum combustion. Both oxygen content and temperature will be monitored within the primary combustion chamber, with combustion control systems maintaining stable conditions within the process. Low-NOx auxiliary burners will also be provided and will ignite should the temperature within the combustion chamber fall below the required 850°C under the IED.

Selective non-catalytic reduction (SNCR) will also be employed as secondary abatement to further reduce NOx levels. In the SNCR system, a NOx reduction reagent will be injected into the boiler (specifically, directly into the hot flue gases above the flame) to convert both nitrogen oxide (NO) and nitrogen dioxide (NO_2) to nitrogen, carbon dioxide and water. For the purposes of this application it has been assumed that the reagent is ammonia solution; however, it is requested that this is confirmed via a pre-operational condition. The injection of this reagent would be via a bank of nozzles to provide flexibility in dosing locations/amounts.

The temperature window at which the SNCR system will operate will be selected based on the effectiveness of abatement. Reactions will take place between 850 – 1,050°C; however, maximum efficiency is typically achieved between 850 – 950°C. Secondary air will be preheated and control systems will help maintain a high temperature level in the secondary combustion zone. Secondary air injection will therefore be optimised to ensure that the SNCR system is operating at optimal temperatures.

Further upstream of the boiler, a flue gas treatment system will be installed. Acid gases produced during the combustion process will be reduced through a dry sorbent injection system within a reactor vessel. It is proposed to use hydrated lime as the reagent in this system. The acid gases

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(including hydrogen fluoride, hydrogen chloride and sulphur dioxide) will be neutralised as they react with this reagent. In addition to lime injection, it is also proposed to inject Powder Activated Carbon (PAC) into the reactor vessel, to reduce emissions of dioxins, mercury (volatile metals) and other heavy metals.

The lime dosing system will be controlled by upstream acid gas concentration measurements and proportioned to the volumetric flow rate of the flue gases. The lime and activated carbon dosing systems will have separate control systems for the injection into the flue gas stream, but they may be injected through the same injection points.

After the flue gas has passed through the reactor vessel, a fabric bag filter will provide filtration of particulates (including the lime and PAC reagents, which will remain on the inside of the bag filter as a ‘cake’) prior to release of the flue gas from the stack. Some of this residual material (cake) will be re-circulated in the flue gas treatment system to reduce the overall consumption of reagents in the process, as not all the reagents will have fully reacted.

The bag filter will be divided into compartments. Regular bag filter cleaning will be performed online by pulsing compressed air through the filter bags, and the cake will be regularly displaced. Air pollution control residues (APCr) will be collected in fully enclosed hoppers beneath the flue gas treatment systems and stored in silos. Individual compartments (chambers) can be isolated and repaired in case of failure in the integrity of the bag filter. Online monitoring of pressure will identify where failure has occurred, and the bag filters will also be subject to regular preventative maintenance to assess wear and tear.

The treated flue gases will be discharged to atmosphere via an 85m stack.

1.4.5 Emissions monitoring and stacks

The flue gas treatment system(s) will be designed to ensure that the Facility operates within the BAT-AELs required by the Waste Incineration Best Available Techniques Reference Document (BREF). As the treated flue gas is discharged from the stack, it will be monitored for pollutants.

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 NO_2 and nitrous oxide, N_2O);
- 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 per line and a stand-by CEMS which can be switched between the two lines as required. This will ensure that there is continuous monitoring data available even in the event of a problem with the duty CEMS on either line.

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 Drainage arrangements

During normal operation the Facility will not give rise to process effluents and will be classified as a ‘zero discharge’ process. However, during periods of extended shutdown, there may be a need to discharge excess effluents (e.g. following draining of the boiler). As the MedwayOne development does not have a foul sewerage system, the excess process effluents may be tankered off-site. In the event that a foul sewer is installed at the MedwayOne development, Medway Energy Recovery Limited will look to make a connection to the foul sewer to enable the excess process effluents to be discharged to sewer in accordance with a Trade Effluent Discharge Consent.

Surface water run-off from building roofs and areas of hardstanding will be collected in an on-site surface water drainage system and collected in an attenuation pond, prior to discharge into the existing surface water drainage system for the Kingsnorth Power Station which outfalls to the River Medway, herein referred to as the MedwayOne drainage system.

Surface water run-off from areas from areas of vehicle movement areas and roadways will pass through an interceptor(s) prior to discharge into the surface water drainage system.

In the event of a spill/pollution incident, there will be a penstock valve to inhibit the discharge from the Site into the MedwayOne drainage system.

Domestic effluent will be treated in an on-site package water treatment plant, prior to discharge to the MedwayOne drainage system.

1.4.7 Ancillary operations

The Facility is expected to consume approximately 8.5 t/h of process water. The primary requirement of mains water is to maintain the water level in steam cycle within the boiler, and to cool down the boiler blow down water. A water treatment plant (using either reverse osmosis or ion exchange technology) will produce high-quality demineralised water, required to fill the boiler and replenish blow down. A number of water treatment chemicals will be stored within/adjacent to the water treatment plant, required for both the demineralisation process and for boiler water dosing (e.g. de-scalers).

Water for firefighting will be stored in a firewater storage tank with a duty electric pump and standby diesel pump or standby electric pump supplied from the emergency generator.

The Facility will be provided with auxiliary burners to support start-up and shutdown operations by raising the temperatures of the furnaces. The burners may also ignite during operations should the furnace temperature fall below the required 850°C. The auxiliary burners will be fired on low sulphur fuel oil.

An emergency generator, fuelled on diesel, will provide safe shutdown of the site in the event of a loss in grid connection. The generator would typically only operate for short-term periods for testing and maintenance purposes, i.e. <50 hours per year.

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An alternating current (AC) uninterruptible power supply (UPS) will be provided for essential functions, such as the facility control system, that cannot tolerate a loss of supply, even for a very short period (i.e. while the emergency generator starts up).

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.

Table 2: Types and amounts of primary raw materials

Schedule 1 Activity	Material	Estimated storage capacity (m^3)	Estimated annual consumption (tpa)	Description
Section 5.1	Fuel oil	120	475	Auxiliary fuel supplying the auxiliary burners to maintain combustion temperature
	Hydrated Lime ($Ca(OH)_2(s)$)	240	10,200	Acid gas reagent for flue gas treatment
	Ammonia (25%) [(1)]	75	1,900	Reduction agent for NOx abatement
	PAC	75	150	Powdered activated carbon

Notes:

(1) For the purposes of this application it has been assumed that the SNCR reagent is ammonia solution, but this will be confirmed vie a pre-operational condition.

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	$C_{12}H_{23}$	475	100	0	0	Low impact	Auxiliary fuel for start-up and shutdown of the Facility.
Hydrated Lime	$(Ca(OH)_2(s))$	10,200	100	0	0	Low impact	Lime 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.
Ammonia (25%)	NH_3	1,900	0	100	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.
PAC	C (100 wt.%)	150	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;
2. CEMS calibration gasses;
3. refrigerant gases for air conditioning plant;
4. glycol/anti-freeze for cooling; and
5. boiler water dosing chemicals.

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.

Medway Energy Recovery Limited 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

2.1.2.1 Unloading of reagents/raw materials

A range of chemical substances and hazardous materials associated with the process, including ammonia solution, lime and activated carbon, will be delivered to the site. Ammonia will be delivered in sealed tankers and off-loaded to an ammonia storage tank via a standard hose connection. The delivery 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 ammonia are contained.

The lime 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 – 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.

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 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. 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 auxiliary fuel and liquid chemicals will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery – this will be achieved by the use of sumps to the ammonia and auxiliary fuel unloading areas (i.e. they will drain to a blind collection point).

Sumps will 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 trigger water testing.
- Any sub-surface tanks and sumps, where appropriate, will be designed with leak detection systems. Preventative maintenance will be implemented for all subsurface structures. This will include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc.

Furthermore, adequate quantities of spillage absorbent materials will be made available at easily accessible location(s) where chemicals are either stored or unloaded.

The measures outlined above are considered to be sufficient to prevent in the first case, or mitigate, any leaks from tanker offloading of materials.

2.1.2.2 Storage of reagents/raw materials

A range of chemical substances and hazardous materials associated with the process, including ammonia solution, lime and activated carbon, will be stored at the site. These materials will be stored in accordance with current guidance. All liquid chemicals and raw materials (including ammonia) will be stored in controlled areas, with secondary containment facilities having a volume of 110% of the stored capacity.

Ammonia solution will be stored within a tank in a dedicated storage area, with secondary containment such as bunding. The ammonia 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 ammonia is stored within the tank. Good design of pipework and regular preventative maintenance will allow for the safe transfer of ammonia into the SNCR system.

Lime and activated carbon, used within the flue gas treatment process, will be stored within separate storage silos located to the west of the flue gas treatment system. The storage of these reagents will be in dedicated steel silos with equipment for filling from a tanker through a sealed pipework system. Lime and activated carbon will be dosed into the flue gas treatment process with separate dosing controls.

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

Boiler make-up water will be supplied from an onsite demineralisation water treatment plant. Boiler water treatment chemicals will be used to control water hardness, pH and scaling and will be delivered in sealed containers and stored in an area with suitable secondary containment (e.g. bunding) within the water treatment room.

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).

Further detail on the containment measures for raw material and reagent storage is presented within the Site Condition Report – refer to Appendix B.

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	280	192.41
Cost of residue disposal	£/tonne	186	155
Overall Cost	£/op.hr/kmol	46.1	26.1
Overall Cost	£/op.hr/kg	109.0	67.0
Ratio of costs		84.0	85.0

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

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

- The residue has a higher leaching ability than lime-based residue, which limits the disposal options;
- The reaction temperature doesn't match as well with the optimum adsorption temperature for carbon, which is dosed at the same time;

- The sodium bicarbonate system has a slightly higher global warming potential due to the reaction chemistry; and
- The overall cost per kmol of reagent required to abate HCl is around 77% higher.

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

2.1.3.2 NOx abatement

NOx abatement systems can be operated with 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 aqueous ammonia for the SNCR system, because the climate change impacts of urea outweigh the handling and storage issues associated with ammonia solution. These issues can be overcome by good design of the ammonia tanks and pipework and the use of suitable procedures for the delivery of ammonia. Taking this into consideration, the use of ammonia solution in the NOx abatement system is considered to represent BAT for the Facility.

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. fuel 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 MedwayOne Energy Hub will be used to recover energy from waste, with European Waste Catalogue (EWC) Codes as presented in Table 5. The Facility will primarily accept refuse derived fuel (RDF) and solid recovered fuel (SRF), which typically have higher NCVs than non-treated waste.

Table 5: Waste to be processed in the MedwayOne Energy Hub

EWC Code	Description of Waste
Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01	Packaging (including separately collected municipal packaging waste)
15 01 01	Paper and cardboard packaging which is contaminated and would otherwise be destined for landfill
15 01 03	Wooden packaging which is contaminated and would otherwise be destined for landfill
15 01 05	Composite packaging
15 01 06	Mixed packaging which is contaminated and would otherwise be destined for landfill
15 01 09	Textile packaging
Construction and demolition wastes (including excavated soil from contaminated sites)	
17 02	Wood, glass, and plastic
17 02 01	Wood which is contaminated and would otherwise be destined for landfill
Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 02	Wastes from physical/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)

EWC Code	Description of Waste
19 02 03	Premixed wastes composed only of non-hazardous wastes
19 05	Wastes from aerobic treatment of solid wastes
19 05 01	Non-composted fraction of municipal and similar wastes (which is otherwise contaminated or unsuitable for recycling)
19 05 02	Non-composted fraction of animal and vegetable waste (which is otherwise contaminated or unsuitable for recycling)
19 05 03	Off-specification compost (which is otherwise contaminated or unsuitable for recycling)
19 06	wastes from anaerobic treatment of waste
19 06 04	digestate from anaerobic treatment of municipal waste (which is otherwise contaminated or unsuitable for recycling)
19 06 06	digestate from anaerobic treatment of animal and vegetable waste (which is otherwise contaminated or unsuitable for recycling)
19 12	Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified
19 12 01	Paper and cardboard which is contaminated and would otherwise be destined for landfill
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
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 10	Clothes
20 01 11	Textiles
20 01 38	Wood other than that mentioned in 20 01 37 (rejects from materials recovery plants only)
20 02	Garden and park wastes (including cemetery waste)
20 02 01	Biodegradable waste (which is otherwise contaminated or unsuitable for recycling)
20 03	Other municipal wastes
20 03 01	Mixed municipal waste
20 03 02	Waste from markets

Some of the EWC codes listed above include for waste plastic materials (such as EWC code 15 01 06 and 20 01 38) and 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.

Furthermore, although it is acknowledged that the combustion of plastics contained within the waste has the potential to release emissions of dioxins and furans, PCBs and mercury, the wastes will be mixed within the waste bunker to ensure a homogeneous waste feed to the furnace. This will lie within the capability of the flue gas treatment system, therefore maintaining emissions to within the limits prescribed by the EP.

Some of the EWC codes relate to wastes which have a relatively high calorific value. However, the wastes will be mixed within the waste bunker to ensure a homogeneous waste feed to the furnace, thereby avoiding upset to the boiler as a result of spikes in CV. The Facility will be designed to process wastes with a range of NCVs – refer to the Firing Diagram presented within Appendix A. Taking the above 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.

In addition to the above, some waste codes have the potential to be more odorous than other waste codes. The quantities of these wastes which will be received at the Facility will be small compared to the overall waste capacity of the Facility. Waste acceptance procedures will be developed for all incoming wastes. It is the responsibility of the site management to ensure that odour control can and is maintained. If upon arrival at the site, it is deemed that odour control cannot be maintained due to the nature of the waste, the waste will not be accepted at the site.

Waste under EWC codes 19 06 04 and 19 06 06 will comprise digestates that are unsuitable for processing in an alternative treatment facility, for example due to contamination. The digestates received will be digestate that does not meet the requirements of PAS 110 (or is otherwise unsuitable for spreading on land as a fertiliser). It is anticipated that the quantity of these wastes will be small compared to other wastes processed at the Facility. These wastes would be mixed with the rest of the waste in the bunker to ensure that it is suitable for incineration. The digestate may need to be dewatered to reduce its moisture content and make it suitable for handling at the Facility, but this would need to occur prior to transfer to the Facility. Taking this into consideration, Medway Energy Recovery Limited considers that the digestates that will be accepted at the Facility are suitable for combustion in a moving grate system.

2.2.2 Waste handling

2.2.2.1 Waste acceptance and pre-acceptance procedures

Waste supply contracts will be held with waste suppliers that will supply waste directly to the Facility. The contracts will ensure that the waste suppliers provide the waste to in accordance with the waste specification for the Facility.

Documented procedures for pre-acceptance and acceptance of all wastes will be developed prior to the commencement of operation, in accordance with the documented management systems for the MedwayOne Energy Hub. Medway Energy Recovery Limited would propose to provide the EA with a summary of the documented procedures prior to commencement of operation, as typically required for EPs of this nature.

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

Procedures will be implemented on site for the review of wastes at the weighbridges (i.e. a review of the relevant documentation accompanying the waste) and for periodic inspections of wastes at the weighbridge against the agreed EWC codes.

The waste pre-acceptance and acceptance procedures will comply with the Indicative BAT requirements in EPR5.01, including:

- 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. Should a significant spillage occur which has the potential to contaminate the surface water drainage system, an isolation valve will prohibit the release of any contaminated effluent off-site.
- Fire-fighting measures will be designed by consultation with the Local Fire Officers, with particular attention paid to the waste storage area. Refer to the Fire Prevention Plan (Appendix H) for further details.
- Delivery and reception of waste will be controlled by a management system that will identify all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Waste will be:
  - delivered in enclosed vehicles or other appropriate containers; and
  - unloaded in the enclosed waste reception area.
- 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 inspection will take place by the plant operatives during vehicle tipping/waste unloading.

2.2.2.2 Receiving waste

Waste will be delivered to the Facility in enclosed waste delivery vehicles. Waste will be delivered predominantly in bulk waste delivery vehicles although some RCVs may occur. Checks will be made on the paperwork accompanying each delivery from external sources to ensure that only waste for which the plant has been designed will be accepted. Vehicles will be weighed on one of two incoming weighbridges where the quantity of the waste will be recorded, prior to proceeding to the enclosed waste reception and tipping hall area (herein referred to as the waste reception area). Vehicle loads will be inspected periodically at the weighbridge layby to confirm the nature of the wastes being delivered.

Once within the tipping hall, the waste delivery vehicles will reverse into a vacant tipping bay and tip waste into the bunker. Once a delivery has been made, road delivery vehicles exiting the site will then be weighed again upon exit in order to determine the mass of waste that has been delivered to the Facility.

The tipping hall will incorporate multiple tipping bays, and will be fitted with fast acting roller shutter doors, which will be kept closed when waste deliveries are not occurring. Routine waste inspections will take place within the quarantine area of the tipping hall. It can be confirmed that waste will be received, handled and stored within the main waste reception building, which will have contained drainage with links to the process drainage system.

A crane grab will transfer the waste from the bunker to the feed hoppers/feeding chutes. The crane grab will also be used to remove any unsuitable or non-combustible items which are identified by the crane driver. These items will be removed from the bunker and placed in the quarantine area for further inspection, prior to transfer offsite to a suitable disposal/recovery facility. The waste bunker will allow for back-loading of waste in the event of unplanned periods of prolonged shutdown. Two waste back-loading bays will be at either end of the bunker for the removal of the waste.

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

The waste bunker will be constructed of reinforced concrete and will be designed as a water retaining structure in accordance with '*BS EN 1992-3:2006, Eurocode 2*'. During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of the bunker. This will minimise the potential for damage of the bunker during operation of the Facility.

Regular preventative maintenance as part of documented management systems at the site will ensure that the bunker integrity is maintained throughout the lifetime of the Facility. Preventative maintenance will include for periodically emptying the bunker and undertaking visual inspections of the concrete from which it 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 (such as leachates from waste) do not leak from the bunker 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. boiler conditions;
4. flue gas treatment control; and
5. waste management.

All of these techniques meet the Indicative BAT requirements from EPR5.01 and the waste 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. Waste will originate from a variety of sources and suppliers. The mixing of wastes from different suppliers within the waste bunker will improve the homogeneity of waste 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 boilers – 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 (waste), uniform waste 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 waste feed rate and combustion air flows.

2.2.3.4 Boiler conditions

Online boiler cleaning will be achieved through the installation of cleaning systems within the boiler that are capable of operating when the Facility is in operation. The exact specifications of the boiler cleaning systems will be subject to the detailed design of the Facility.

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

Whilst it is subject to detailed design, the online boiler cleaning systems are expected include the following:

1. water spray cleaning in the radiative passes;
2. pneumatic rapping systems for cleaning of any horizontal boiler sections; and
3. shockwave generators or soot-blowers for cleaning of any vertical boiler sections.

2.2.3.5 Flue gas treatment control – acid gases

Close control of the flue gas treatment system will minimise the use of reagents and hence minimise the amount of air pollution control residue (APCr) produced.

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

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

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

2.2.3.6 Flue gas treatment control – NOx and particulates

The SNCR system will require the injection of ammonia solution, into the radiation zone of the boilers at an appropriate level.

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

The optimal adjustment of the SNCR ammonia injection ensures the maximal NOx reduction through the SNCR system.

Following commissioning of the Facility it is proposed to submit to the EA a report which describes the performance and optimisation of the SNCR system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in the EP.

To remove particulates, including lime and activated carbon particles, the gases will be drawn through a fabric bag filter. Some of the residual material will be recirculated to reduce the amount of reagent consumed, as it will not be fully reacted.

Each fabric filter will be divided into compartments. The treated flue gas will pass through an induced draught (ID) fan into the stack for release. Regular bag filter cleaning will be performed on-line by pulsing compressed air through the filter bags. The residues will be collected in fully enclosed hoppers beneath the filters. Bag failure, albeit an infrequent occurrence, would be identified by a sudden increase in particulate concentration measured at particulate meters installed immediately downstream of the bag filter or by a reduction in the pressure differential across the bag filter.

After cleaning, the combustion gases from the combustion process will be released into the atmosphere via a gas flue within a stack.

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 waste 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 waste 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 waste charging system (i.e. waste into the hopper) using locks. If a period of abnormal operation exceeds 4 hours, the operators will be required to prohibit the waste charging system.
- There will be a fire extinguishing system in the event of a fire in the pre-chamber (i.e., prior to waste 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, typically 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 waste in the hopper.
- Following loading into the feeding system, the waste will be transferred onto the grate by hydraulic powered feeding units.
- A fuel detection system will be employed in the feeding system to monitor the level of waste 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 waste. 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

2.3.1 Overview

The main use of water at the Facility will be to make up the water for the boilers. Other water-consuming processes will include cooling of blowdown and the SNCR system. The following key points should be noted:

- The water system has been designed with two key objectives:
  - minimal process water discharge; and

  - minimal consumption of potable water discharge into the drainage systems.
- Where practicable, waste waters generated from the process will be reused/recycled within the process, for example in the ash quench system.
- In the event that excess process effluents are generated, these will either be tankered off-site to a suitably licensed waste management facility or sewer if such a connection becomes available.
- Most of the steam used in the turbine will be recycled as condensate.
  - The remainder will be lost as blowdown to prevent the build-up of sludge and chemicals, in addition to soot blowing, blowdown cooling and flue-gas treatment.
  - Lost condensate will be replaced with high-quality boiler feedwater.
- Surface water from external areas of hardstanding and roadways will be discharged into the on-site surface water attenuation pond. Oil interceptors would treat surface water prior to discharge to the MedwayOne drainage system.
- Firewater will be provided by an on-site water tank(s) connected to the mains water supply.
- The Facility will have separate process water, foul water and surface water systems.

2.3.1.1 Potable and Amenity Water

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 compared to the other water uses on site.

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 MedwayOne drainage system.

2.3.1.2 Process Water

Process water use

Mains water will be treated in an on-site water treatment plant to produce high-quality demineralized boiler feedwater. The demineralised water will be used to compensate for boiler blow down losses. It is anticipated that the Facility will consume approximately 6.6 tonnes per hour of mains water.

Process effluents will be recycled (for example, used in the ash quench), to allow a zero-discharge system during normal operations. Process effluents would be temporarily stored within a wastewater pit or similar structure, prior to reuse and recycling within the process.

Integrity of structures

The exact type of structures will be confirmed during the detailed design of the Facility; however, the wastewater pits 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 the process effluent storage facilities. This will minimise the potential for damage of the structure during operation of the Facility.

In addition to the preventative maintenance systems, the dirty water pit will be designed with a leak detection system. The preventative maintenance systems will include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc – to be confirmed during detailed design.

Sources and types of process effluent

It is expected that excess process effluents will include the following sources:

- boiler water resulting from emptying the boiler;
- small quantities of boiler blowdown;
- reject water from the water treatment plant; and
- washdown water from process areas, including the waste reception areas.

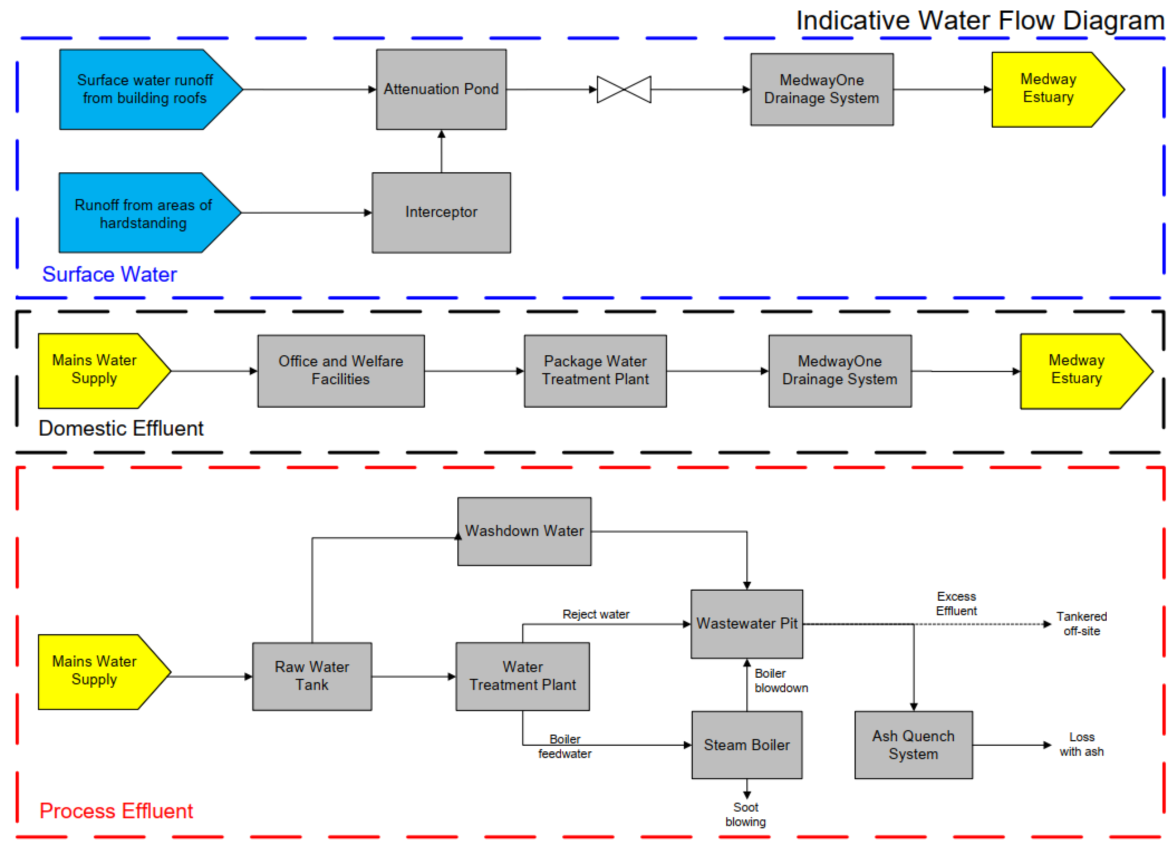
As such, there may be small quantities of boiler treatment chemicals present in the process effluent. The exact types of water treatment chemicals to be added to boiler feedwater are subject to detailed design of the Facility. The chemicals will be significantly diluted by other process effluents within the wastewater pit. The following are 'typical' examples of water treatment chemicals:

- sodium hydroxide (NaOH);
- sulphuric acid (H_2SO_4);
- hydrochloric acid (HCl);
- sodium chloride (NaCl);
- oxygen scavenger;
- sodium phosphate (Na_3PO_4) (descaler); and
- ammonium hydroxide (NH_4OH) (pH control).

2.3.2 Summary

An indicative water flow diagram for process water is presented in Figure 2, a larger version is provided in Appendix A.

Figure 2: Indicative water flow diagram



2.4 Emissions

The source of point source emissions from the Facility are presented in Table 6.

Table 6: Proposed emission points

Emission Point Reference	Source
A1	Line 1
A2	Line 2
A3	Emergency Diesel Generator
W1	Uncontaminated surface water run-off

An emissions point drawing is provided in Appendix A.

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 proposed emission limits for atmospheric emissions from the Facility is provided in Table 7.

Table 7: Proposed air emission limit values (ELVs)

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
Emission points A1 and A2 (1)				
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(2)	50	
Sulphur dioxide	mg/Nm^3	200	30	
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	120	
Ammonia	mg/Nm^3		10	
Hydrogen fluoride	mg/Nm^3			1.00
Cadmium & thallium and their compounds (total)	mg/Nm^3			0.02
Mercury and its compounds	$\mu g/Nm^3$			0.007
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3			0.30
Dioxins & furans	ng I-TEQ $/Nm^3$			0.04
Dioxin & furan-like PCBs	ng WHO-TEQ$/Nm^3$			0.06
Emission points A3				
No emission limits proposed				

Notes :

1. *All expressed at 11% oxygen in dry flue gas at standard temperature and pressure.*
2. *Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.*

2.4.2 Fugitive emissions to air

2.4.2.1 Waste handling and storage

Fugitive emissions of dust and litter have the potential to occur during waste unloading, processing, and storage operations, however these will be minimised wherever possible. Waste reception, handling, and storage at the Facility will be undertaken in an enclosed building, to prevent the release of litter and dusts. Fast-acting roller shutter doors will be in place at the entrance to the main building. Good housekeeping will also be employed at the Facility to minimise the build-up of dust and litter (such as regular washdown activities).

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'.

In addition to those measures outlined above for the prevention and reduction of fugitive emissions to air of dust and litter, the speed of vehicles on-site will also be limited to further reduce dust emissions.

The measures described above are considered to provide sufficient dust control at the Facility and it is not considered that additional dust suppression measures will be required. In the unlikely event that dust poses a significant problem during the operational phase of the Facility, the use of dust suppression equipment (such as misting sprays) will be re-examined and will be employed if required, subject to agreement with the EA.

2.4.3 Point source emissions to water and sewer

During normal operations, process effluents from the Facility (such as washdown water) will be reused within the site (e.g. for the ash quench). In the event that excess process effluents are generated, these will be tankered off site for disposal.

Surface water run-off from building roofs and areas of hardstanding will be collected in an on-site surface water drainage system and collected in an attenuation pond, prior to discharge into the existing surface water drainage system for the Kingsnorth Power Station which outfalls to the River Medway, herein referred to as the MedwayOne drainage system.

2.4.4 Contaminated water

2.4.4.1 Storage and containment facilities

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

All chemicals will be stored in an appropriate manner incorporating the use of suitable secondary and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment and tertiary abatement measures. The exact design of the containment measures is subject to the detailed design of the Facility. However, Medway Energy Recovery Limited can confirm that all storage and containment facilities will be designed and operated in accordance with relevant guidance relating to the design and construction of containment systems, including the Guidance for Pollution Prevention (GPP) guidance notes and the relevant EA/Government guidance including '*Pollution prevention for businesses*'. Medway Energy Recovery Limited would be happy to provide details to the EA of the proposed containment measures following completion of detailed design.

The primary containment for raw materials will be the vessel in which the raw material is stored in. Secondary containment will be provided to contain a spill or leak. The secondary containment for liquid materials will provide at least 110% of the storage capacity, in accordance with the EA guidance '*Pollution prevention for businesses*.' Tertiary containment will be any additional measures to ensure that contaminants are not released from the site in the unlikely event that the secondary containment was to fail.

The exact materials from which chemical storage facilities will be constructed from is subject to the detailed design of the Facility. Therefore, it cannot be confirmed whether alkali or acid resistant coatings will be used at this stage. However, with regards liquid chemicals, it can be confirmed that the ammonia and fuel oil tanks will be metal tanks located within an area with secondary containment (i.e. bunding or sumps) which will be able to contain a spill.

Areas of external hardstanding will also incorporate site kerbing to provide additional containment. This provides further 'protection' against any potential spills from causing pollution of the ground/groundwater and surface water. The potential for accidents, and associated environmental impacts, is therefore limited.

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

Process water drains within the Facility will drain to a process water tank/dirty water pit or similar prior to re-use within the process, for example within the ash quench. In the unlikely event that excess process effluents are generated, these will be tankered off-site to a suitably licensed waste management facility or, should a connection be secured in future, discharged to sewer in accordance with a Trade Effluent Consent.

2.4.4.2 Tanker unloading

With regards the unloading of raw materials and chemicals, tanker off-loading of fuel oil and liquid chemicals such as ammonia will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery. This will include measures such as areas of hardstanding with falls to a gully and/or sump. Other external unloading areas (e.g. for solid raw materials such as lime, activated carbon) will have contained drainage with falls to the process drainage system. In accordance with the EA guidance, delivery pipes will clearly be marked with the tank volume and substance stored to ensure deliveries are made to the correct tanks, reducing the risks of accidents and spillages during unloading operations.

2.4.4.3 Maintenance and inspections

Operational techniques will be in place to inspect and identify damage to the hardstanding and curbing across the site. The site EMS will contain a preventative maintenance regime for all plant and equipment (including civils such as drainage systems, hardstanding, kerbing etc). For hardstanding and kerbing, visual inspections will be undertaken at defined intervals set out within the preventative maintenance programme. Should it be identified that any damage has occurred to the structures, repairs will be undertaken to ensure that their integrity has been maintained and that there is no compromise in terms of leakage or contamination of the underlying ground/groundwater.

Similarly, regular preventative maintenance of any sumps/containment bunds across the site will be undertaken, which will include for periodically emptying sumps/bunds and undertaking visual inspections of the concrete or other material from which the sumps/bunds are constructed. In the event that the visual inspection identifies that the integrity of the sumps or bunds has been compromised, additional pressure tests, leak tests and material thickness checks may be undertaken. The measures described above will ensure the integrity of containment systems is maintained throughout the lifetime of the site.

It is expected that any secondary containment bunds will meet the CIRIA 736 standard ('*Containment systems for the prevention of pollution*'). However, should the EPC contractor propose an alternative standard, Medway Energy Recovery Limited will ensure that this standard is equivalent to CIRIA 736.

With regards the penstock valves to be installed at the site, regular preventative maintenance of these will also be undertaken in accordance with the manufacturers recommendations.

2.4.4.4 Response to spillages

In accordance with the emergency response procedures which will be developed for the Facility, spillages will be reported to the site management and a record of the incident will be made. The relevant authorities (Environment Agency / Health and Safety Executive) will be informed if spillages/leaks are significant, in accordance with documented management procedures. Spillages will be recorded in accordance with installations inspection, audit and reporting procedures. The effectiveness of the emergency response procedures will be subject to Management Review and will be revised and updated as appropriate following any major spillages.

2.4.5 Odour

The storage and handling of waste 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.

2.4.5.1 Delivery and storage of waste

Fuel delivery vehicles will proceed via a ramp to an elevated tipping hall, where they will be directed to a vacant tipping bay to discharge into the bunker. Medway Energy Recovery Limited has stated that the facility may utilise tipping chutes. Closing the tipping bay doors reduces odour release from the bunker when the Facility is shutdown.

2.4.5.2 Inspections and monitoring

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

- olfactory checks for odour in the waste 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 waste deliveries are occurring); and
- monitoring combustion air flow, with odorous air extracted via the boilers and the stack.

During periods of shutdown, the frequency of the above inspections would be increased, including monitoring combustion air flow if the ID fan operation can be maintained, for instance during periods of maintenance. Doors to the waste reception hall would be kept closed. In addition, during shutdown, additional 'sniff testing' 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.

2.4.5.3 Active mitigation

During normal operation, bunker management procedures will be employed to avoid the development of anaerobic conditions and decomposition in the waste bunker, which could generate further odorous emissions. These management procedures will include the frequent mixing and rotation of waste to ensure regular and well distributed turnover of waste. The process also results in a more homogeneous waste feed, which would increase efficiency in the incineration process.

Prior to periods of planned maintenance, bunker management procedures will reduce the amount of material in the bunker before shutdown. Maintenance would typically be undertaken of the incineration lines in succession– i.e. it is unlikely that both lines will be offline at the same time. In the event that both lines are offline (expected to be an unlikely scenario), the bunker management procedures (mixing of waste) would not normally be implemented, to avoid the generation of odorous emissions especially when waste volumes within the bunker are low. In the event of an extended unplanned shutdown where both lines are non-operational, if odour is identified to pose an issue despite the preventative measures in place, waste will be unloaded from the bunker for transfer off-site to a suitably licensed waste management facility.

2.4.5.4 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. In addition to the measures already outlined above:

- The operation of the Facility will not 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.
- Waste will not be stored in bales at the Facility.

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):

- Particulates (dust);
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- carbon monoxide (CO);
- oxides of nitrogen (nitric oxide NO, nitrogen dioxide NO_2 and nitrous oxide, N_2O);
- ammonia; and
- VOCs, expressed as total organic carbon.

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).

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:

- 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.

Include any additional information as appropriate (such as relating to specific BREF monitoring requirements, for example mercury and dioxin protocols).
The BREF states that continuous monitoring of hydrogen fluoride (HF) is required but can be replaced with periodic monitoring, with a frequency of once every six months, if hydrogen chloride (HCl) levels are proven to be sufficiently stable. As such the EA do not typically expect continuous monitoring of HF and periodic sampling is the norm.

The BREF also states that monitoring of mercury should be continuous, but notes that "for plants incinerating wastes with a proven low and stable mercury content (e.g. mono-streams of waste of a controlled composition), the continuous monitoring of emissions may be replaced by long-term sampling or periodic measurements with a minimum frequency of once every six months".

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 a stand-by CEMS 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 waste. 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

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

- combustion air;

- waste feed rate;
- SNCR system;
- flue gas oxygen concentration at the boiler exits;
- flue gas composition at the stack;
- combustion process;
- boiler feed pumps and feedwater control;
- steam flow at the boiler outlets;
- steam outlet temperature;
- boiler drum level control;
- flue gas control;
- power generation; and
- steam turbine exhaust pressure.

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

The following process variables have particular potential to influence emissions:

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

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

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.

Ammonia will be injected into the flue gases at a temperature of between 850°C and 1000°C. This narrow 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. It is acknowledged that the Waste Incineration BREF identifies a narrower effective temperature range of 850 – 950°C for optimum reaction rates. 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, where possible.

Sufficient nozzles will be provided at each level to distribute the ammonia correctly across the entire cross section of the radiation zone. CFD modelling will be utilised to determine the appropriate location and number of injection levels as well as number of nozzles to ensure the SNCR system achieves the required NOx reduction for the whole range of operating conditions while maintaining the ammonia slip below the required emission level. The CFD modelling will also be used to optimise the location of the secondary air inputs into the combustion chamber.

2.5.2.2 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 waste 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 waste from the feed inlet to the residue discharge. The grate movement turns and mixes the waste along the surface of the grate to ensure that all of the waste 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 waste), 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/waste from the feed inlet to the residue discharge. The grate movement turns and mixes the waste/waste along the surface of the grate to ensure that all waste 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/waste and it is considered that the burnout criteria required by Article 50(1) of the IED would be difficult to achieve. Therefore, these systems are not considered practical and have not been considered any further 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 waste.

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 into a waste-derived fuel. However, the use of fluidised beds to treat non-hazardous wastes 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/waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be from the combustion of part of the syngas.

   Various suppliers are developing pyrolysis and gasification systems for the incineration of waste fuels. However, the facilities which have been constructed have suffered issues with reliability and availability. Taking this into consideration, Medway Energy Recovery Limited does not consider pyrolysis and gasification systems to be a robust and proven technology for the treatment of waste. 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

		Grate	Fluidised Bed
Global Warming Potential	t CO2 eq pa	-133,200	-131,700
Ammonia Consumption	tpa	1,800	1,400
Residues (Total ash)	tpa	121,400	126,870
Annual Total Materials Costs		£6,730,000	£7,310,000
Annual Power Revenues		£21,540,000	£21,300,000

The grate has a lower global warming potential than the fluidised bed, but will consume approximately 25% more ammonia.

Both combustion technologies will produce similar quantities of ash, although the fluidised bed produces a separate boiler ash residue.

The material costs are approximately 9% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue. However, it is acknowledged that it is marginal and should be noted that this assessment is based on the assumption that the incoming waste will not require any additional pre-processing to be suitable for combustion within a fluidised bed.

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 (ammonia solution) into the flue gas flow path at an appropriate location, typically the high temperature region of the boiler. The ammonia solution 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 treatment based on 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 waste), 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. Ammonia 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

	Units	SNCR	SCR	SNCR + FGR
NO_x released after abatement	tpa	320	220	320
NO_x removed	tpa	630	730	530
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq pa	-12,200	-8,400	-12,200
Global Warming Potential	t CO_2 eq pa	1,500	5,300	2,000
Ammonia Used	tpa	1,900	1,000	1,600
Total Annualised Cost	£ pa	£596,000	£3,057,000	£803,000
Average cost per tonne NO_x abated	£ p.t NO_x.	£950	£4,190	£1,520

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

4. increases the annualised costs by approximately £2.5 million;
5. abates an additional 100 tonnes of NOx per annum;
6. reduces the benefit of the Facility in terms of the global warming potential by approximately 3,300 tonnes of CO_2;
7. reduces reagent consumption by approximately 900 tonnes per annum; and
8. costs more than 440% more per additional tonne of NOx abated, compared to an SNCR system.

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 160%. It has no effect on the direct environmental impact of the plant, but it increases the impact on climate change by approximately 500 tonnes of CO_2 per annum while reducing ammonia consumption by approximately 300 tonnes per annum. Allowing for the increase in the costs of NOx abatement for a SCR system compared to the climate change and reagent consumption associated with FGR, an SNCR system with or without FGR is considered to represent BAT.

The proposed designs do not include FGR. Therefore, taking the above into consideration, the use of SNCR without FGR is considered to represent BAT for the abatement of NOx within the Facility.

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.	1,220	1,220
Photochemical Ozone Creation Potential (POCP)	t-ethylene eq	380	380
Global Warming Potential	tn-CO_2 eq p.a.	5,100	10,600
Additional water required in a semi-dry system	t.p.a.	-	40,380
APC residues	t.p.a.	19,400	18,600
Annualised cost	£ p.a.	£11,753,000	£11,419,000

The performance of the options is very similar.

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

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

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

2.6.4 Particulate matter abatement

The Facility will use a multi-compartment fabric filter for the control of particulates. There are a number of alternative technologies available, but none provide the same level of abatement performance as a fabric filter. Fabric filters represent BAT for this type of thermal treatment plant, when compared to the alternative technologies, for the following reasons:

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

Fabric/'bag' filters are considered to represent BAT for the removal of particulates for this Facility.

The bag filter will not require a flue gas bypass duct, as the bag filters will be preheated allowing start-up without a bypass, which is considered to represent BAT. Therefore, a bypass system will be included within the design of the flue gas treatment system.

Filter bags containing catalyst materials are also a possible technology for the abatement of particulates and other pollutants. A review of catalytic filter bags is presented within the response to BAT 30 – refer to section 2.7.2.

2.6.5 Cooling technology

There are three technologies which are considered to represent BAT in EPR 5.01 for the Facility, which are:

- 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 steam. 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 suitable watercourse to the site is the River Medway Estuary which lies approximately 500 m to the south of the site, but this area is designated as a SPA, Ramsar and SSSI. In addition, potential for additional industrial developments to lie in-between the Facility and the River Medway. As such, groundworks (including potentially culverts for the flow from and return of water to the river) would be required to enable water cooling.

Due to the sensitivity of the receiving waters, water cooling systems are not considered to be ‘available’ for the Facility, and water cooling systems are not considered to be suitable technology for cooling at 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 wider visual impact beyond the structure itself (a 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 MedwayOne Energy Hub 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

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 fuel 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

#	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 3.1 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 Medway Energy Recovery Limited 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.
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 the greenhouse gas assessment (refer to Appendix E), the gross electrical efficiency of the plant is calculated to be approximately 30.1 %. Therefore, Medway Energy Recovery Limited understand that this is in accordance with the requirements of BAT 2. Further detail on the energy efficiency of the Facility is set out within section 2.8.
3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF.	As set out in section 2.5 of the Supporting Information, the process parameters for monitoring of emissions to air are as follows: • water vapour content • temperature; and • pressure. The oxygen content and flow rate of the flue gases will also be monitored. Temperature will be monitored in the combustion chamber. There will be no emissions of water from FGC systems. Furthermore, there will be no emissions to water from the adjacent IBA facility – any process effluents would be contained and re-used in the process. Excess process effluents will be tankered off-site for treatment. Taking the above into consideration, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply. Medway Energy Recovery Limited 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	It is anticipated that emissions to air will be monitored with the following frequency: <u>Continuous Monitoring</u>

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

#	BAT Conclusion	How met or reference
		Medway Energy Recovery Limited 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).	In the BREF Implementation Plan and the EA OTNOC Management Plan guidance, the EA has stated how monitoring of emissions of PCCD/F and dioxin-like PCB's 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 repeated once every 3 years. However, it is acknowledged that monitoring of PCCD/F and dioxin-like PCB 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, Medway Energy Recovery Limited 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, the BREF Implementation Plan and the EA'sOTNOC Management Plan guidance.
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 emissions to water from the IBA 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 relevant EN standards. Medway Energy Recovery Limited considers that the proposals for monitoring of slags and bottom ashes are in accordance with the requirements of BAT 7.

#	BAT Conclusion	How met or reference
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, Medway Energy Recovery Limited does not consider that the requirements of BAT 8 are applicable to the Facility.
9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f).	As described in Section 2.2 of the Supporting Information, the Facility will employ the following techniques as required by BAT 9: • 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. • Implementation of waste acceptance procedures. The Facility will accept a mix of wastes delivered both directly to the site and also from the adjacent MRF. The Operator will develop acceptance procedures for wastes delivered to the Facility, in order to ensure that only the wastes which the Facility is permitted to receive are received at the Facility. Paperwork accompanying each delivery will be checked. Periodic inspections of the waste will be undertaken as part of the scope where practicable, prior to transfer into the bunker, to confirm that it complies with the specifications of the waste transfer note (WTN). Waste delivered in road vehicles will be inspected by the crane operator as it is tipped into the bunker and mixed. • Medway Energy Recovery Limited will develop and implement waste pre-acceptance and acceptance procedures at the Facility. The waste acceptance procedures will identify the records required for wastes to be accepted at the Facility and where records associated with the waste should be retained in the document management system which will be employed at the Facility. • Waste acceptance procedures will be used to identify any unacceptable wastes which are not suitable for processing within the Facility and require quarantine and transfer off-site. It is understood that technique (f) of BAT 9 does not apply as the Facility will not incinerate hazardous waste.

#	BAT Conclusion	How met or reference
		Medway Energy Recovery Limited considers that the proposed arrangements for the receipt and segregation of waste complies with the requirements of BAT 9.
10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	It can be confirmed that the EMS in place at the site will include for the output quality management features stated in the BREF that are applicable to the bottom ash treatment plant (IBA facility).
11	In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk posed by the waste, the elements as listed in BAT 11 of the BREF.	As described in section 2.2.2 of the Supporting Information, and explained in relation to BAT 9 above, periodic monitoring of waste deliveries will be undertaken at the Facility. This will include the following elements in accordance with BAT 11: • Weighing of the waste deliveries by use of a weighbridge at the entrance/exit of the Facility. • Periodic visual inspection of waste either prior to being tipped into the bunker, or where this is not practicable, as it is tipped into the bunker by the crane operator. • Periodic sampling of waste deliveries and analysis of key properties, such as calorific value and metal content. – Sampling will be undertaken when accepting a new waste stream at the Facility (e.g. from a new waste supplier), or to determine the NCV of waste sources accepted should the plant be operating outside the permitted range shown on the firing diagram. Periodic sampling of waste will also be undertaken for waste streams to ensure consistency in parameters. It is expected that waste 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 waste 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 waste delivery load. These would then be combined into a pile. Two representative samples of equal weight

#	BAT Conclusion	How met or reference
		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. Medway Energy Recovery Limited considers that the proposed arrangements for monitoring the waste deliveries as part of the waste acceptance procedures complies with the requirements of BAT 11.
12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the following techniques: Use impermeable surfaces with an adequate drainage infrastructure; and Have adequate waste storage capacity.	The surfaces of the waste reception, handling and storage areas have been designed and will be constructed as impermeable structures. Adequate drainage infrastructure will be fitted to areas where receipt, handling and storage of waste takes place – these areas will have appropriate falls to the process water drainage system. The integrity of areas of hardstanding will be periodically verified by visual inspection. Regular maintenance of the drainage systems will be undertaken in accordance with documented management procedures to be developed for the Facility. Adequate waste storage capacity will be available on site – the maximum waste storage capacity of the waste bunker will be established and not exceeded. The quantity of waste will be visually monitored against the maximum storage capacity. During periods of planned maintenance, quantities of waste within the bunker will be run down where possible. Medway Energy Recovery Limited considers that the proposed arrangements for environmental risks associated with the reception, handling and storage of waste comply with the requirements of BAT 11.
13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques as listed in BAT 13 of the BREF.	The Facility will not process clinical or hazardous waste. Therefore, Medway Energy Recovery Limited 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	Bunker crane mixing and advanced control systems will be employed at the Facility. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As

#	BAT Conclusion	How met or reference
	waste, BAT is to use an appropriate combination of the techniques given below:	described in section 2.5.2 of the Supporting Information, the system will control and/or monitor the main features of the plant operation including, but not limited to the following: • combustion air; • waste feed rate; • SNCR system; • flue gas oxygen concentration at the boiler exits; • flue gas composition at the stack (including HCl measurements); • combustion process; • boiler feed pumps and feedwater control; • steam flow at the boiler outlets; • steam outlet temperature; • boiler drum level control; • flue gas control (including differential pressure across the bag filters); • power generation; and • steam turbine exhaust pressure. Water, electricity and auxiliary fuel usage will also be monitored to highlight any abnormal usage. Medway Energy Recovery Limited considers that the proposed arrangements for ensuring the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste comply with the requirements of BAT 14.
15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste.	The Facility will be controlled from a dedicated control room, with an advanced control system to optimise the process. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system: for example, ammonia solution dosing will be optimised and adjusted to minimise the ammonia slip. Lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response

#	BAT Conclusion	How met or reference
		upstream acid gas monitoring. Activated carbon dosing will be based on flue gas volume flow measurement. Medway Energy Recovery Limited 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). Waste will be kept at suitable levels in the waste bunker to maintain operation during periods when waste is not delivered. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations. Medway Energy Recovery Limited considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations to comply with the requirements of BAT 16.
17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the wastewater treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability.	The FGC and wastewater treatment systems will be appropriately designed and operated within the design range. The FGC and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures. Medway Energy Recovery Limited considers that the design and operation of the FGC and wastewater treatment plants will ensure that emissions to air (and water where applicable) are reduced, and will ensure their optimal availability, to comply with the requirements of BAT 17.
18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the EMS that includes the elements as identified in BAT 18 of the BREF.	The EA's BREF implementation document sets out a definition of OTNOC, and lists 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 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, Medway Energy Recovery Limited 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

#	BAT Conclusion	How met or reference
		would be achieved by either a pre-operational or improvement condition in the EP. This is a similar approach that we have seen applied on recent applications. Medway Energy Recovery Limited 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 steam boilers to produce steam which is used to produce electricity. The Facility will also have the provision to export heat to local users. Medway Energy Recovery Limited 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: • Minimise heat losses via the use of integral furnace boilers – heat will be recovered from the flue gases by means of steam boilers integral with the furnaces; • Optimisation of the boiler design to improve heat transfer – the boilers will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste that is combusted; • High steam conditions (approximately 430°C and approximately 60 bar(a), subject to detailed design), to increase electricity conversion efficiency; • Cogeneration of heat and electricity – the Facility has been designed as a combined heat and power plant and will have the capacity to provide heat to local users, refer to Appendix G. Subject to commercial agreements with heat users, a scheme for the export of heat will be implemented. Medway Energy Recovery Limited 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 b (reduction of flue gas flow), e (low temperature flue gas heat exchangers) and i (dry bottom gas handling) within BAT 20 has been undertaken and is presented below. Technique (b) Technique (b) relates to reducing the flue gas flow rate through either an improvement in the primary and secondary combustion air distribution, or through using flue gas recirculation (FGR).

#	BAT Conclusion	How met or reference
		The Facility will be designed to optimise both primary and secondary combustion air distribution to improve the efficiency of the combustion process. The volume of both primary and secondary air will be regulated by a combustion control system. Primary combustion air will be optimised and improved through the continuous monitoring of process variables, including combustion air flow. Secondary combustion air distribution will be optimised through the use of Computational Fluid Dynamics (CFD) modelling, which will be used to select and optimise the location of secondary air inputs into the combustion chamber, to increase the efficiency of the SNCR system for NOx abatement. The optimisation of the combustion control system, as described above, will reduce the resulting flue gas flow rate by reducing air intake, hence lowering the oxygen content within the furnace and reducing the air output at the boiler exit. However, to ensure that the combustion process remains stable, it is important to maintain a balance between the air intake and the resulting flue gas flow rate. The provision of some excess oxygen is essential to cover any fuel spikes and avoid incomplete combustion, reducing the risk of any spikes in carbon monoxide emissions. FGR has the potential to improve the performance and efficiency of combustion systems, with some grate suppliers gaining benefits of reduced NOx generation from the use of FGR. However, other grate suppliers 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. Adding FGR may even have the potential to cause additional problems relating to the availability of the plant, which would reduce the overall efficiency through reduced power generation and an increase in the number of shutdowns. As justified within section 2.6.2, the proposed designs do not currently include FGR. However, it is requested that a pre-operational condition is included within the EP to allow details of the NOx abatement system to be confirmed during detailed design of the Facility. Therefore, taking this into consideration, the use of SNCR with or without FGR is considered to represent BAT for the abatement of NOx within the Facility. Medway Energy Recovery Limited will comply with any Improvement Conditions (ICs) or Pre-operational Conditions (POCs) imposed by the EP, such as confirmation of details on the performance and optimisation of the SNCR system and confirmation of the boiler design through computational fluid dynamics (CFD) modelling.

#	BAT Conclusion	How met or reference
		<u>Technique (e)</u> Technique (e) is to use low-temperature flue gas heat exchangers to recover additional energy from the flue gas at the boiler exit. The recovered heat could then be used for heating purposes and/or internally for preheating of boiler feedwater. 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. Section 4.4.10 of the BREF states that at temperatures below 180°C, when using low-temperature heat exchangers, there is an increased risk of corrosion in the economiser and of the piping upstream of acid gas scrubbing. Corrosion risks can arise from HCl and SOx in MSW flue gases, which can attack the steel in the (cool) metal tubes of the heat exchanger. The boiler design has assumed a flue gas temperature of approximately 150°C at the exit of the boiler, i.e. prior to the hot gases passing to the flue gas treatment system. As this temperature is below 180°C, this introduces a higher possibility for corrosion risks. It is acknowledged that it is possible to use heat exchangers made of special materials such as enamel to reduce corrosion, or to design the cycle to use a separate waste heat boiler after the main boiler to avoid corrosion conditions. However, this would require the system to be re-designed and may introduce additional capital costs. In addition to the above, when considering the use of heat exchangers, it is important to ensure that the flue gas temperature is not lowered enough to impact the operation of the FGT system. The BREF states that a dry FGT process, such as that proposed for the Facility, can accept flue gas temperatures of around 130 – 300°C, with bag filters generally requiring temperatures in the region of 140 – 190°C. As the temperature of the flue gases at the boiler exit is expected to be approximately 150°C, and assuming a minimum required temperature of 130°C for the FGT process, this would only allow for a maximum temperature 'loss' of 20°C for the flue gases when passing through the heat exchanger. When accounting for efficiency losses in the heat exchanger, this would result in a very low exchange of heat overall. Furthermore, reagent consumption in the FGT system will increase as the temperature of the flue gases decreases due to reduced reaction rates. Should the flue gases be required to be reheated before entering the FGT system, this would be counterproductive from an energy efficiency point of view, allowing for the additional losses from the heat exchanger.

#	BAT Conclusion	How met or reference
		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. As described within section 4.3.5 of the WI BREF, the preheating of incineration air in grate-type municipal waste incineration plants is normally done with low-pressure steam and not by heat exchange from the flue-gases (due to complicated air ducts and corrosion problems). Furthermore, the installation of a post abatement heat exchanger would also introduce a high associated capital cost. 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. Taking the above into consideration, the use of a low-temperature heat exchanger is not considered to represent BAT due to the corrosion risks, 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) 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 volumes of effluent generated, which may require off-site treatment prior to discharge to the aquatic environment. 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.

#	BAT Conclusion	How met or reference
		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: • Waste in the Facility will be stored in an enclosed bunker area under negative pressure. The extracted air will be used as combustion air for incineration. • The operation of the Facility will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to the Facility. • Odour will be controlled during shutdown periods by minimising the amount of waste in storage. Waste will be run-down prior to periods of planned maintenance. In addition, doors to the 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 substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	Gaseous wastes and liquid wastes will not be accepted at the Facility. Therefore, the requirements of BAT 22 do not apply to the Facility.
23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the EMS the following diffuse dust emission management features:	There will 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	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 24 do not apply.

#	BAT Conclusion	How met or reference
	use an appropriate combination of the techniques as given in BAT 24 of the BREF.	
25	In order to reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 25 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air: • Bag filters – to reduce particulate content of the flue gas. • Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of lime to abate acid gases. The concentrations of metals and metalloids will be monitored in accordance with the EP for the Facility. It is considered by Medway Energy Recovery Limited 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: • Wet scrubber; • Semi-wet absorber; • Dry sorbent injection; • Direct desulphurisation (only applicable to fluidised beds); and • Boiler sorbent injection. In a dry sorbent injection system, the reagent is injected into the flue gas stream within the flue gas treatment system, located after the boiler. In direct boiler sorbent injection, the reagent is injected directly into the flue gas stream within the boiler. This only achieves partial abatement of the acid gases and does not eliminate the need for additional flue gas cleaning stages. 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.

#	BAT Conclusion	How met or reference
		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. The design of the dry sorbent injection system will include the following controls to ensure that the Facility operates in accordance with the relevant ELVs: • A flue gas monitoring system at the exit of the boilers to control reagent dosing rate within the flue gas treatment system; and • Recirculation of a proportion of the flue gas treatment residues to reduce reagent consumption. It is considered by Medway Energy Recovery Limited 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: • The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment, including automated reagent dosage. • A proportion of the APC residues will be recirculated to reduce the amount of unreacted reagent in the residues. • The concentrations of HCl, HF and SO_2 released from the Facility will comply with BREF limits. The techniques listed above to reduce channelled peak emissions to air of acid gases will ensure that the Facility will comply with the requirements of BAT 28.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR	The following elements have been incorporated into the design of the Facility: • Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14);

#	BAT Conclusion	How met or reference
	and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	• An SNCR system; and • Optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip). 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. As justified in section 2.6.2 of the Supporting Information, flue gas recirculation is not currently proposed in the design of the Facility however this will be examined during the detailed design stages. With regards catalytic filter bags, these have the potential to reduce emissions of dioxins and furans, as well as NOx when used in combination with a source of ammonia. It is stated within the BREF that the temperature of the flue gas when entering the filter bags should be above 170 – 190°C for effective destruction of dioxins and furans, and above 180 – 210°C for the effective destruction of NOx. However, the temperature of flue gases at the boiler exit is expected to be approximately 150°C, and further down the process (after FGT and when leaving the stack) the flue gases are expected to be at a temperature of approximately 140°C, as stated within the Air Quality Assessment submitted with the application. Therefore, the flue gases would not be at a high enough temperature for treatment in catalytic filter bags regardless of what stage in the FGT process they are used. It could be possible to reheat the flue gases to the appropriate temperature for treatment in catalytic filter bags; however, this would require an additional energy source, making the Facility less efficient overall.
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;	The Facility will employ the following techniques to reduce channelled emission to air of organic compounds: • Optimisation of the incineration process – the boilers will be designed to minimise the formation of dioxins and furans as follows: • Minimise residence time in critical cooling section to avoid slow rates of combustion gas cooling, minimising the potential for 'de-novo' formation of dioxins and furans.

#	BAT Conclusion	How met or reference
	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.	• Apply CFD modelling to the design where appropriate to ensure gas velocities are in a range that negates the formation of stagnant pockets/low velocities. • Minimise volume in critical cooling sections. • Prevent boundary layers of slow-moving gas along boiler surfaces via good design and regular maintenance. • Online and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler. • Dry sorbent injection using activated carbon and lime, in combination with a bag filter. The concentrations of dioxins and furans released from the Facility will comply with BREF limits. As described above, it can be confirmed that the Facility will use techniques (a) – (d) and also technique (e), dry sorbent injection, to reduce channelled emissions to air of organic compounds. The Facility will not use catalytic filter bags. The Facility will utilise the injection of ammonia in an SNCR system to abate NOx emissions. This is considered to be a proven method to reduce NOx emissions to below the required ELVs and has been successfully used on a number of plants in the UK and Europe. It should be noted that catalytic filter bags are generally used as a replacement for other filter bags which may already absorb dioxins by the injection of activated carbon, as is proposed for the Facility. The removal of activated carbon injection from the process may result in an increase in mercury emissions to air. Therefore, the use of catalytic filter bags may require additional abatement techniques to be installed for the removal of mercury. This is not considered to represent BAT for the Facility. It is stated within the WI BREF that the flue gas temperature when entering the catalytic filter bags should be above 170 – 190°C in order to achieve effective destruction of PCDD/F and prevent adsorption in the media. As stated in the air quality assessment (refer to Appendix E), the temperature of the flue gas leaving the stack is expected to be approximately 140°C. Therefore, the use of catalytic filter bags is not considered to be appropriate for the design of the Facility, as the flue gases would require re-heating which will reduce the efficiency of the process.

#	BAT Conclusion	How met or reference
		The techniques described above to reduce channelled emission to air of organic compounds will ensure that the Facility will comply with the requirements of BAT 30. Therefore, the Facility will meet the requirements of BAT 30 without the use of catalytic filter bags.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility in combination with a bag filter. It is considered by Medway Energy Recovery Limited that the use of these techniques will ensure that the Facility will comply with the requirements of BAT 31.
32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	There will be separate foul/domestic water, process water and surface water drainage systems at the site. Further information on the drainage arrangements is presented within section 1.4.6. An indicative water flow diagram depicting the segregation of different water streams for the Facility is presented in Appendix A. It is considered by Medway Energy Recovery Limited that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility will comply with the requirements of BAT 32.
33	In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce water usage and prevent wastewater generation: • Use of a flue gas treatment system that does not generate wastewater – by utilising dry sorbent injection of lime and PAC. • Where practicable process effluents will be re-used within the process. Excess amounts of process effluent (which will rarely be generated) will be tankered off-site for treatment at a suitably licensed waste management facility. It is considered by Medway Energy Recovery Limited 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. Technique (d) of BAT 33 relates to dry bottom ash handling. As described and justified within the response to BAT 20(i) above, dry bottom ash handling is not considered to represent BAT for the site.

#	BAT Conclusion	How met or reference
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 and treatment 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/treatment. 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 treatment/handling. Therefore, it is considered by Medway Energy Recovery Limited that the site will comply with the requirements of BAT 34.
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, Medway Energy Recovery Limited considers that the Facility will comply with the requirements of BAT 35.
36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 36 do not apply.
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: • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. • Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Waste deliveries will take place primarily during daytime hours.

#	BAT Conclusion	How met or reference
		• Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level. • Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. • Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. Refer to the Noise Assessment presented in Appendix C for further details on noise mitigation measures proposed for the site. It is considered by Medway Energy Recovery Limited 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

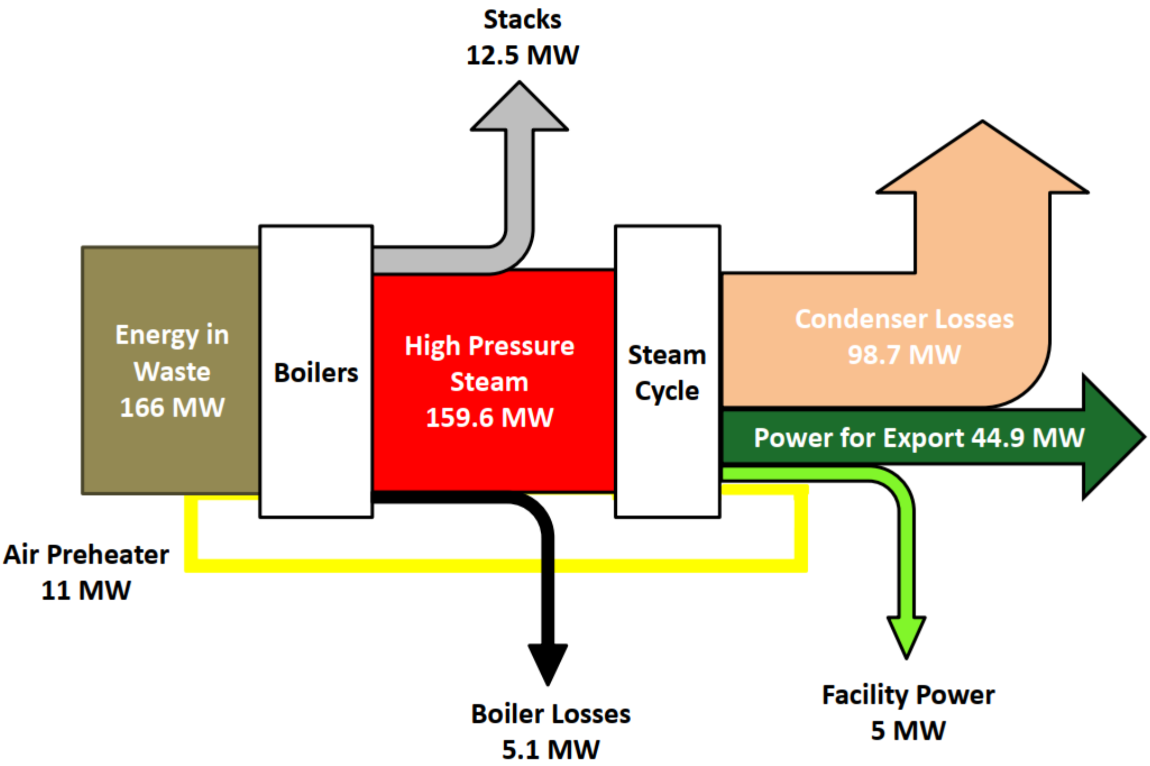
The Facility will utilise boilers which will generate steam used to supply a turbine to generate electricity. The Facility will generate power for export to the local electricity distribution network via a transformer which increases the voltage to the appropriate level. The Facility also has the potential 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 3.



Based on the nominal design capacity of the ERF - No Heat Export

Figure 3 - Indicative Sankey Diagram - No heat export case

As described within the CHP-ready assessment (Appendix G), the Facility will have the capacity to export up to approximately 15 MWth of heat.

The thermal capacity of the Facility is 166 MWth. Assuming electricity-only mode, the Facility will generate up to 49.9 MWe of electricity. The Facility will have a parasitic load of approximately

5 MWe. Therefore, the Facility is designed to export approximately 44.9 MWe. Taking this into consideration, the gross electrical efficiency of the Facility will be approximately 30.1%.

As stated previously, the Facility will process approximately 456,000 tpa of waste, assuming an NCV of 10.5 MJ/kg and an availability of 8,000 hours per annum. This equates to an approximate hourly throughput of 28.5 tph per line. Assuming this availability, the Facility will annually generate approximately 399,200 MWh and export approximately 359,280 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	MWh/t	0.79	0.6 – 0.9	Waste Incineration BREF
Internal power consumption, design capacity	MWh/t	0.09	0.06 – 0.19	Waste Incineration BREF
Power generation (assumed gross)	MWe	10.9	5 – 9	EPR5.01

Therefore, the Facility will comply with all of the relevant benchmarks for energy efficiency required by the Waste Incineration BREF.

2.8.2.1 Energy consumption and thermal efficiency

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

- primary and secondary combustion air fans;
- Induced Draft fans;
- boiler feed water pumps;
- ACC fans;
- air compressors;
- waste 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:

- The boilers will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste that is combusted;
- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- Low grade heat will be extracted from the turbine and used to preheat combustion air in order to improve the efficiency of the thermal cycle;

- Steady operation will be maintained as required by using auxiliary fuel firing; and
- Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

Due consideration will be given to the recommendations 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 will 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, Medway Energy Recovery Limited 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. Medway Energy Recovery Limited intends 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.

Medway Energy Recovery Limited does not intend to separate ferrous metals from the bottom ash stream on site but does intend to separate oversize items. As such, an oversize separator will be required at the exit of the vibrating conveyor. Furthermore, storage will be required on site for oversize items separated but awaiting collection.

A conveyor will be used to transport the IBA to the ash storage area following removal of oversize items.

2.9.2 Air Pollution Control residues

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

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

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

APCr is classified as hazardous (due to its elevated pH) and requires specialist landfill disposal or treatment. Medway Energy Recovery Limited 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 Medway Energy Recovery Limited will continue to explore alternative options for the treatment of APCr throughout the lifetime of the Facility.

APCr will be removed from site in enclosed tankers thereby minimising the chance of spillage and dust emissions. During the tanker filling operation, displaced air released to the atmosphere would first pass through a fabric filter.

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 14.

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
Incinerator Bottom Ash (IBA)	Grate ash (mixed with boiler ash). This ash is relatively inert, classified as non-hazardous.	The facility will have a dedicated IBA storage area for IBA, with a roll on-roll off container to store oversize items. The IBA storage area will be sized to contain up to 5 days of IBA.	102,000 tpa (wet) at design point	To be transferred off-site for processing and recycling into secondary aggregate.
Air Pollution Control residues (APCr)	Ash from flue gas treatment, may contain some unreacted lime.	Residue will be stored in two sealed silos, total capacity of 730 m^3, adjacent to the FGT equipment.	19,400 at design point	Residue will be transported by road in a sealed tanker to an appropriate treatment or disposal facility.

3 Additional information

3.1 Management

3.1.1 Introduction

Medway Energy Recovery Limited 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 plant takeover.

As part of its ongoing commitment to sustainable and responsible development and to regulatory compliance, Medway Energy Recovery Limited 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 to meet the requirements of the BS EN ISO 14001:2015 Environmental Management System Standard.

A site-specific EMS will be developed following detailed design, which will contain a set of procedures describing how pollution risk will be minimised from the activities to be undertaken at the site. The EMS will be certified to the ISO 14001 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. Medway Energy Recovery Limited regards the ISO 14001 certification to be of considerable importance and relevance to a waste treatment site. It is 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 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;
- Health and Safety Procedures; and
- An operational guidance manual which will include process plant operating procedures for both standard and emergency conditions.

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

3.1.2.1 Scope and structure

The scope of the ISO 14001 certification for the site will cover three key areas. These are:

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

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

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

- an environmental policy;
- identification of potential environmental impacts;
- documented procedures to control operations that may have an adverse impact on the environment;
- ensuring adequate responsibility, authority and resources to management necessary to support the EMS;
- defined procedures for identifying, reviewing and prioritising items of plant and equipment for which preventative maintenance regimes are appropriate;
- 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);
- documented procedures for monitoring relevant emissions or environmental impacts;
- establishing performance indicators to measure the effectiveness of the procedures;
- monitoring, measuring and analysing the procedures for effectiveness; and
- implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

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.

Medway Energy Recovery Limited will adapt and extend the scope of the current environmental policies for each company that make up the joint venture. The resulting environmental policy will act as a commitment to continual improvement of Medway Energy Recovery Limited's operations including a commitment to comply with relevant legislation.

3.1.2.3 Site operations

The Facility will operate as an Energy Recovery Facility, with the main activity being undertaken the incineration of non-hazardous waste to recover energy.

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*':

- buildings and any other main constructions such as security fences;
- storage facilities for hazardous materials (oil or fuel tanks), chemical stores, waste materials;
- the location of items for use in accidents and emergencies, such as spill kits;
- entrances and exits for use by emergency services;
- any points designed to control pollution (e.g., containment facilities or penstock valves);
- effluent or water discharge points;
- areas vulnerable to pollution such as watercourses, adjacent industrial premises etc;
- drainage facilities; and
- 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 waste and other residues/wastes

Upon completion of detailed design of the site, a waste/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 waste storage areas. General information in relation to waste storage at the site is set out as follows:

- Five days fuel storage will be provided for the RDF waste using a bunker with a 12 m depth and a 30 m bunker span (from tipping wall to back of bunker).
- Flue gas treatment residue will be stored using 2 silos with a total volume of 364 m^3 which providing a five day storage capacity.

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:

- 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.
- Records will be kept of any maintenance carried out on plant and machinery.

3.1.2.7 Personnel

Medway Energy Recovery Limited 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 'Plant' or 'General' Manager for each component at the site will have overall responsibility for management of the facility and compliance with the EP. The Plant Manager will have extensive experience relevant to their responsibilities.
- The 'Operations' Manager(s) will have day-to-day responsibility for the operation of each component, 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.
- The '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.
- The 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 (electricians/fitters/crane operatives) or technical engineers (control and plant). In addition to the above, roles could include site fitters, security officers, engineers, technicians, administrators, weighbridge operatives, shift leaders, crane operatives, site operatives etc.

3.1.2.8 Competence, training and awareness

Medway Energy Recovery Limited 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:

- awareness and importance of regulatory implications of the EP for the activities and operations undertaken at the site;
- awareness of potential environmental effects from operation under normal and abnormal circumstances (e.g., periods of shutdown);
- awareness of the need to report any significant deviations from the EP;
- prevention of accidental emissions and action to be taken when accidental emissions occur and
- 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. Medway Energy Recovery Limited 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

Medway Energy Recovery Limited 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:

- the Environmental Policy;
- the requirements of the EP;
- the Health and Safety Policy and Procedures; and
- the 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

Medway Energy Recovery Limited 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 5.1.2.1, 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:

- the likelihood of the accident happening;
- the consequences of the accident happening;

- proposed measures to be taken to avoid the accident happening; and
- 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:

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

Copies of any approved plans (such as the fire prevention plan and dust management 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.

A hard copy of the EMS will be kept at the gatehouse, with electronic copies of the EMS and supporting documents (including records) 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:

- breakdown scenarios;
- enforced shutdowns;
- planned shutdowns; and
- 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:

- the EP holder’s name;
- an emergency contact name and telephone number;
- a statement that the site is permitted by the Environment Agency;
- the EP number; and
- 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:

- comprehensive description of each component at the site including operating hours and design details;
- as-built drawings of the site;
- maintenance and service plans;
- staffing and staff responsibilities;
- waste acceptance and pre-acceptance procedures;
- waste storage and handling procedures;
- copies of any guaranties/warranties/certificates; and
- 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:

- the level of planned and lifecycle maintenance;
- the continued supply of waste; and
- the development of alternative methods competing for the same waste 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,Medway Energy Recovery Limited 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:

- underground pipework to be avoided except for supply and discharge utilities such as towns water, sewerage lines and gas supply;
- safe removal of all chemical and hazardous materials;
- adequate provision for drainage, vessel cleaning and dismantling of pipework;

- disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, release of dust or other hazardous substance;
- where practicable, the use of construction material which can be recovered (such as metals);
- methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater; and
- soil and groundwater sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report and any ongoing monitoring undertaken during operation of the 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 list of recyclable materials/components and current potential outlet sources;
- a list of materials/components not suitable for recycle and potential outlet sources;
- a list of materials to go to landfill with current recognised analysis, where appropriate;
- a list of all chemicals and hazardous materials, location and current containment methods; and
- 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

Medway Energy Recovery Limited 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, Medway Energy Recovery Limited will comply with the typical Pre- Operational Conditions which will be included for this type of installation, as follows:

- Submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non-Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx) emissions. The report will also confirm and justify the selection of the reagent to be used within the SNCR system. This will include provision of procedures for the safe handling and management of the reagent.
- 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.
- 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.
- 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.
- 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 MedwayOne Energy Hub, Medway Energy Recovery Limited will comply with the typical Post-Commissioning Conditions which will be included for this type of installation, as follows:

- Submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non-Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx) emissions.
- 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.
- Provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the PM10 and PM2.5 ranges from the MedwayOne Energy Hub. The report will detail a timetable for undertaking the tests and producing a report on the results.
- 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.
- Submit a written report to the EA on the commissioning of the MedwayOne Energy Hub. 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 consent

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