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Consulting Engineers Limited

Tees Valley Energy Recovery Facility

Viridor Tees Valley Ltd

EP Application Supporting Information

ENGINEERING + CONSULTING

Document approval

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Contents

1 Introduction

Viridor Tees Valley Ltd (Viridor) is developing the Tees Valley Energy Recovery Facility (herein referred to as the 'Tees Valley ERF' or 'Facility') to incinerate incoming non-hazardous residual waste. The Facility will be located at the site of a former British Steel works in Grangetown, a large industrial brownfield site in Redcar and Cleveland Borough Council in an area known as Grangetown Prairie.

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. In section 1, an overview of the Facility is provided. In section 2, further information and detail on the Facility is provided, mostly in response to specific questions raised in the application forms.

1.1 The Applicant

Viridor is one of the UK's leading recycling, resource and waste management companies. Viridor provides a range of recycling and waste management solutions to transform domestic and commercial waste and recyclables into high quality raw materials and renewable energy, in turn contributing to the improvement of the UK's resource efficiency.

Viridor currently operate ten operational Energy Recovery Facilities (ERF's) which recover energy from residual waste streams. Viridor is the largest operator of ERF's within the UK and has invested over £1.2 billion in the development of a network of advanced ERFs across the UK, which reduce the country's reliance on landfill or export of waste. These facilities include the Beddington, Cardiff and Runcorn ERF's.

1.2 The Site

The Facility will be located on land within the South Tees Development Corporation (STDC) area, which comprises 4,500 acres (1,800 hectares) of land that forms part of the STDC Regeneration Master Plan.

The ERF will occupy a 25-acre (10 hectare) site situated at the southwestern corner of the STDC area, within the Grangetown Prairie Zone. The site lies 1.2km south of the River Tees and approximately 4 miles to the northeast of Middlesbrough Town centre. The Facility will be located at an approximate national grid reference NZ 54436 21340.

The Facility is bounded to the north by the main Middlesbrough to Redcar railway line, to the east by the site of Lackenby steel works, to the south by industrial units and beyond them the A66 road and to the west by various industrial units. Access to the site will be via a new site access on the corner of Eston Road that will serve a new internal highway network for the Grangetown Prairie plots. This access will be constructed as part of the enabling works for all development plots by STDC. The site is brownfield land which has been cleared and was once dominated by industrial buildings at the heart of the steel making industry on Teesside. Some industrial buildings /plant still surround the Grangetown Prairie site on its south, east and western boundaries.

A site location plan and installation boundary drawing are presented in Appendix A.

1.3 The Activities

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

1. a twin-line waste incineration plant processing waste which is delivered to the Facility from off-site via road;
2. generation of power for export to the National Grid and the potential to export heat;
3. production of an inert bottom ash material that will be transferred off-site to a suitably licensed waste treatment facility for recovery/disposal; and
4. generation of an air pollution control residue that will be transferred off-site to a suitably licensed hazardous waste facility for disposal or recovery.

Table 1 lists the Schedule 1 and directly associated activities which are proposed at the Facility.

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)	Line 1 – The incineration of non-hazardous waste in a waste incineration plant with a capacity of 3 tonnes per hour or more	From receipt of waste to treatment and emission of exhaust gas and disposal of any residues arising. Waste types as specified in Table 5.
Installation	Section 5.1 Part A(1) (b)	Line 2 – The incineration of non-hazardous waste in a waste incineration plant with a capacity of 3 tonnes per hour or more	From receipt of waste to emission of exhaust gas and disposal of waste arising. Waste types as specified in Table 5.
Directly associated activities			
Directly Associated Activities		Energy generation	Generation 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		Waste reception area	The receipt, handling and bulking for transfer off-site of non-hazardous waste.
Directly Associated Activities		A medium combustion plant comprising a 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).

Type of Activity	Schedule 1 Activity	Description of Activity	Limits of specified activity
Directly Associated Activities		Surface water management	From collection of uncontaminated surface water drainage to the discharge to drainage pond and SUDS.

The Facility will include the following key components: waste reception and storage; water, fuel oil and air supply systems; furnaces; boilers; steam turbine/generator set; facilities for the treatment of exhaust or flue gases; on-site facilities for storage of residues and wastewater; flues with associated stack; and devices and systems for controlling combustion operations and recording and monitoring combustion conditions.

The firing diagram for the Facility which is presented within Appendix A. At the nominal design point, the Facility is capable of processing 26.3 tonnes per hour of waste per line with an NCV of 10.25 MJ/kg. On this basis, the nominal design capacity of the Facility is approximately 430,000 tonnes per annum (tpa)with an availability of approximately 8,147 hours.

The technology supplier has advised that long term the operation of the boiler can be sustained at 110% of the design fuel throughput, i.e. 29 tonnes per hour per line. Therefore, allowing for the maximum theoretical availability (i.e. 8,760 hours per annum) at the design point, the Facility is capable of processing a total of approximately 510,000 tonnes per annum. However, this does not account for periods of start up, shut down and other periods of non-availability. Allowing for these periods, Viridor would expect that the maximum capacity of the Facility to be approximately 495,000 tonnes per annum.

1.4 The Facility

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

The Facility includes two waste incineration lines, waste reception (or ‘tipping hall’), waste bunker, turbine hall, air cooled condensers, boiler hall including boilers and FGT system, ash handling/storage facility, and an 80 m stack.

In addition, the Facility will include the following infrastructure:

1. 5 weighbridges (3 ‘in’ and 2 ‘out’ weighbridge);
2. Offices, control room and staff welfare facilities;
3. Site fencing, security barriers, gates and landscaping;
4. Drainage infrastructure;
5. Lighting and CCTV;
6. External hard standing areas for vehicle manoeuvring/parking;
7. Internal access roads and car parking;
8. Reagent and raw material tanks and silos;
9. Residue silos and storage areas;
10. Transformer and sub-station enclosure; and
11. Fire water tank and water treatment plant.

The Facility will have a design capacity (combined thermal boiler capacity) of approximately 150 MWth. The Facility has been designed to export power to the National Grid. The Facility will generate approximately 48.2 MWe of electricity in full condensing mode at the design point (with average ambient temperature). The Facility will have a parasitic load of approximately 10% (approximately 4.6 MWe). Therefore, the export capacity of the Facility, with average ambient temperature, will be approximately 43.6 MWe.

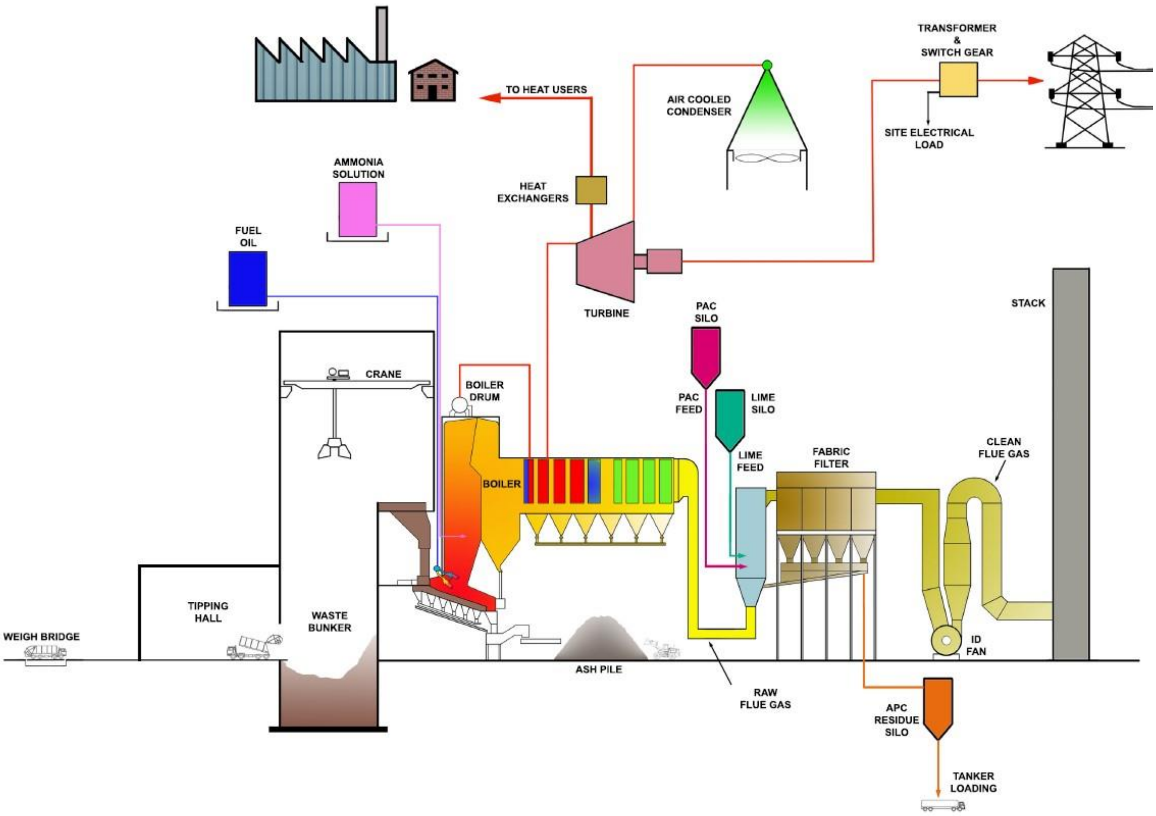
As the waste quality will fluctuate, and if heat is exported from the facility to local heat users in the future, the power exported will fluctuate. The power exported will also fluctuate depending on ambient temperatures.

The Facility will be constructed as 'CHP Ready' and will have the capacity to export up to 12 MWth of heat, subject to technical and economic feasibility. The CHP assessment (refer to Appendix G) has identified that there are opportunities to export an annual average net load of up to approximately 5.5 MWth, with a peak load of 12 MWth to potential heat users. The amount of heat exported will depend on the demand of the heat users and will be subject commercial agreements with the potential heat users.

'Enabling' heat off-take equipment would be installed as part of the Facility. Should a contract(s) be agreed with the potential heat user(s), heat export infrastructure will be installed (comprising of a feed pipe and a return pipe).

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

Figure 1: Indicative Schematic of the Waste Incineration Process



1.4.1 Raw materials

All incoming waste will be delivered to the Facility by road. The Facility will also use consumables including lime, activated carbon, ammonia solution, auxiliary fuel (fuel oil), water treatment chemicals and various maintenance materials (oils, greases, insulants, antifreezes, welding and firefighting gases etc).

Waste will be stored within a dedicated waste bunker. Allowing for stacking within the bunker, the waste storage capacity of the bunker will be equal to approximately 7 – 8 days of waste processing capacity, equivalent to around 10,185 tonnes (or 30,625 m^3). However, allowing for extended periods of shutdown, the maximum amount of time that waste will be stored in the bunker is 4 weeks.

All consumables (lime, ammonia solution and activated carbon) will be delivered to the Facility by road.

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

1.4.2 Combustion process

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

The furnaces will be designed to ensure that the exhaust gases are raised to a minimum temperature of 850°C, with a minimum of 2 seconds flue gas residence time at this temperature to ensure the destruction of dioxins, furans, PAHs and other organic compounds. An adequate air supply will also be maintained to give the correct volume of oxygen for optimum combustion. The main source of airflow will be controlled through the grates. Gas temperatures will be continually monitored and recorded, and audible and visible alarms will trigger in the control room if the temperature starts to fall towards 850°C. However, a drop in temperature below 850°C rarely occurs. The control system will regulate combustion conditions and control the boilers.

Primary combustion air will be drawn from the waste bunker area to maintain negative pressure in this area with the extracted air being 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. Both primary and secondary air will be regulated by a combustion control system.

Ammonia solution will be injected into the high temperature region of the boilers, as part of the SNCR de-NOx system. The ammonia reacts with the oxides of nitrogen formed in the combustion process forming water, carbon dioxide and nitrogen. By controlling the dosing rate of ammonia introduced into the gas stream, the concentration of NOx will be reduced to achieve the proposed emission limits.

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

1.4.3 Energy recovery

The heat released by the combustion of the waste will be recovered by means of steam boilers, which are integral to the furnaces and will produce (in combination with superheaters) high pressure superheated steam at approximately 430 – 440°C and approximately 65 bar(a). As the Facility comprises a twin line system there will be two boilers working in parallel. The steam from the boilers will then feed a high-efficiency steam turbine which will generate at the design point, with average ambient temperature, approximately 48.2 MWe. The turbine will have a series of extractions at different pressures that will be used for preheating air and water in the water/steam cycle. The site electrical (parasitic) load will be approximately 4.63 MWe, assuming no heat is exported, resulting in approximately 43.6 MWe of power available for export at the design point.

The remainder of the steam left after the turbine will be condensed back to water to generate 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 and from there again as feedwater to the closed-circuit pipework system to the boilers.

The Facility will have the capacity to export up to 11.55 MWth of heat to local heat users, with an average net heat load of approximately 5.46 MWth. Dependent on the requirements of 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.

A number of potential heat users have been identified for the export of heat from the. However, at this stage, there are no formal contracts in place with potential heat users. Whilst such export of heat would reduce the electrical output of the installation, the net effect would be to increase the overall thermal efficiency of the Facility.

1.4.4 Flue gas treatment

The flue gas treatment system will consist of the following:

- selective non-catalytic reduction (SNCR);
- lime and activated carbon injection (dry system);
- a fabric filter; and
- flue gas recirculation (FGR)

The abatement of oxides of nitrogen (NOx) will be achieved by careful control of combustion air and an SNCR system. An adequate supply of primary air will be maintained to give the correct volume of oxygen for optimum combustion. Oxygen will be monitored, alongside the temperature in the primary combustion chamber. The combustion control systems will maintain stable combustion conditions within the boiler; therefore, optimising the combustion process. In addition, the combustion chamber will be provided with low-NOx auxiliary burners which will be initiated if the temperature within the combustion chamber falls below the required levels.

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

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

After NOx abatement and heat recovery, lime and powdered activated carbon (PAC) will be injected into the flue gases upstream of the fabric filter in order to abate acidic gases, heavy metals and any remaining dioxins and furans. The lime will abate the emission of acidic components, including hydrogen fluoride, hydrogen chloride and sulphur dioxide, via neutralisation reactions. The activated carbon will abate emissions of volatile metals (mercury), organic compounds and dioxins and furans. The lime and activated carbon will be stored in separate silos adjacent to the FGT system, with the lime dosing rate 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 via the same injection points.

Following the injection of lime and activated carbon, the flue gas will then pass through a bag/fabric filter arrangement, which will remove the particulates, reaction products and unreacted reagent solids, collectively known as Air Pollution Control residues (APCr). The APCr cakes the outside of the filter bags with the units being periodically cleaned by a reverse jet of air, displacing the filtered solids into chutes beneath them and recycling a proportion of the APCr back into the flue gas stream, to minimise the consumption of reagent, with the remainder transferred to the APCr silo.

The bag filter arrangement will be divided into separate compartments to allow for maintenance. There will be online monitoring of the pressure drop within bag filter compartments to identify when there has been bag filter failure. If a pressure drop is identified, bag filter compartments will be isolated to prevent uncontrolled emissions and repaired before being brought back on-line. The plant would be capable of operating at full capacity with one compartment off-line whilst maintenance activities are being undertaken. Spare bags / plugs will be held on site and installed when a failure occurs.

Bag filters will be subject to regular preventative maintenance to assess wear and tear and will be replaced on a periodic basis to minimise the risk of failure.

The cleaned flue gas will be monitored for pollutants and discharged to atmosphere via an 80 m stack.

1.4.5 Ash handling

The 'main' residue produced by the Facility will be bottom ash, which is the burnt-out residue from the combustion process. Bottom ash is collected at the end of the combustion grate and the bottom ash ejector will include a water quench. 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 and to ensure an airtight seal to the furnaces to avoid air ingress to the combustion chamber from the boiler house. Boiler ash, the ash fraction that collects within a boiler, will also be conveyed to the discharger, and will mix with the bottom ash within the quench to form the residue known as Incinerator Bottom Ash (IBA).

The quenched ash will be transferred, via inclined conveyor, to the ash storage area with capacity for the storage of approximately 7 days storage capacity. There will be regular collections of IBA from the IBA storage area for transfer off-site to a suitably licensed waste facility. Ash will be transferred to vehicles for transfer off-site using a front-end loader. Ash handling will be undertaken within enclosed buildings, with the ash maintained wet from quenching to prevent the release of dust emissions off site. In addition, any overflow from the ash quench system will be contained in the process effluent drainage system, and hence there will not be any release to water of effluent from the ash quench system.

1.4.6 Site drainage

1.4.6.1 Surface water

Surface water run-off from buildings, roadways and areas of hardstanding will be discharged into the site surface water drainage system.

The site surface water drainage system will convey the surface water to the surface water attenuation storage system via petrol interceptors. The surface water will then be discharged off-site via the drainage pond and sustainable urban drainage system (SuDS). The surface water drainage system will be fully segregated from any foul or process water systems.

The surface water attenuation storage system will comprise the following:

- lined pond; and
- lined below-ground attenuation tank.

The capacity of the attenuation storage system is subject to the detailed design of the drainage systems; however, it is expected that it will require between 2,284m^3 and 3,312m^3 of storage volume. This has been designed in accordance with SUDS requirements and will allow for a 1 in 100-year 24-hour storm event (inclusive of a 40% allowance for climate change) without causing any surface flooding on the site.

The benefits of a 'hybrid' approach for the attenuation storage is that utilisation of the pond will be maximised to serve all impermeable areas in close proximity where connections can be achieved by gravity. The tank will then be used to serve areas of the site that are further away, and will be connected to the pond.

The surface water drainage system will be installed with a penstock valve or similar which will prohibit the discharge of contaminated surface water offsite in the event of a fire or other emergency.

During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of the surface water attenuation storage. This will minimise the potential for damage during operation of the Facility.

Regular preventative maintenance as part of documented management systems at the site will ensure that the integrity of both the surface water attenuation storage and the penstock valve is maintained throughout the lifetime of the Facility. Preventative maintenance will include for periodically emptying the surface water attenuation storage facilities and undertaking visual inspections of the material from which they are constructed. Should it be identified that damage has occurred to the structures, repairs will be undertaken to ensure that integrity is suitably maintained.

In addition to the above, rainwater harvesting will be incorporated into the design of the Facility. It is proposed for rainwater from building roofs to 'top up' the process water demand (e.g. for the ash quench).

Additional SUDS features may be incorporated into the surface water systems as part of the detailed design stage for the Facility.

1.4.6.2 Process effluents

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 ash handling facility and waste reception areas.

Where practicable process effluents will be re-used within the process. Process effluents will be stored within a process water tank or similar prior to reuse and recycling within the process. In the unlikely event that excess process effluents are generated, such as during emptying of the boilers, these will require discharge. It is intended to tanker these off-site for treatment at a suitably licensed waste management facility.

The exact type of structure will be confirmed during the detailed design of the Facility; however, it can be confirmed that the material from which the process effluent tank/pit will be constructed will be impermeable to the liquids that are being stored.

During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of the tank/pit. This will minimise the potential for damage of the tank/pit during operation of the Facility.

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

The tank/pit will be designed with a leak detection system, in addition to the preventative maintenance described above. This will include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc – to be confirmed during detailed design.

1.4.6.3 Foul water

It is proposed to treat foul effluent from domestic facilities in a wastewater treatment plant at the site. The treated effluent will then be discharged to foul sewer. Any excess wastewaters that are generated will be tankered off-site for treatment at a suitably licensed waste management facility.

1.4.7 Emissions monitoring and stack

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

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

- particulates;
- sulphur dioxide;
- hydrogen chloride;
- carbon monoxide;
- nitrogen oxides;

- 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)[1];
- nitrous oxide;
- dioxins and furans;
- dioxin-like PCBs; and
- PAHs.

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 environmental permit.

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

1.4.8 Ancillary operations

The Facility will require a top-up water supply of approximately 8.5 m^3 per hour. The primary requirement of mains water is to maintain the water level in the boiler system (steam cycle) and cool down the boiler blow-down water. A water treatment plant will produce high quality demineralised make-up water for the boilers. Various chemicals would be required for the demineralisation process and for boiler water dosing.

Water for firefighting will be stored in a firewater storage tank with a duty electric pump and standby diesel pump.

Auxiliary burners, fired on low sulphur fuel oil, will support start up and shutdown operations by raising the temperature of the furnaces during start up and maintaining required temperatures during shutdown periods.

One emergency diesel generator will be provided at the site to enable safe shut-down of the Facility in the event of a loss in grid connection. The diesel generators would only be expected to operate for short-term periods (i.e. <50 hours per year) for testing purposes. It is expected that the diesel generator will have a capacity of around 9 MWth (3MW_e).

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

In the event that the waste bunker does not have available capacity for the receipt of waste, an area of the building, adjacent to the Tipping Hall, is provided for the receipt, handling and bulking for transfer off-site of non-hazardous waste. The incoming waste will be temporarily held in this area until sufficient quantity has been accepted to transfer off-site to a suitably licensed Facility. This area will be emptied and cleaned down on a daily basis.

[1] Subject to agreement with the Environment Agency.

2 Other information for application form

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. Information on the potential environmental impact of the primary raw materials is included in Table 3.

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

Schedule 1 Activity	Material	Estimated storage capacity [m^3]	Estimated annual throughput [tonnes per annum] at design capacity	Description
Primary Raw Materials				
Section 5.1 Part A (b)	Low sulphur fuel oil	155	100*	Fuel for auxiliary burners
	Ammonia solution	42	4,250	Ammonium hydroxide, estimated 25% concentration
	Lime	420	8,750	Calcium hydroxide, $Ca(OH)_2$
	Activated carbon	75	125	Powdered
	Water treatment chemicals	N/A – various storage facilities	<50	E.g. oxygen scavenger, pH corrector, corrosion inhibitor. Types to be confirmed during detailed design.
**Assuming 4 start ups each year*				

Table 3: Raw materials and their effect on the environment

Product	Chemical Composition	Estimated annual consumption (tpa)	Relative impact (%)			Impact Potential	Comments
			Air	Land	Water		
Low sulphur fuel oil	-	100	100	0	0	Low impact	Auxiliary fuel for start-up and shutdown of the Facility.
Ammonia solution	$NH_4(OH)$	4,250	100	0	0	Low impact	Reacts with oxides of nitrogen to form nitrogen, carbon dioxide and water vapour. Any unreacted ammonia (a chemical intermediate) is released to atmosphere at low concentrations.
Lime	$Ca(OH)_2$	8,750	0	100	0	Low impact	Lime is injected and removed with the APC residues at the bag filter and disposed of as hazardous waste (or alternatively treated and recovered) at a suitable licensed facility.
Activated Carbon	C	125	0	100	0	Low impact	Injected carbon is removed with the APC residues at the bag filter and disposed of as hazardous waste (or alternatively treated and recovered) at a suitable licensed facility.
Boiler water Treatment Chemicals	Oxygen scavenger, pH control, descaler etc	<50	0	0	100	Low impact	E.g. hydrochloric acid, caustic soda, boiler water dosing chemicals will be used for the demineralized water production and for the treatment of the boiler feedwater. Specific substances to be confirmed during detailed design of the water treatment plant.

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

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

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

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

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

2.1.2 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 the 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. 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 as well as areas of hardstanding. 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 will 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 fuel oil 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 fuel oil 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 extended to 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.

2.1.2.2 Storage of reagents/raw materials

A range of chemical substances and hazardous materials associated with the process, including ammonia solution, fuel oil / heating gasoil, lime and activated carbon, will be stored at the site. These materials will be stored in accordance with current guidance.

All liquid chemicals (including ammonia solution and fuel oil) and raw materials will be stored within a tank in a dedicated storage area, with secondary containment such as bunding. Bulk storage tanks will be bunded to 110% of the tank's capacity; therefore, minimising the risk of any fugitive emissions from leaks whilst the liquids are stored within the tanks. Good design of pipework and regular preventative maintenance will allow for the safe transfer of liquids to their point of use.

Lime and activated carbon, used within the flue gas treatment process, will be stored within separate storage silos located within the building adjacent to 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 pipe work system. Lime and activated carbon will be dosed into the flue gas treatment process with separate dosing controls.

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.

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 section 2.2 of 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 eliminated by the BAT assessment in Appendix F section 2.1. Therefore, the two alternative reagents for a dry system – lime and sodium bicarbonate – have been assessed further.

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

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

Table 4: Acid gas abatement BAT data

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

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

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

- 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 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 almost 60% higher.

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

2.1.3.2 NOx abatement

The SNCR system can be operated with dry urea (prills), urea solution or ammonia solution. There are advantages and disadvantages with all options:

- dry urea is safer to handle than ammonia; however, once the ammonia solution is in the storage tank no further handling is required;
- ammonia tends to give rise to lower nitrous oxide formation than urea, hence urea may have a worse climate impact;
- dry urea needs big-bag handling whereas urea and ammonia solution can be delivered in tankers and stored in bulk storage tanks; 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 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 (gas oil) / heating gasoil; or
3. natural gas.

Auxiliary burner firing on a well-managed waste combustion plant is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to 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 location of the site to the Middlesbrough to Redcar railway line, LPG is not considered to be a suitable auxiliary fuel for the Facility due to the potential for explosion risk.

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. When firing, this requires large volumes of gas which would be needed to be supplied from a gas main within a reasonable distance from the Facility. Given the small overall gas consumption expected, limited site space and fuel oil having the dual benefit of being used for auxiliary firing and also for fuelling site mobile equipment, 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 gas storage and pipework. The combustion of fuel oil will lead to some emissions of sulphur dioxide, but these emissions will be minimised as far as reasonably practicable through the use of low sulphur fuel oil.

Taking the above into consideration, low sulphur fuel oil or heating gasoil is considered to represent BAT for auxiliary firing at the Facility.

2.2 Incoming waste management

2.2.1 Waste to be processed in the Facility

The Facility will process incoming waste with the European Waste Catalogue (EWC) Codes presented in Table 5.

Table 5: Waste to be processed in the Facility

EWC Code	Description of Waste
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING**
02 01	**Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 02	animal-tissue waste
02 01 03	plant-tissue waste which is otherwise unsuitable for composting or anaerobic digestions
02 01 04	waste plastics (except packaging)
02 01 07	wastes from forestry
02 01 09	agrochemical waste other than those mentioned in 02 01 08
02 03	**wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation**
02 03 04	materials unsuitable for consumption or processing
02 05	**wastes from the dairy products industry**
02 05 01	materials unsuitable for consumption or processing
02 06	**wastes from the baking and confectionery industry**
02 06 01	materials unsuitable for consumption or processing
02 06 02	wastes from preserving agents
03	**WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD**
03 01	**wastes from wood processing and the production of panels and furniture**
03 01 01	waste bark and wood
03 01 05	sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04

EWC Code	Description of Waste
03	**WASTE FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD**
03 03	**Wastes from pulp, paper and cardboard production and processing**
03 03 01	Waste bark and wood
03 03 07	Mechanically separated rejects and pulping of waste paper and cardboard
03 03 08	Waste from sorting of paper and cardboard destined for recycling
04	**WASTES FROM THE LEATHER, FUR AND TEXTILES INDUSTRIES**
04 02	**Wastes from the textiles industry**
04 02 09	Wastes from composite materials, (impregnated textile, elastomer, plastomer)
04 02 10	Organic matter from natural products (for example grease, wax)
04 02 21	Wastes from unprocessed fibres
04 02 22	Wastes from processed fibres
07	**WASTES FROM ORGANIC CHEMICAL PROCESSES**
07 02	**wastes from the MFSU of plastics, synthetic rubber and man-made fibres**
07 02 13	waste plastic (which is not suitable for recycling)
09	**WASTES FROM THE PHOTOGRAPHIC INDUSTRY**
09 01	**wastes from the photographic industry**
09 01 07	photographic film and paper containing silver or silver compounds
09 01 08	photographic film and paper free of silver or silver compounds
09 01 10	single-use cameras without batteries
12	**WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS**
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastics**
12 01 05	plastics shavings and turnings (which are not suitable for recycling)
15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	**Packaging (excluding separately collected municipal packaging waste)**
15 01 01	Paper and cardboard packaging (which is contaminated and not suitable for recycling)
15 01 02	Plastic packaging (which is contaminated and not suitable for recycling)
15 01 03	Wooden packaging
15 01 05	Composite packaging
15 01 06	Mixed packaging
15 01 09	Textile packaging
15 02	**Absorbents, filter materials, wiping cloths and protective clothing**
15 02 03	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02

EWC Code	Description of Waste
16	**WASTES NOT OTHERWISE SPECIFIED IN THE LIST**
16 01	**End-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**
16 01 19	Plastic (which is contaminated and not suitable for recycling)
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 02	**Wood, glass and plastic**
17 02 01	Wood
17 02 03	Plastic (which is contaminated and not suitable for recycling)
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03
18	**WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (except kitchen and restaurant wastes not arising from immediate health care)**
18 01	**wastes from natal care, diagnosis, treatment or prevention of disease in humans**
18 01 04	wastes whose collection and disposal is not subject to special requirements in order to prevent infection(for example dressings, plaster casts, linen, disposable clothing, diapers)
18 01 07	chemicals other than those mentioned in 18 01 06
18 01 09	medicines other than those mentioned in 18 01 08
18 02	**wastes from research, diagnosis, treatment or prevention of disease involving animals**
18 02 03	wastes whose collection and disposal is not subject to special requirements in order to prevent infection
18 02 06	chemicals other than those mentioned in 18 02 05
18 02 08	medicines other than those mentioned in 18 02 07
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 02	**wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)**
19 02 03	Premixed wastes composed only of non-hazardous waste
19 02 10	Combustible wastes other than those mentioned in 19 02 08 and 19 02 09
19 03	**stabilised/solidified wastes**
19 03 05	stabilised wastes other than those mentioned in 19 03 04
19 03 07	solidified wastes other than those mentioned in 19 03 06
19 05	**Wastes from aerobic treatment of solid waste**
19 05 01	Non-composted fraction of municipal and similar wastes
19 05 02	Non-composted fraction of animal and vegetable waste

EWC Code	Description of Waste
19 05 03	Off specification compost
19 06	**wastes from anaerobic treatment of waste**
19 06 04	digestate from anaerobic treatment of municipal waste which is unsuitable for land spreading
19 06 06	digestate from anaerobic treatment of animal and vegetable waste which is unsuitable for land spreading
19 08	**wastes from waste water treatment plants not otherwise specified**
19 08 01	screenings
19 10	**wastes from shredding of metal-containing wastes**
19 10 04	fluff-light fraction and dust other than those mentioned in 19 10 03
19 08	**Wastes from waste water treatment plants not otherwise specified**
19 08 14	Sludges from other treatment of industrial waste water other than those mentioned in 19 08 13
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 not suitable for recycling)
19 12 04	Plastic and rubber (which is contaminated and not suitable for recycling)
19 12 07	Wood other than that mentioned in 19 12 06
19 12 08	Textiles
19 12 10	Combustible waste (refuse derived fuel)
19 12 12	Other wastes (including mixtures of materials from mechanical treatment of wastes other than those mentioned in 19 12 11)
20	**MSWS (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**Separately collected factions (except 15 01)**
20 01 01	Paper and cardboard (which is contaminated and not suitable for recycling)
20 01 08	Biodegradable kitchen and canteen waste
20 01 10	Clothes
20 01 11	Textiles
20 01 25	Edible oil and fat
20 01 28	Paints, inks, adhesives and resins other than those mentioned in 20 01 27
20 01 30	Detergents other than those mentioned in 20 01 29
20 01 32	Medicines other than those mentioned in 20 01 31
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 38	Wood other than that mentioned in 20 01 37
20 01 39	Plastics (which is contaminated and not suitable for recycling)
20 02	**Garden and park wastes (including cemetery waste)**
20 02 01	Biodegradable waste

EWC Code	Description of Waste
20 02 03	other non-biodegradable wastes
20 03	**Other MSWs**
20 03 01	Mixed MSW
20 03 02	Waste from markets
20 03 03	Street cleaning residues
20 03 06	Waste from sewage cleaning
20 03 07	Bulky waste
20 03 99	MSWs not otherwise specified

2.2.2 Waste handling

2.2.2.1 Waste acceptance and pre-acceptance procedures

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 Facility. Viridor would propose to provide the EA with a summary of the documented procedures prior to commencement of operation, as typically required for permits of this nature.

The pre-acceptance and acceptance checks on wastes being delivered to the Facility are completed to ensure that it is in accordance with the waste descriptions, specifications and EWC codes within the EP. 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 specifications.

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 permit 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, this will be a mixture of RCV's and bulk waste delivery vehicles. Checks will be made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed will be accepted. The 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, the waste delivery vehicles will then be weighed again upon exit from the Facility in order to determine the mass of waste that has been delivered to the Facility.

The tipping hall will incorporate up to 11 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 shredder will be located adjacent to the waste bunker, and will be used to break up larger/bulkier items which are unsuitable for loading into the feed hoppers/feeding chutes. It is expected that the shredder will have a maximum processing capacity of 25 tonnes of waste per hour, and will operate up to 8 hours each day. 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.

In the event that the waste bunker does not have available capacity for the receipt of waste, an area of the building, adjacent to the Tipping Hall, is provided for the receipt, handling and bulking for transfer off-site of non-hazardous waste. The incoming waste will be temporarily stored in this area until sufficient quantity has been accepted to transfer off-site to a suitably licensed Facility.

The waste bunker is designed to allow for back-loading of waste in the event of unplanned periods of prolonged shutdown. A hatch will be installed to the side of the waste bunker for the removal of the waste. The crane maintenance arrangement will be used as a back-loading facility to remove any oversized items or non-combustible items within the waste bunker. 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 will 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. furnace conditions;
4. flue gas treatment control; and
5. waste management.

All of these techniques meet the Indicative BAT requirements from EPR5.01 and the 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 waste deliveries within the waste bunker will improve the homogeneity of the waste input to the furnaces.

The shredder will be used to break up larger/bulkier items which are unsuitable for loading into the feed hoppers/feeding chutes.

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 have been designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling will be avoided via boiler design to ensure the residence time is minimised in the critical cooling section and to avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans. The boiler will be designed so that the steam/metal heat transfer surface temperature will be above a minimum of 170°C, where the flue gas is in the de novo synthesis temperature range.
- The residence time and temperature profile of flue gas will be considered during the detailed design phase to ensure that dioxin formation is minimised.
- It is reported in the guidance that the injection of ammonia compounds into the furnaces – i.e. an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction. An SNCR system to abate emissions of NOx is considered to represent BAT for the Facility, refer to section 2.6.2.
- Computational Fluidised Dynamics (CFD) will be applied to the design, where considered appropriate, to ensure gas velocities are in a range that negates the formation of stagnant pockets / low velocities. A copy of the CFD model will be supplied to the EA prior to

commencement of commissioning. It is proposed that this is provided in accordance with a pre-operational condition.

- Minimising the 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 good waste mixing, 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 cleaning systems installed within the boiler which will remove boiler ash which accumulates within the boiler. The boiler cleaning systems will be designed to remove boiler ash from the surfaces within the boiler when it is in operation. The exact specifications of the boiler cleaning systems will be subject to the detailed design of the Facility; however, it is expected that these will include the following elements:

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.

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

2.2.3.5 Flue gas treatment control – acid gases

Close control of the flue gas treatment system will minimise the consumption of reagents and quantities of APCr generated.

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 dosing controls.

2.2.3.6 Flue gas treatment control – NOx

The SNCR system will require the injection of ammonia solution, into the radiation zone of the boilers at several levels.

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 Environmental Permit.

2.2.3.7 Waste management

The arrangements for the management of residues produced by the installation are presented in section 2.9. In particular, bottom ash 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. Auxiliary burners fired with light 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 the operators will be required to prohibit the waste charging and feeding systems.
- The isolation doors that prevent the fire burning back up the chute will be double doors and/or have a cooling system, to prevent the ignition of waste in contact with the outside of the door;
- Following loading into the feeding chutes by the grab, the waste will be transferred onto the grates by hydraulic powered feeding units;
- The backward flow of combustion gases and the premature ignition of waste will be prevented by keeping the chutes full of waste and by keeping the furnaces under negative pressure;
- A level detector will monitor the amount of waste in each feed chute and an alarm will be sounded if the fuel falls below the safe minimum level. Secondary air will be injected from

nozzles in the wall of the furnaces to control the combustion within the furnaces (flame height and directions of air/flame flow); and

- In a breakdown scenario, operations will be reduced or closed down as soon as practicable until normal operations can be restored.

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

2.3 Water use

2.3.1 Overview

The main use of water at the 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 be tankered off-site to a suitably licensed waste management facility.
- 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 drainage system via silt traps and oil interceptors where appropriate, prior to the attenuation storage systems. The attenuation storage, subject to detailed design, will restrict surface water runoff generated from roofs and hardstanding prior to infiltration to ground.
- The Facility will employ rainwater harvesting. It is proposed for rainwater from building roofs to 'top up' the process water demand (e.g. for the ash quench).
- Firewater will be provided by an on-site water tank connected to the mains water supply.
- The Facility will have separate process water, foul water and surface water systems.

An indicative water flow diagram for the Facility is presented in Figure 2 below. A larger version of this drawing is included within Appendix A.

2.3.1.1 Potable and Amenity Water

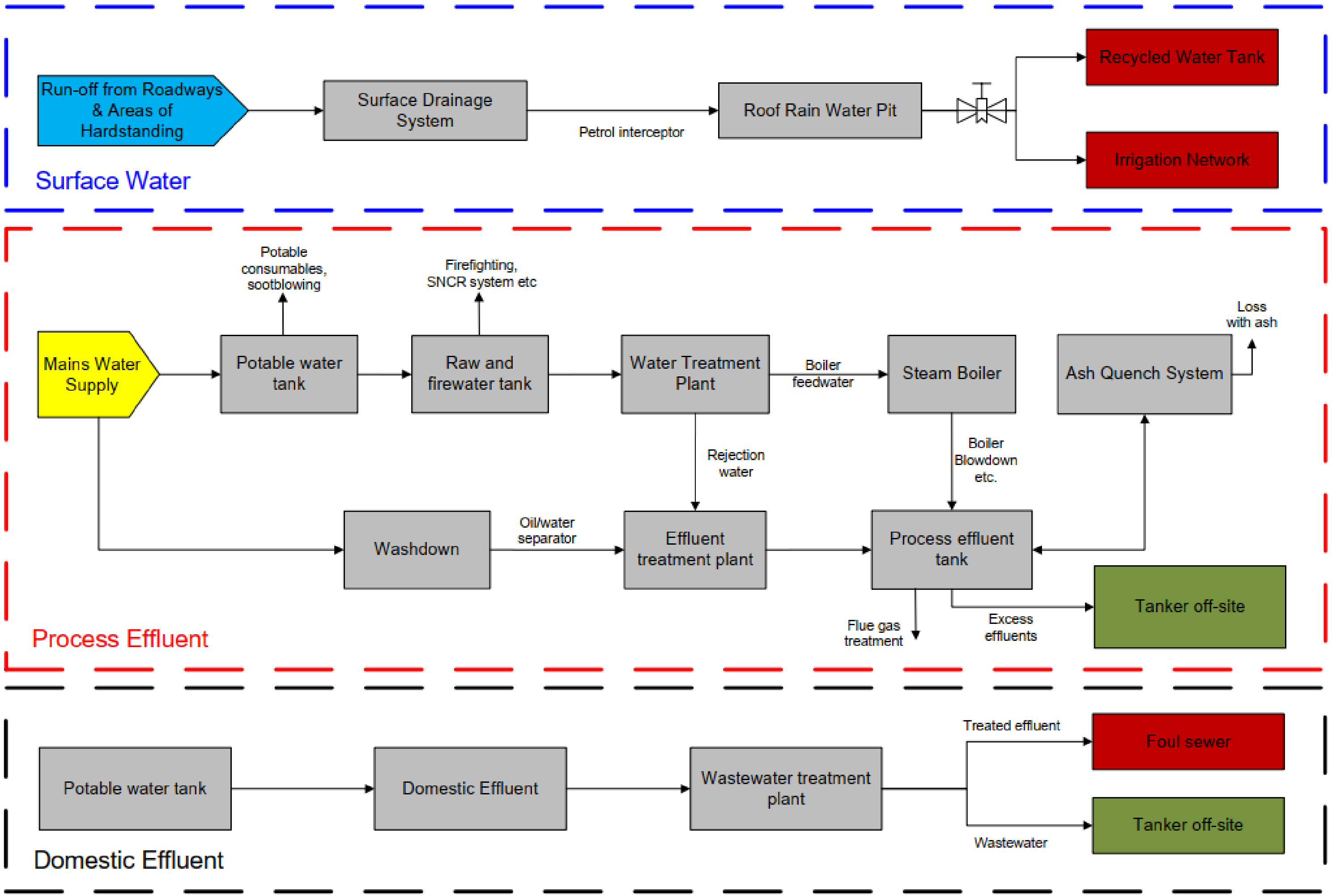
Water for drinking supplies for the offices and welfare facilities will come from a potable water supply. The quantity of this water is expected to be small compared to the other water uses on site.

Wastewater and domestic effluents from showers, toilets, and other mess facilities will be treated in an on-site package treatment plant prior to discharge.

2.3.1.2 Process Water

All process waters will be supplied by mains water. 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 8.5 m^3 per hour of mains water.

Figure 2: Indicative water flow diagram



2.4 Emissions

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

Table 6: Proposed emission points

Emission Point Reference	Source
Emissions to air	
A1	Air emissions stack
A2	Emergency diesel generator exhaust
A3	Diesel fire pump
Emissions to water	
W1	Surface water drainage system to storm sewer
W2	Surface water drainage system to storm sewer
Emissions to sewer	
S1	Domestic/foul effluent to foul sewer

The arrangements for the discharge of surface water and treated domestic effluents are subject to detailed design of the Facility. The emissions point drawing in Appendix A may be updated to reflect the 'as built' emissions points following completion of detailed design of the drainage systems.

2.4.1 Point source emissions to air

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

Table 7: Proposed emission limit values (ELVs)

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit	Periodic Limit – Reference period
Emission Points A1 and A2					
Particulate matter	mg/Nm^3	30	5		
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10		
Hydrogen chloride	mg/Nm^3	60	6		
Carbon monoxide	mg/Nm^3	150*	50		
Sulphur dioxide	mg/Nm^3	200	30		
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	100		
Ammonia	mg/Nm^3		10		
Hydrogen fluoride	mg/Nm^3			1	

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit	Periodic Limit – Reference period
Cadmium & thallium and their compounds (total)	mg/Nm^3			0.02	Average of three consecutive measure-ments of at least 30 minutes each
Mercury and its compounds	mg/Nm^3			0.02	
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3			0.3	
Dioxins & furans	ng I-TEQ $/Nm^3$			0.04	Periodic over minimum 6 hours, maximum 8 hour period
Dioxin & furan-like PCBs	ng WHO-TEQ/Nm^3			0.06	
Emission Points A3 and A4					
No emission limits are proposed.					
All expressed at 11% oxygen in dry flue gas at standard temperature and pressure. **Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24 hour period.*					

The BAT Reference Document on Waste Incineration (herein referred to as the Waste Incineration BREF) and the European Union Commission Implementing Decision (EU) 2019/2010 dated 12 November 2019 (establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration) were published in December 2019. Therefore, in accordance with the Waste Incineration BREF, the Facility will be required to comply with the BAT-AELs, for a 'new' facility, from commencement of operation.

The emission limits being applied for are in accordance with the upper end of the BAT-AEL ranges for a 'new' facility, with the exception of the long-term emission limit for NOx, where a lower emission limit of 100 mg/Nm^3 has been applied for.

2.4.2 Fugitive emissions to air

2.4.2.1 Waste handling and storage

Waste reception, handling and storage will be undertaken in enclosed areas, with the waste reception area held under negative pressure, to prevent the release of litter and dusts. Fast-acting roller shutter doors will be in place at the entrance to the tipping hall. Good housekeeping will also be employed at the Facility to minimise the build up of dust and litter (such as regular washdown activities).

Primary combustion air will be drawn from the waste bunker area to maintain negative pressure in the waste bunker area and fed into the combustion chamber beneath the grates. Additional bunker management procedures, and the inclusion of regular clean downs of the waste reception areas, will minimise the release of litter and dusts.

Bottom ash would first be dampened and cooled using a water quench prior to discharge/storage. This highly reduces the likelihood of dust being generated. Mobile plant (e.g. bucket loaders) and vehicle operators 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. It is expected that there will be a wheel wash facility (e.g. pressure washer) in the bottom ash storage area to prevent dust/ash being tracked across the site. Furthermore, during prolonged periods of dry weather, the site roads will be damped down / washed to minimise the potential for fugitive dust impacts as required.

2.4.2.2 Silos

All silos will be fitted with bag filter protection to prevent the uncontrolled release of dusts during refilling activities.

Maintenance procedures will be developed for routine inspection and testing of the bag filters.

The APCr silos will be unloaded by a chute system. All unloading operations will be supervised by site operatives. Dusty air from the unloading of the APCr silos will be extracted and vented to atmosphere via bag filters fitted to prevent the release of dusts from silo unloading operations.

The unloading chute from the APCr silo will be designed with an inner core, which will be used for the unloading of APCr of the silo, and an outer 'bellow' which will extract displaced air from the silo and pass it through a filter with the air subsequently vented back into the silo.

The site operatives will assist the delivery driver in positioning the tanker underneath the loading chute. The delivery driver will be responsible for connecting the unloading chute to the tanker. Site operatives will be responsible for checking that the loading chute is closed following completion of unloading and will be required to clear up any spilled material. Cleaning of the tanker will be prohibited outside the enclosed loading area. The APCr unloading area will have a dedicated drainage system, with all runoff/leachate diverted to the process effluent tank.

2.4.2.3 Additional measures to minimise fugitive dust emissions

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

Process effluent from the Facility will not be discharged to water. In the event that excess process effluents are generated, these will be tankered off site.

All bottom ash handling arrangements (including loading of ash into vehicles for transfer off-site) will be undertaken within enclosed buildings and on areas of hardstanding, preventing the release of any process water from the ash handling and quench system to the site surface water drainage system. All containers or vessels used for the transfer of ash off-site will be sealed or covered to prevent the release of dust or excess water when in transport.

Surface water run-off from buildings, roadways and external areas of hardstanding will be discharged into the surface water drainage system. The surface water drainage system will discharge, via petrol interceptors, into attenuation storage prior to discharge to storm sewer. In the case of a fire or a significant spill occurring at the Facility, an isolation valve will prohibit the discharge of contaminated effluent to sewer.

It is proposed to treat foul effluent from domestic facilities in a wastewater treatment plant at the site prior to discharge to foul sewer. Any excess wastewaters from the wastewater treatment plant will be tankered offsite.

2.4.4 Contaminated water

In the event of a fire, contaminated water used for fighting fires will be collected through the site drainage systems. Although the site drainage systems are subject to detailed design, it is anticipated that the primary source of firewater containment will be the waste bunker. Site drainage for external areas will be fitted with an isolation valve to prevent the discharge of contaminated water from the surface water drainage system in the event of a fire. Sufficient storage capacity for external firewater will be available from both site kerbing and the SUDS attenuation storage. Regarding firewater into the foul drainage system, an isolation valve will be installed in the foul manhole upstream of the drainage pond to prevent contaminated firewater infiltration into the ground. These are identified in the Fire Prevention Plan (Appendix H).

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 recycled water tank or similar via an oil/water separator and effluent treatment plant 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.

Any spillage that has the potential to cause environmental harm or to leave the installation will be reported to the site management and recorded in accordance with installations inspection, audit and reporting procedures. The relevant regulatory authorities (Environment Agency / Health and Safety Executive) will be informed if required in accordance with the Facility’s documented management procedures.

Maintenance procedures will be developed for the inspection of 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.

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. 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 Noise

2.4.5.1 General considerations

The design layout and design measures have been considered to minimise the noise impacts associated with the design of the Facility.

Most of the 'noisy' plant items at the Facility will be installed within the main building and equipped with appropriate noise insulation. The air-cooled condensers will be designed to reduce noise and tonal components. If steam bursting discs or pressure relief valves release externally to the building they will be fitted with appropriate silencers. Doors to the building will be kept closed when not in use in order to minimise off-site noise impacts, with the doors to the tipping hall and turbine acoustically rated to appropriate levels. Doors to the tipping hall will be fast-acting roller shutter doors, which would close after a delivery vehicle has entered the tipping hall. On average, it is expected that the doors to the tipping hall would be open for less than 1 minute to allow a vehicle to enter the tipping hall.

Vehicle movements at night will be limited where possible and vehicles will be fitted with non-tonal reversing alarms. A one-way system will be in place for HGVs and waste delivery vehicles will only reverse once inside the tipping hall. Regular maintenance of plant items will be undertaken in accordance with preventative maintenance procedures.

Any mobile plant to be used on-site will be operated and maintained in accordance with the manufacturer's instructions, whilst complying with the latest standards including those on noise emissions. Mobile plant would be fitted with broadband noise type reversing alarms. Broadband noise type alarms contain a mixture of tones that do not stand out as discrete noise pulses and are at frequencies that are attenuated to over a greater distance. The mobile plant is expected to operate mostly within the process buildings, which will provide some level of attenuation. As such, the operation of the mobile plant within the process buildings is not expected to provide a significant contribution to the noise impacts of the Facility.

Noise level checks will be carried out regularly in operational areas where high noise levels may be present, with early warning of increasing noise levels resulting in a noise reduction or mitigation program. It is assumed that the frequency of noise level checks will be daily in the main process areas.

2.4.6 Odour

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

2.4.6.1 Delivery and storage of waste

If waste delivered to the Facility is not in accordance with the relevant EWC Codes or description of the waste, it will not be accepted at the Facility and will be diverted to an alternative waste treatment facility.

Waste will be delivered to the Facility in enclosed or otherwise covered vehicles, to prevent fugitive emissions of odour during transport. Doors to the tipping hall will be fast-acting roller shutter doors, which will close once a delivery vehicle has entered the tipping hall. This will minimise the time in which they are open and so reduce the potential for fugitive emissions of odour to be released from the building.

All wastes received at the Facility will be unloaded and stored within the enclosed waste reception area. The waste reception area will be retained at negative pressure using forced draught fans located above the bunker. The fans will draw air from the waste reception area into the furnace to be used as combustion air within the process. Negative pressure within the waste reception area will minimise odorous emissions (as well as dust and litters) from escaping the Facility. It is not expected that both incineration lines will be shut down at the same time at any point during the year, as planned maintenance of each line will be undertaken in succession. However, in the very unlikely event that both lines are shutdown due to an unplanned event, waste will be backloaded from the bunker and transferred off-site should odour be deemed a potential issue. If required, additional odour abatement can be achieved through the use of an odour abatement system, described in further detail below.

The waste reception area will provide for the receipt, handling and bulking for transfer off-site of non-hazardous waste. The incoming waste will be temporarily held in this area until sufficient quantity has been accepted to transfer off-site to a suitably licensed Facility. This area will be emptied and cleaned down on a daily basis.

2.4.6.2 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 extended, 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 test' and inspection around the boundary of the Facility would be conducted. In the unlikely event that odour is detected outside the building or if odour complaints are received from neighbours, full odour surveys would be undertaken. If it is deemed appropriate, operating procedures would be amended to deal with any issues identified at the site.

2.4.6.3 Bunker management

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 fuel, which would increase fuel efficiency in the incineration process. During periods of shutdown, the bunker management procedures would not normally be implemented, to avoid the generation of odorous emissions especially when waste volumes within the bunker are low.

Prior to periods of planned maintenance, bunker management procedures will reduce the amount of material in the bunker before shutdown. In the event of an extended unplanned shutdown, 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.

Should odour be deemed an issue, for example during periods of shutdown, an odour abatement system will be employed, described as follows. During extended periods of planned and unplanned shutdown an atomisation or 'deodorising' system will be employed, to manage emissions of odour from the Facility. Should odour be detected, a deodorising substance (to be confirmed following detailed design) would be discharged into the atmosphere at the source of the odour, to mix or chemically react with odorous components. The deodorising substance would be delivered through a misting system, where chemicals are first diluted with water and then ejected through nozzles.

2.5 Monitoring methods

2.5.1 Emissions monitoring

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

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

The purpose of monitoring has three main objectives:

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

2.5.1.1 Monitoring emissions to air

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

1. carbon monoxide;
2. hydrogen chloride;
3. sulphur dioxide;
4. oxides of nitrogen;
5. ammonia;
6. volatile organic compounds (VOCs); and
7. particulates.

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

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

1. hydrogen fluoride;
2. group 3 heavy metals [antimony (Sb), arsenic (As), lead (Pb); chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V)];
3. cadmium (Cd) and thallium (Tl);
4. mercury (Hg);
5. nitrous oxide;
6. dioxins and furans;
7. dioxin like PCBs; and
8. PAHs.

The Waste Incineration BREF requires the continuous monitoring of mercury. However, it states that for plants incinerating wastes with a proven low and stable mercury content, continuous monitoring may be replaced by periodic monitoring once every six months. In accordance with its Implementation Document, the EA will allow 'new plants' which can demonstrate that emissions of mercury are ‘low and stable’ to implement periodic monitoring techniques for emissions of mercury. Taking this into consideration, Viridor is applying for the periodic monitoring of mercury, and demonstrating that emissions of mercury are ‘low and stable’ via an Improvement Condition or similar.

The Waste Incineration BREF also requires continuous monitoring of hydrogen fluoride; however, it is stated that this may be replaced by periodic monitoring if hydrogen chloride levels are proven to be sufficiently stable. Viridor considers that the proposed techniques for the abatement of acid gases (refer to section 2.2.3.5) will ensure that emissions of hydrogen fluoride are ‘stable’. On this basis, Viridor is applying for the periodic monitoring of hydrogen fluoride.

The frequency of periodic measurements will comply with the IED as a minimum. The flue gas sampling techniques and the sampling platform will comply with Environment Agency Technical Guidance Notes M1 and M2. Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations.

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. The CEMs will be supplied with remote access to allow service engineers to provide remote diagnostics.

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 will be retained for inspection.

2.5.1.2 Monitoring emissions to water and sewer

Under normal operation, there will be no emissions of process effluent from the Facility. In the unlikely event that excess process effluents are generated, it is intended to tanker these off-site for treatment at a suitably licensed waste management facility. Therefore, it is not currently proposed to undertake monitoring of process effluents.

Uncontaminated surface water run-off will be discharged to sustainable urban drainage system (SuDS) via attenuated storage. It is not proposed to undertake monitoring of uncontaminated surface water.

Foul/domestic effluent from welfare facilities will be treated in a wastewater treatment plant before being discharged to foul sewer. Monitoring may be undertaken in accordance with any discharge consents if required by the Sewerage Undertaker. However, this is subject to the detailed design of the Facility and progression of the drainage systems.

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;
- fuel 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 of the bottom ash.

During the operational phase, the temperature at the 2-seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes 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 will 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 exits of the Facility will be monitored and controlled to ensure that there will always be adequate oxygen for complete combustion of combustible gases. Oxygen concentration will be controlled by regulating the combustion airflows and the waste feed rate.

2.6 Technology selection (BAT)

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

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

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 initial qualitative assessment.

2.6.1 Combustion technology

It is proposed that the waste treatment/energy recovery technology for the Facility will utilise two moving grate furnaces. The moving grates will comprise of inclined fixed and moving bars that will move the fuel from the feed inlets to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

The Waste Incineration BREF and the BREF for Large Combustion Plants identify a number of alternative technologies for the combustion of waste fuels. The suitability of these technologies 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 fuels, 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 fuel from the feed inlet to the residue discharge. The grate movement turns and mixes the fuel along the surface of the grate to ensure that all fuel is exposed to the combustion process.

   Grate systems are designed for large quantities of heterogeneous waste and so would be appropriate for the fuel to be processed at the Facility.

2. **Fixed hearth**

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

3. **Pulsed hearth**

   Pulsed hearth technology has been used for waste fuels, such as those proposed in the Facility, as well as other solid wastes. However, there have been difficulties in achieving reliable and effective burnout of the 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 waste, but they have not been used in the UK for large volumes of waste derived fuels.

   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.

   In addition, typical oscillating kiln units have a maximum processing capacity of approximately 8 tonnes per hour; therefore, the Facility would require around 6 kilns to attain the maximum throughput. Considering the proposed capacity of the Facility, this is considered impractical and would lead to significant efficiency losses. Therefore, rotary kilns have not been considered further.

5. **Fluidised bed combustor**

   Fluidised beds are designed for the combustion of relatively homogeneous fuel. Therefore, fluidised beds are appropriate for waste which has been pre-processed to produce a pre-processed waste fuel. The waste delivered to the Facility would require further processing to ensure that it is suitable to be combusted in a fluidised bed.

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

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

6. **Pyrolysis/Gasification**

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

   Various suppliers are developing pyrolysis and gasification systems for the incineration of waste fuels such as that proposed for the Facility, however, systems such as these are not considered to be a robust and proven technology for the treatment of residual MSW and C&I waste at the proposed waste processing capacity for the Facility. Therefore, these systems have not been considered any further.

A quantitative BAT assessment for combustion technologies has been undertaken and is presented in Appendix F, section 2. The conclusions of the assessment are summarised in Table 8.

Table 8: BAT assessment – combustion techniques

Parameter	Units	Grate	Fluidised bed
Global warming potential	t CO2 eq p.a.	-126,900	-125,400
Ammonia consumption	t.p.a.	4,300	3,500
Residues (total ash)	t.p.a	116,289	120,869
Annual total materials cost	p.a.	£6,220,000	£6,660,000

Parameter	Units	Grate	Fluidised bed
(reagents plus residues)			
Annual power revenue	p.a.	£19,494,000	£19,226,000

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

The material costs are approximately 7% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue. It is acknowledged that it is marginal. The grate system will be able to process the varying waste composition compared to a fluidised bed system which requires a consistent and homogenous fuel and therefore requiring additional treatment of the waste.

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

2.6.2 NOx abatement 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

It is currently assumed that the Facility will not employ FGR. However, this is subject to detailed design of the Facility.

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

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

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

2. SNCR

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

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

SNCR is widely deployed across waste, 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.

3. **SCR**

In this technique, the NOx abatement reagent is injected into the flue gases immediately upstream of a reactor vessel containing layers of catalyst. The reaction is most efficient in the temperature range 200 to 350°C. The catalyst is expensive and to achieve a reasonable working life, it is necessary to install the SCR downstream of the flue gas treatment plant. This is because the flue gas treatment plant removes dust which would otherwise cause deterioration of the catalyst.

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

Whilst SCR systems can achieve low concentration of NOx, SCR systems are often seen as considerably more complicated and more capital intensive than SNCR systems.

A quantitative BAT assessment of the available technologies has been undertaken and is presented in Appendix F, section 3. This assessment uses data obtained by Fichtner from a range of different projects using the technologies proposed in this application.

Table 9: BAT assessment – NOx abatement

Parameter	Units	SNCR	SCR	SNCR + FGR
NOx released after abatement	t p.a.	240	190	240
NOx abated	t p.a.	620	670	530
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq p.a.	-9,200	-7,200	-9,200
Global Warming Potential	t CO2 p.a.	1,400	5,300	1,900
Ammonia used	t.p.a.	4,250	2,000	3,630
Annualised Cost	£ p.a.	£845,000	£3,018,000	£1,004,000
Cost per tonne NOx abated	£ p.t NOx.	£1,360	£4,470	£1,890

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

1. increases the annualised costs by approximately £2,060,000;
2. abates an additional 50 tonnes of NOx per annum;
3. reduces the benefit of the facility in terms of the global warming potential by approximately 3,900 tonnes of CO_2;

4. reduces reagent consumption by approximately 2,250 tonnes per annum; and
5. costs an additional £3,300 per additional tonne of NOx abated compared to SNCR.

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

Including FGR to the SNCR system to abate NOx increases the cost per tonne of NOx abated by approximately 40%. 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 580 tonnes per annum.

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

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

Dry and semi-dry systems can easily achieve the BAT-AEL emission limits required by the Waste Incineration BREF and both systems have been demonstrated to achieve the proposed emission limits on operational plants in the UK and Europe. Furthermore, both are considered to represent BAT by EPR5.01. The advantages and disadvantages of each technique are varied which makes assessment complex; therefore, the assessment methodology described in Horizontal Guidance Note H1 has been used and is detailed in Appendix F section 4.

A quantitative assessment of the available technologies for the abatement is acid gases is presented in Table 10.

Table 10: BAT assessment – acid gas abatement

Parameter	Units	Dry	Semi-dry
SO_2 abated	t.p.a.	1,120	1,120
Photochemical Ozone Creation Potential (POCP)	t-ethylene eq	340	340

Parameter	Units	Dry	Semi-dry
Global Warming Potential	tn-CO_2 eq p.a.	4,800	10,100
Additional water required in a semi-dry system	t.p.a.	-	36,000
APC residues	t.p.a.	7,800	7,500
Annualised cost	£ p.a.	£9,679,000	£10,162,000

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

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

2.6.4 Particulate matter abatement

The Facility will use a multi-compartment fabric filter for the control of particulates. There are a number of alternative technologies available, but none offer the performance of the fabric filter. Fabric filters represent BAT for this type of thermal treatment plant 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 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. It can be confirmed that no bypass will be used within the flue gas treatment process.

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 Table 12.

2.6.5 Steam condenser

There are three potential BAT solutions considered in EPR 5.01 as representing indicative BAT 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 Facility is the River Tees which lies approximately 1.2km to the northwest of the Facility. In addition, the Darlington to Saltburn Network Rail Line and potential new industrial developments lie in-between the Facility and the River. As such, the required groundworks (including culverts for the flow from and return of water to the river) required to enable water cooling would be significant. Furthermore, the cost associated with the use of potable water within water cooling systems is significant. Therefore, water cooling is not considered to be an 'available' technology for the Facility.

Evaporative condenser systems use water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling. They also require large volumes of water. Evaporative condenser systems can create a visible plume from the condenser which will have a visual impact. Objections may be raised to plume formations, and it is not possible to eliminate the risk of a plume even with hybrid cooling towers. As stated above, an 'available' source for the abstraction and discharge of cooling water has not been identified. Taking this into consideration, alongside the potential for the generation of a visible plume, the use of evaporative condenser systems is not considered to represent BAT for the Facility.

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

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

2.6.6 Odour Abatement Technology

The EA H4 guidance on odour identifies the following techniques for the abatement of odour:

1. adsorption;
2. dry chemical scrubbing;
3. wet chemical scrubbing;
4. biological treatment;
5. thermal treatment;
6. odour modification systems;
7. ozone treatment;
8. condensation;
9. open systems; and
10. new systems.

The guidance considers that, for very odorous air, it is common to use a combination of these methods. However, considering that odour from the Facility is not expected to be a significant issue, and that combination systems can be expensive and complex requiring significant maintenance, it is proposed to use a single abatement technique – odour modification systems.

Odour modification systems discharge additional substances into the atmosphere which mix or chemically react with the odorous components, and result in a more acceptable, or less intense, odour. Depending on the variation of such systems, the additional substances can be added either at source, where they mix directly with the odorous materials, or at a distance from source, between the source and the receptor. The additional substances are invariably delivered through a misting system, where the chemicals are diluted into water and ejected through nozzles. The nozzles cause the formation of a fine mist, which also helps suppress any dusts.

Odour treatment chemicals can be effective in cases where the atmosphere is contained, such as in a waste reception area. This technology can be fixed or portable and has relatively low capital costs. However, operating costs can be high, and the results can vary with time and odour concentration. Furthermore, the odour of some odour modification chemicals can be perceived as offensive and can be a cause of concern itself. In some cases, simple water misting may be as effective as more complex agents. Viridor propose to overcome some of these potential issues by using a robust and proven deodorising agent.

Viridor has significant experience of operating odour modification systems supported with pro-active management systems on its existing ERFs. It is understood that these have been accepted by the EA as representing BAT for the abatement of odour.

Taking the above into consideration, Viridor considers the use of odour modification systems is considered to be a proven technology for the abatement of odours compared to the alternative odour abatement technologies, and have been accepted as representing BAT for other facilities.

On this basis, the use of an odour modification system is considered to represent BAT for the Facility.

2.7 The Legislative Framework

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

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

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

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

Table 11 identifies the relevant Articles of the IED and explains how the Facility will comply with them. Many of the articles in the IED impose requirements on regulatory bodies, in terms of the permit conditions which must be set, rather than on the operator. Table 11 only covers the requirements which the IED imposes on 'Operators' and either explains how this is achieved or refers to where within the EP application an explanation of how the Facility satisfies this requirement 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 2.4.1 and 2.5.
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 2.2.1 of the Supporting Information which lists the categories of waste to be incinerated at the Facility.

Article	Requirement	How met or reference
	(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.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to Section 2.9 of the Supporting Information.
	(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law.	Refer to Section 2.9 of the Supporting Information.
46 (1)	Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Refer to Appendix 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 2.4.1 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.
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 1.4.8 of the Supporting Information.

Article	Requirement	How met or reference
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.
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 and 2.1.3.3 of the Supporting Information.
50 (3)	Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas.	Refer to Sections 2.2.3.8 and 2.1.3.3 of the Supporting Information.
50 (4)	Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations:	Refer to Section 2.2.3.8 of the Supporting Information.

Article	Requirement	How met or reference
	(a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached;	
	(b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained;	Refer to Section 2.2.3.8 of the Supporting Information.
	(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Refer to Section 2.2.3.8 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.
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 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. Upon adoption of the final BREF, the EA are required to review and implement conditions within all permits which require operators to comply with the requirements set out in the BREF.

It is understood from recent applications that the EA will require details of how the Facility will meet the requirements of the Best Available Techniques (BAT) conclusions as set out in the Final BREF. Table 12 identifies the requirements of the BAT conclusions 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 2.10 of the Supporting Information. The EMS will be developed throughout the development stage of the project. It is proposed that a pre-operational condition is included within the EP which requires Viridor to provide a summary of the proposed EMS prior to commencement of operation.
2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the 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 Facility is calculated to be approximately 33.5%. Therefore, Viridor understand that this is in accordance with the requirements of BAT 2.
3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF.	As set out in section 2.5, 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 FGT systems and there will be no bottom ash treatment undertaken at the Facility – therefore, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply to the Facility. Viridor can confirm that the Facility will include for monitoring of the key process parameters relevant for emissions to air in accordance with BAT 3.
4	BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	It is anticipated that emissions to air will be monitored with the following frequency: Continuous Monitoring • Oxygen; • Carbon monoxide; • Hydrogen chloride;

#	BAT Conclusion	How met or reference
		• 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 2.5.1.1, 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. Viridor consider that the proposals for monitoring of emissions to air are in accordance with the requirements of BAT 4.
5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).	The continuous emissions monitoring systems (CEMS) installed at the Facility will monitor emissions to air of NOx, NH_3, CO, SO_2 HCl, dust and TOC during periods of OTNOC. Measurement campaigns to measure dioxins and furans during start up and shutdown operations will be

#	BAT Conclusion	How met or reference
		conducted every 3, where it is possible to schedule the monitoring. The frequency of monitoring will be reviewed following any further guidance being published by the EA.
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, the Facility will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGT systems. Furthermore, there will not be any emissions to water from the treatment or handling bottom ash. Therefore, it is understood that the requirements of BAT 6 are not applicable to the Facility.
7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards.	As explained in section 2.2.3.3, TOC will be measured in the bottom ash to confirm that it is less than 3%, and/or Loss on Ignition LOI will be measured to confirm it is less than 5%. Measurements will be taken at least once every 3 months and will be in accordance with EN standards. Viridor considers that the proposals for monitoring of slags and bottom ashes are in accordance with the requirements of BAT 7.
8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, wastewater) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	The Facility will not incinerate hazardous waste. Therefore, Viridor 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, 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 Codes that will be listed in the permit, 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. Viridor will develop (and implement) acceptance procedures for all wastes delivered to the Facility, in order to ensure that only the wastes which the Facility is permitted to receive are received at the Facility. Paperwork

#	BAT Conclusion	How met or reference
		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. • 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 to a suitably licensed waste treatment facility. As the Facility will not incinerate hazardous waste technique (f) of BAT 9 does not apply. Viridor considers that the proposed arrangements for the receipt and segregation of waste in accordance with the requirements of BAT 9.
10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	The Facility will not include a bottom ash treatment plant within the Installation Boundary for the Facility. Therefore, Viridor does not consider that the requirements of BAT 10 apply to the Facility.
11	In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk posed by the waste, the elements as listed in BAT 11 of the BREF.	As described in section 2.2.2.1, and explained in relation to BAT 9, 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 streams at the Facility, 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 -*

#	BAT Conclusion	How met or reference
		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. 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 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 mainly receive municipal and commercial waste. Therefore, it is not proposed to undertake radioactivity detection of incoming waste. Viridor considers that the proposed arrangements for monitoring the waste deliveries as part of the waste acceptance procedures in accordance 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 fuel within the bunker will be run down where possible. Viridor considers that the proposed arrangements for environmental risks associated with the reception, handling and storage of waste in accordance 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	The Facility will not process clinical or hazardous waste. Therefore, Viridor does not considers that the requirements of BAT 13 are applicable to the Facility.

#	BAT Conclusion	How met or reference
	combination of the techniques as listed in BAT 13 of the BREF.	
14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below:	Bunker crane mixing and advanced control systems will be employed at the Facility. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in Section 2.5.2, the system will control and/or monitor the main features of the plant operation including, but not limited to the following: • combustion air; • fuel feed rate; • SNCR system; • flue gas oxygen concentration at the boiler 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. Viridor 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 in accordance with the requirements of BAT 14.

#	BAT Conclusion	How met or reference
15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste.	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, as follows: • ammonia solution dosing will be optimised and adjusted to minimise the ammonia slip; • lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring; and • activated carbon dosing will be based on flue gas volume flow measurement. Viridor considers that the proposed control systems will ensure that the Facility is designed to allow for the adjustment of the plant's settings in accordance with the requirements of BAT 15.
16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	The Facility will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable. Waste will be kept at suitable levels in the waste bunker to maintain operation during periods when waste is not delivered. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations. Viridor considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations in accordance 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 FGT and wastewater treatment systems will be appropriately designed and operated within the design range. The FGT and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures. Viridor considers that the design and operation of the FGT 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	A risk-based OTNOC management plan will be incorporated into the BMS for the Facility. This will include the following elements: • identification of potential OTNOC, root causes and potential consequences; • regular update of the list of identified OTNOC following periodic assessment;

#	BAT Conclusion	How met or reference
	plan as part of the EMS that includes the elements as identified in BAT 18 of the BREF.	• appropriate design of critical equipment (the Facility will utilise compartmentalisation of the bag filter and ensure that the bag filter is not bypassed during periods of start-up or shutdown); • implementation of preventative maintenance plans for critical equipment; • monitoring and recording of emissions during OTNOC and associated circumstances; and • periodic assessment of the emissions and circumstances occurring during OTNOC and implementation of corrective actions as required. Viridor considers that the incorporation of a risk-based OTNOC management plan will ensure that the Facility is operated in accordance with the requirements of 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. Viridor considers that the use of heat recovery boilers is in accordance 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 fuel that is combusted; • High steam conditions (approximately 430 – 440°C and approximately 65 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. Subject to commercial agreements with heat users, a scheme for the export of heat will be implemented. Viridor 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.

#	BAT Conclusion	How met or reference
		Technique (b) Technique (b) relates to reducing the flue gas flow rate through either an improvement in the primary and secondary combustion air distribution and through the use of FGR. 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 of the Supporting Information, the proposed designs do not currently include FGR. However, it is requested that a pre-operational condition is included within the permit 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. Viridor 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

#	BAT Conclusion	How met or reference
		SNCR system and confirmation of the boiler design through computational fluid dynamics (CFD) modelling. Technique (e) Technique (e) is to use low-temperature flue gas heat exchangers to recover additional energy from the flue gas at the boiler exit. 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 would introduce additional capital costs. In addition, 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

#	BAT Conclusion	How met or reference
		be counterproductive from an energy efficiency point of view, allowing for the additional losses from the heat exchanger. 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, higher ground level concentrations of pollutants, and corrosion of the stack and flues. Another alternative would be to use a post-abatement heat exchanger (i.e. once the flue gas has undergone treatment); however, this would also result in lower flue gas temperatures, resulting in the same problems. 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). In addition, the heat plan submitted with the application has not identified any currently viable options for heat export from the Facility. The installation of a post abatement heat exchanger would also introduce a high associated capital cost. Taking the above into consideration, the use of a low-temperature heat exchanger is not considered to represent BAT due to potential corrosion risks; increased capital costs; the efficiency and operation of the FGT system; and dispersion of emissions; and the visible plume. <u>Technique (i)</u> 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.

#	BAT Conclusion	How met or reference
		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. Finally, using air from the bottom ash storage area within dry bottom ash handling will reduce the quantity of combustion air required to be extracted from the bunker and tipping hall areas, subsequently reducing the effectiveness of the proposed odour control systems within the waste reception areas. This could result in increased odour emissions and odour risks from the Facility. The additional abatement of 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.	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, Viridor does not consider that the requirements of BAT 22 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	The treatment of slags and/or bottom ashes will not undertaken at the Facility. Therefore, the requirements of BAT 23 do not apply to the Facility. However, identification of the most relevant diffuse dust emissions, and definition and implementation of appropriate actions

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

#	BAT Conclusion	How met or reference
		In a dry sorbent injection system, the reagent is injected into the flue gas stream within the flue gas treatment system, located after the 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. 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. Viridor considers that the use of dry sorbent injection to reduce channelled emissions to air of acid gases is in accordance 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.	The following techniques will be employed at the Facility to reduce peak emissions of acid gases (hydrogen chloride, sulphur dioxide and hydrogen fluoride) 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.

#	BAT Conclusion	How met or reference
		• The concentrations of acid gases released from the Facility will comply with relevant BAT-AELs. The techniques listed above to reduce channelled peak emissions to air of acid gases is in accordance with the requirements of BAT 28.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	The following elements have been incorporated into the design of the Facility: • Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14); • An SNCR system; 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 carbon monoxide, nitrous oxide and ammonia) are in accordance 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 135°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.

#	BAT Conclusion	How met or reference
30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below to reduce channelled emissions to air of organic compounds: a) Optimisation of the incineration process; b) Control of the waste feed; c) On-line and off-line boiler cleaning; d) Rapid flue-gas cooling; e) Dry sorbent injection; f) Fixed-or-moving bed adsorption; g) SCR; h) Catalytic filter bags; and i) Carbon sorbent in a wet scrubber.	The Facility will employ the following techniques to reduce channelled emission to air of organic compounds: • 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. • 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 BAT-AELs. 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.

#	BAT Conclusion	How met or reference
		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 135°C. Therefore, the use of catalytic filter bags is not considered to be appropriate for the design of the Facility, as the flue gases would require re-heating which will reduce the efficiency of the process. The techniques described above to reduce channelled emission to air of organic compounds will ensure that the Facility will comply with the requirements of BAT 30. Therefore, the Facility will meet the requirements of BAT 30 without the use of catalytic filter bags.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility in combination with a bag filter. It is considered by Viridor that the use of these techniques will ensure that the Facility will comply with the requirements of BAT 31.
32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	There will be separate foul/domestic water, process water and surface water drainage systems at the Facility. Foul effluents from domestic sources will be treated in an on-site wastewater treatment plant prior to discharge to sewer, with any excess effluents tankered offsite. It can be confirmed that there will be no wastewater arising from flue gas treatment. Bottom ash handling will be undertaken in an enclosed building with a dedicated drainage system. The drainage in the Facility's waste reception, handling and storage areas will be contained and reused within the process. Uncontaminated water streams, such as surface water run-off, will be segregated from other wastewater streams requiring treatment. Surface water runoff from roadways and vehicle movement areas will pass through petrol interceptors prior to discharge. An Indicative water flow diagram depicting the segregation of different water streams for the Facility is presented in Appendix A. Viridor considers that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility operates in accordance with the requirements of BAT 32.

#	BAT Conclusion	How met or reference
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 require discharge; these will be tankered off-site for treatment at a suitably licensed waste management facility. It is considered by Viridor 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 Facility.
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 treatment of slags and bottom ashes undertaken on-site (i.e. within the Installation Boundary for the Facility). In addition, there will be no emission to water from FGC. The risk of emissions to water from the storage of bottom ash at the Facility will be minimised – any overflow from the ash quench will be contained and reused within the process and hence there will not be any release of effluent from the ash quench system. In accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above. Viridor considers that the Facility will operate in accordance with the requirements of BAT 34 by reducing emissions to water from the storage of bottom ash.
35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	It can be confirmed that bottom ash and APCr will be handled and disposed of separately at the Facility. Therefore, Viridor considers that the Facility will operate in accordance with the requirements of BAT 35.

#	BAT Conclusion	How met or reference
36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	There will be no bottom ash treatment undertaken at the Facility (i.e. within the Installation Boundary for the Facility). Therefore, it is understood that the requirements of BAT 36 do not apply to the Facility.
37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques as listed in BAT 37 of the BREF.	In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the Facility to prevent or reduce noise emissions: • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. • Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Waste deliveries will take place primarily during daytime hours. • Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level. • Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. • Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. In addition, refer to the Noise Assessment presented in Appendix C. Viridor considers that the techniques listed above to reduce noise emissions will ensure that the Facility is operated in accordance with the requirements of BAT 37.

2.8 Energy efficiency

2.8.1 General

The Facility will utilise steam boilers which will generate steam which will be used to supply a steam turbine to generate electricity. The Facility will supply electricity to the local electricity grid via a power transformer which increases the voltage to the appropriate level.

The Facility has also a provision for heat take-off to be able to export heat off-site in the future.

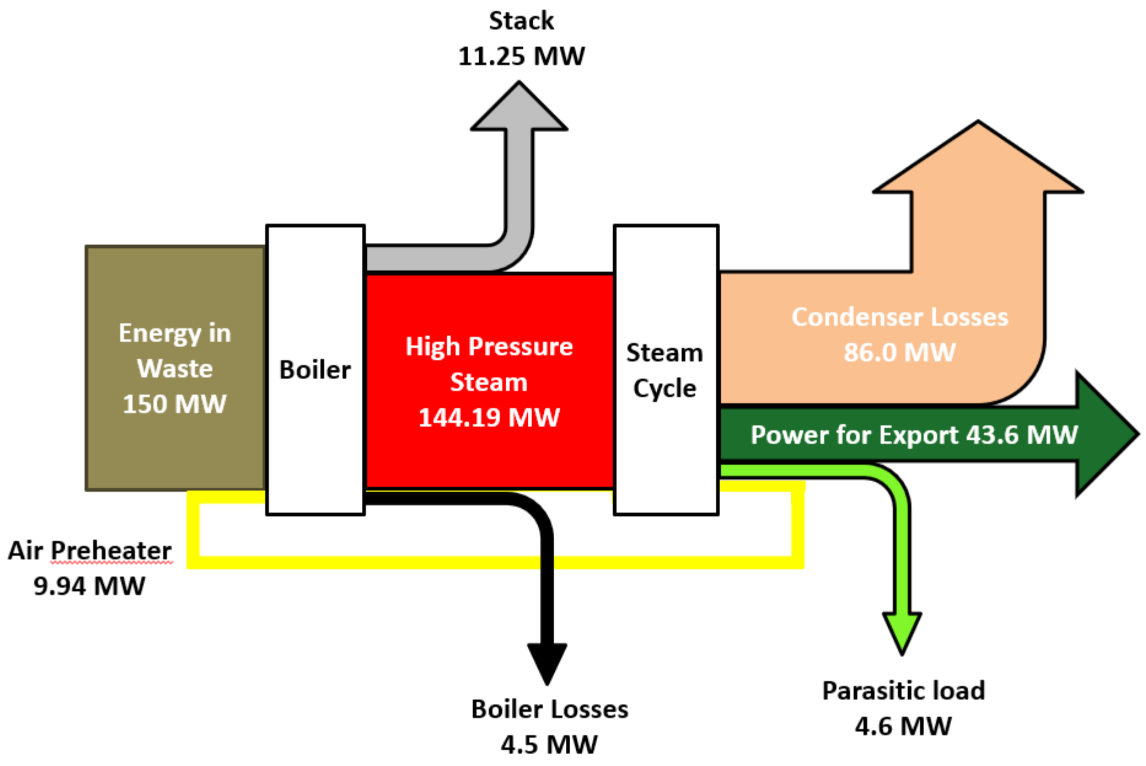
In case of failure of the electricity supply, an emergency diesel generator will be provided to safely shut down the Facility and to provide an emergency supply to the rest of the Facility.

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 waste incineration plant for the 'No heat export' case is presented in Figure 3.

Figure 3: Indicative Sankey Diagram - No Heat Case



The Facility will have the capacity to export up to 12 MWth of heat, subject to technical and economic feasibility. At this stage, technically feasible opportunities have been identified with the potential to export an annual average heat load of up to approximately 5.46 MWth, with a peak load of 11.55 MWth – refer to Appendix G. The export of heat would reduce the electrical output of the Facility but increase the overall thermal efficiency.

Assuming electricity-only mode and average ambient temperature, the Facility will generate approximately 48.2 MWe of electricity in full condensing mode. The Facility will have a parasitic load of approximately 4.63 MWe. Therefore, the export capacity of the Facility with average ambient temperature is approximately 43.6 MWe.

The Facility will process approximately 430,000 tonnes per annum (at the design capacity of 26.3 tph per line with a design NCV of 10.25 MJ/kg and an availability of approximately 8,147 hours). At the design capacity, the Facility will annually generate approximately 392,896 MWh and export approximately 355,168 MWh of electricity.

The maximum capacity of the Facility will be up to 495,000 tonnes per annum of waste as described within section 1.3.

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 (BREF WI).

Table 13: Facility design parameters comparison table

Parameter	Unit	The Facility	Benchmark
Gross power generation, design capacity (26.3 tph per line at 8,147 hours availability)	MWh/t waste	0.915	0.415-0.644
Net power generation, design capacity (26.3 tph per line at 8,147 hours availability)	MWh/t waste	0.828	0.279-0.458
Internal power consumption, design capacity (26.3 tph per line at 8,147 hours availability)	MWh/t waste	0.088	0.15
Power generation (assumed gross) for 100,000 tpa of waste	MWe	11.2	5-9

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

2.8.2.1 Energy consumption and thermal efficiency

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

- primary and secondary combustion air fans;
- Induced Draft fans;
- boiler feed water pumps;
- ACC fans;
- air compressors;
- fuel 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 fuel that is combusted;
- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- Low grade heat will be extracted from the turbine and used to preheat combustion air in order to improve the efficiency of the thermal cycle;
- Steady operation will be maintained 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 and the Waste Incineration BREF.

2.8.2.2 Operating and maintenance procedures

An O&M manual will be developed for the Facility. 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 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 should be recovered as far as practicable. In order to demonstrate this, the following points should be noted.

1. Economisers will be installed to recover flue gas heat, compatibly with the temperature requirements of the flue gas treatment system.
2. The boilers will operate with superheated steam.

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

A CHP assessment has been developed for the Facility and is presented within Appendix G.

2.9 Residue recovery and disposal

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

1. IBA; 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*'.

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

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

2.9.1 Incinerator Bottom Ash

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

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

IBA handling 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. There is little to no risk of contaminated runoff from the IBA storage area entering nearby watercourses and/or polluting the ground.

The use of an ash quench will limit dust generation within the IBA handling and storage area. A wheel washing facility (such as pressure washers) will be provided in the IBA handling and storage area to prevent the tracking of ash from storage areas off-site. The IBA will also be transferred offsite in covered vehicles to minimise the potential for fugitive emissions during transport.

It is not currently proposed to undertake further treatment, including metals recovery, of the IBA on-site. Municipal waste accepted at the Facility will have typically undergone either source segregation (i.e. kerbside recycling) and/or pre-treatment (for example at a waste transfer station) prior to transfer to the Facility. Therefore, the quantities of metals within the waste will be small having been removed prior to delivery to the site. Furthermore, IBA will be transferred off-site for processing at a suitable licensed waste management company prior to re-use (e.g. as a secondary aggregate). Metals recovery may be undertaken at the IBA processing facility.

2.9.2 Air Pollution Control residue

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. Viridor re-use APCr to neutralise acid wastes and are currently investigating other options for the disposal of APCr. 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 Viridor 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 13.

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	Expected Frequency
IBA	Bottom ash (mixed with boiler ash). This ash is relatively inert, classified as non-hazardous.	Ash room, 1,090 m^3	90,940	To be removed from site for processing into a secondary aggregate.	1 – 7 days
APCr	Ash from flue gas treatment, may contain some unreacted lime.	2 x Silos, 620 m^3 total capacity	16,845	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.	3 – 7 days
Recovered metals	Metals recovered from IBA post-incineration.	Storage bay/skip, 75 m^3	1,420	Transferred off-site for recycling.	1 – 7 days
Oversize material	Oversize material extracted from IBA post-incineration.	Storage bay/skip, 75 m^3	7,080	Transferred off-site for disposal.	1 – 7 days

2.10 Management

The Plant will be designed and constructed following the latest international and national regulations, standards and guidance. This will incorporate risk management techniques such as HazOp studies prior to construction and thorough commissioning and testing before plant takeover.

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

2.10.1 Introduction

Viridor operate a Business Management System (BMS). Viridor's aim is to protect human health and the environment by safely, responsibly and efficiently managing waste, and by maximising recycling and resource generation.

2.10.2 Business Management System

Viridor was the first UK waste company to achieve ISO 14001, the highest international environmental standard, across all of its major operational sites, providing assurance to both its customers and communities near its operations. Viridor's Business Management System (BMS) incorporates formal environmental, quality, and health and safety management processes, and applies to all operational facilities.

Compliance with system requirements and policies is mandatory and subject to periodic audit. Viridor's BMS is accredited to the following standards:

- ISO 14001 Environmental Management Systems;
- BS OHSAS 18001 Occupational Health and Safety Management Systems; and
- ISO 9001 Quality Management System.

In addition to an already established management system, Viridor is also incorporating a Competence Management System (CMS), which will demonstrate that Viridor is technically competent to carry out a wide range of permitted waste operations in accordance with all appropriate regulatory requirements. The commitment to implementing CMS complements the ongoing policy to build an environmentally sound business with a safe working environment.

2.10.3 Integrated Management Systems

An integrated management system (IMS) is a management system which integrates all components of a business into one coherent system to enable the achievement of its purpose and mission.

Viridor's BMS is an IMS based on the systematic Plan – Do – Check – Act principle, and shares common elements across ISO 9001, ISO 14001, OHSAS 18001, and CMS. Also integrated are standards for Carbon Management and Biodiversity, which naturally fall into the existing management system structure.

The common elements include:

1. Policy;
2. Planning;
3. Implementation and operation;
4. Performance assessment;

5. Improvement; and
6. Management review.

This approach allows common elements of compliance, corrective and preventative actions and continual improvement to be delivered more efficiently using a single management system.

Benefits of integration include:

- an improved business focus;
- promotion of communication between disciplines;
- encouragement of involvement and ownership;
- provision of a framework for establishing and reviewing objectives;
- reduction of duplication; and
- provision of a simplified approach.

A summary of the key elements of Viridor's Business Management System is given in the table below.

Table .15 – Key elements of Viridor's Business Management System

General Requirements	Establish policies, set objectives and targets with the aim of compliance, continual improvement with sustained customer satisfaction. Top down visible leadership and commitment, critical to the success of the system, but with the involvement of everyone.
Policy	Define the strategic intent and values of the business. Strengthens corporate commitment. Includes Corporate Social Responsibility statement and Health, Safety & Welfare Policy Document.
Planning and Risk Management	Risk identification and management & control to determine which issues are significant and depending on the resultant risk, operational control measures or improvements are implemented. Identifying and responding to any unplanned event, potential emergency or disaster. Control of non-conforming products/services.
Implementation and Operation	The implementation of plans to achieve objectives and targets. The organisation of people, resources and systems needed to operate all facilities and services to the highest environmental, health and safety, and professional standards. The induction and training procedures ensure that all personnel are competent to carry out their roles and responsibilities. The development and maintenance of documented procedures.
Performance	Monitoring, measurement and analysis of performance and customer satisfaction. Implementation of the audit programme and evaluation of legal compliance. Corrective, preventative and improvement action is implemented as required. Customer perception of the service Viridor provides and/or product provided. This data is collected, analysed, and used to improve performance. Includes Monitoring and Measurement of performance, Evaluation of Compliance, Internal Audit, and Handling of nonconformities.

Table .15 – Key elements of Viridor's Business Management System	
Improvement	Commitment to continuously improving the effectiveness of the Business Management System and providing a quality service.
Management Review	The performance of the system is reviewed and reported regularly to the Executive. Changes to ensure continued suitably, adequacy and effectiveness are discussed and implemented.

2.10.4 Developing, Implementing and Improving the BMS

The general scheme of the BMS follows the four-step management method used in business for the continuous improvement of processes:

- PLAN – establish objectives and processes;
- DO – implement processes;
- CHECK – monitor and measure processes; and
- ACT – take actions to improve process performance.

Development, implementation and improvement of the BMS are considered individually below.

2.10.4.1 Developing

Viridor uses a business process approach to identify those areas that need to be managed and controlled in order to deliver essential waste and recycling services to public and private sector customers across the UK whilst taking due account of health & safety, environmental obligations, and regulatory and social responsibilities.

Viridor believe that by adopting this approach they can provide its customers, regulators, employees and interested parties with confidence that significant issues are being properly managed and that the company can comply with legal and customer requirements and deliver quality waste management and recycling services.

2.10.4.2 Implementing

The Business System allows a common approach to be adopted across all units. As the company expands with the addition of new facilities, the BMS is implemented. Sites will then achieve external accreditation within the shortest practical timescale.

2.10.4.3 Improving

Corporate Targets are agreed annually by the Executive Committee and delivered through improvement programmes and site action plan meetings (SAP). They are designed to achieve continual improvement. Sites are also encouraged to set local targets relevant to their specific activities based upon the results of risk assessments.

Progress against objectives is reviewed at least three times per year by the Executive Committee. An external Corporate Responsibility report is produced annually. The report undergoes a rigorous external verification process and is available on Viridor's website. It is distributed to interested parties as necessary.

2.10.5 Reporting Structures and Communication

Control and co-ordination of HS&E matters is provided through a framework of meetings at company, business and site level. The overall structure is described below, and provides a robust structure to monitor and direct improvements in the HS&E performance of the business.

1. **Senior Executive Committee**

   Chaired by the Managing Director, the Senior Executive Committee comprises directors from departments within the company. The role of the committee is to clearly demonstrate leadership and commitment by providing concise direction to Regional Directors through to Area Managers and operational level (working groups) through settling policy, strategy, vision, and objectives. It meets on a quarterly basis.

2. **Director of Environmental Compliance**

   Oversees the environmental compliance function, which includes the Business Management System. Responsible for ensuring that policies, procedures, and arrangements are in place, kept up to date with new information and legal requirements, and kept in line with company strategy.

3. **Corporate Social Responsibility and Regulatory Director**

   Oversees Environmental Compliance, Health and Safety, Human Resources, and Training. Responsible for ensuring corporate and social policies, procedures and arrangements are in place, kept up to date with new information and in line with company strategy. Ensures that the necessary resources are planned into forward budgetary programmes.

4. **Working Groups**

   Working groups are in place to ensure standardised core procedures are in place for processes within the company. Collectively, the working groups:

   – Develop and facilitate the implementation of the Business System to achieve the Company's objectives;
   – Develop and implement policies, procedures, and standards;
   – Provide selected training, support, and advice; and
   – Contribute to the Management Review process.

2.10.5.1 Communication

Communication is critical to the success of our BMS and therefore takes many forms within the organisation. Primarily, information is cascaded from the Senior Executive Committee down to individual managers and then to operational staff. Communication takes many forms, examples including dialogue, e-mails, internal memos, specific instructions, regular management meetings, and notice boards. A company newsletter, Viridor Voice, is circulated every quarter, and additional news articles concerning Viridor within external press, local papers and events, are circulated every month.

The company actively promotes good communications with customers, the public, and stakeholders through regular press briefings and public liaison meetings. It is the policy of the company to have an active site liaison group at all appropriate site open days ensuring direct dialogue with customers.

The company publishes information on its performance and significant environmental information within an annual corporate responsibility report, which is externally verified.

2.11 Closure

2.11.1 Introduction

The Facility is designed for an operational life of approximately 30 years, but the actual operational lifetime is dependent on a number of factors including:

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

When the Facility 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.

2.11.2 Site Closure Plan

At the end of the economic life of the Facility, 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 Facility is sold. However, Viridor 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 watercourses.

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.

2.11.2.1 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).

2.11.2.2 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:
  - steelwork;
  - plastics;
  - cables;
  - concrete and civils materials;
  - oils;
  - chemicals;
  - consumables;
  - contained water and effluents; and
  - residues/wastes including IBA and APCr.

2.11.2.3 Disposal routes

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

2.12 Improvement programme

Viridor is committed to continual environmental improvement of their operations, and is therefore proposing that a small number of improvement conditions be incorporated into the final EP. These have been set out in sections 2.12.1 and 2.12.2.

2.12.1 Prior to commissioning

Prior to commencement of commissioning of the Facility, Viridor 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 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.
- Submit a summary of the site Environment Management System (EMS) for approval by the EA. The summary shall include a copy of the full other than normal operating conditions (OTNOC) management plan which shall be prepared in accordance with BAT 18 of the BAT conclusions.
- Submit a review of the options available for utilising the heat generated, including operating as CHP or supplying district heating, for approval by the EA. The review shall detail any identified proposals for improving the recovery and utilisation of heat and shall provide a timetable for their implementation.

- 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.
- Submit a written report for approval by the EA detailing the waste acceptance procedures to be used at the site. The waste acceptance procedure shall include the process and systems by which wastes unsuitable for incineration at the site will be controlled.
- Submit a report, and obtain the EA's written approval to it, on the baseline conditions of soil and groundwater at the installation. The report shall contain the information necessary to determine the state of soil and groundwater contamination to make a quantified comparison with the state upon definitive cessation of activities provided for in Article 22(3) of the IED.
- submit a written report to the EA for approval, specifying arrangements for continuous and periodic monitoring of emissions to air to comply with EA monitoring guidance notes. The report shall include the following:
  – Plant and equipment details, including accreditation to MCERTS;
  – Methods and standards for sampling and analysis; and
  – Details of monitoring locations, access and working platform.
- Submit, for approval by the EA, a methodology (having regard to Technical Report P4-100/TR Part 2 Validation of Combustion Conditions) to verify the residence time, minimum temperature and oxygen content of the gases in the furnace whilst operating under normal load, minimum turn down and overload conditions.

2.12.2 Post commissioning

Following commissioning of the Facility, Viridor 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 on the implementation of its Environmental Management System (EMS) and the progress made in the certification of the system by an external body or if appropriate submit a schedule by which the EMS will be certified.
- Submit a written report to the Environment Agency describing the performance and optimisation of:
  – The lime injection system for minimisation of acid gas emissions;
  – The carbon injection system for minimisation of dioxin and heavy metal emissions; and
  – The Selective Non Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx). The report shall include an initial assessment of the level of NOx, N2O and NH3 emissions that can be achieved under optimum operating conditions.
- 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 of the validation of residence time, oxygen and temperature whilst operating under normal load, minimum turn down and overload conditions. The report shall identify the process controls used to ensure residence time and temperature requirements are complied with during operation of the incineration plant.
- Provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the PM_{10}

and $PM_{2.5}$ ranges from the Facility. The report will detail a timetable for undertaking the tests and producing a report on the results.

- 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 S3.1 and Table S3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3. The report shall include the results of calibration and verification testing.
- Submit a report on the assessment of the impact of emissions to air of heavy metals. Emissions monitoring data obtained during the first year of operation shall be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application. An assessment shall be made of the impact of each metal against the relevant ES. In the event that the assessment shows that an environmental standard can be exceeded, the report shall include proposals for further investigative work.
- Submit a written report to the EA on the commissioning of the Facility. The report will summarise the environmental performance of the Facility as installed against the design parameters set out in the Application.
- Submit a plan to the EA for approval for implementing a CHO/district heating scheme. This should be submitted should a cost benefit analysis has been completed, and a CHP scheme has been proposed. The plan should include:
  - A timescale for implementation;
  - A description of any dependencies or further approvals required;
  - A description of any changes that will need to be made to the plant;
  - Whether there will be any operational changes which could affect the environmental impact of the installation; and
  - Consideration of whether a permit variation will be required.
- Submit a written report to the EA for approval summarising the results of tests to demonstrate whether the furnace combustion air will ensure that negative pressure is achieved throughout the reception hall. The report will summarise the findings along with any proposed improvements if required.
- Carry out a programme of dioxin and dioxin like PCB monitoring over a period and frequency agreed with the Environment Agency. Submit a report to the Environment Agency with an analysis of whether dioxin emissions can be considered to be stable.
- Carry out a programme of mercury monitoring over a period and frequency agreed with the Environment Agency. Submit a report to the EA with an analysis of whether the waste feed to the plant can be proven to have a low and stable mercury content.

Appendices

A Plans and drawings

B Site condition report

C Noise assessment

D Environmental risk assessment

E Air quality assessment

F BAT assessment

G CHP assessment

H Fire prevention plan

I Planning application

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