FICHTNER

Consulting Engineers Limited

Northacre Facility

Northacre Renewable Energy Limited

Supporting Information

ENGINEERING + CONSULTING

Document approval

	Name	Signature	Position	Date
Prepared by:	James Bernays		Project Engineer	23/07/2020
	Hannah Lederer			10/08/2020
Checked by:	James Sturman		Lead Consultant	23/07/2020
	Stephen Othen		Technical Director	10/08/2020

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
00	23/07/2020	First draft for client	JB2	JRS
01	10/08/2020	Updated following client comments	HKL	SMO

Contents

1 Introduction

Northacre Renewable Energy Limited (NRE) is proposing to build the Northacre Renewable Energy facility (the Facility) on land off Stephenson Road, Westbury, Wiltshire.

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

1.1 The Applicant

NRE is a special purpose joint venture established to deliver the Facility. NRE is jointly owned by Bioenergy Infrastructure Group, a UK independent power producer specialising in energy-from-waste and biomass facilities, and The Hills Group, a Wiltshire-based company with business activities including waste management, quarrying of aggregates and building new homes.

1.2 The site

The site within the installation boundary is approximately 2.6 ha and situated on the Northacre Trading Estate, which is approximately 1.5 km to the north-west of Westbury town centre in Wiltshire Council. The site is located on a parcel of land between Arla Foods Westbury Dairies to the north-east and the Northacre Resource Recovery Centre to the south-east. Stephenson Road is immediately north of the site whilst there are fields to the south side of the site. A site location plan is presented in Appendix A.

Access to the site is from Stephenson Road, which links via the B3097 to the A350. The A350 provides access in all directions via the primary route network.

The nearest residential properties are two dwellings on Brook Lane to the east, Brook Farm and Orchard House to the south west, and a small number of semidetached houses on Storridge Road to the north-east. The Northacre Trading Estate is located approximately 600 m to the north of the site.

The Facility is adjacent to the Northacre Resource Recovery Centre, a Mechanical Biological Treatment (MBT) plant owned by Hills Waste Solutions Ltd (permit number XP3432WW). This is expected to provide approximately 20% of the total tonnage throughput to the Facility in the form of MBT SRF, fines and heavies. The majority of this waste will be delivered directly from the MBT plant to the Facility via a conveyor linking the two. There will also be an internal road allowing the movement of vehicles to transport the waste, should the conveyor be out of service at any point. The operation of the conveyor will be covered in a variation to the MBT permit. The Activities

Activities covered by this application include:

1. a single-line waste incineration plant processing incoming waste fuel which is delivered to the Facility from off-site via road and into a hopper from the adjacent MBT facility;
2. the generation of power and export to the National Grid and local users via private wire connections;
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.

The following table lists the scheduled and directly associated activities.

Table 1: Scheduled and Directly Associated Activities

Type of Activity	Schedule 1 Activity	Description of Activity
Installation	Section 5.1 Part A(1) (b)	The incineration of non-hazardous waste in a waste incineration plant with a nominal design capacity of 30.9 tonnes per hour
Directly Associated Activities		
Directly Associated Activities		Waste reception, storage and handling facilities
Directly Associated Activities		Combustion and energy recovery processes including the export of electricity to the National Grid and nearby users
Directly Associated Activities		Flue gas treatment
Directly Associated Activities		Residue storage and handling facilities
Directly Associated Activities		Standby electrical generation to provide electrical power to the plant in the event of an interruption in the supply.

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

Assuming a design NCV of 10.5 MJ/kg, the Facility will process approximately 243,000 tonnes per annum (at the design capacity of 30.9 tph, assuming 7,860 hours availability). This is represented by the design point on the firing diagram – refer to Appendix A.

1.3 The Facility

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

The Facility includes a single waste incineration line, waste reception area, waste bunker, turbine hall, air cooled condenser, boiler hall including boiler and FGT system, ash storage building, and a 75 m stack. In addition, the Facility will include the following infrastructure:

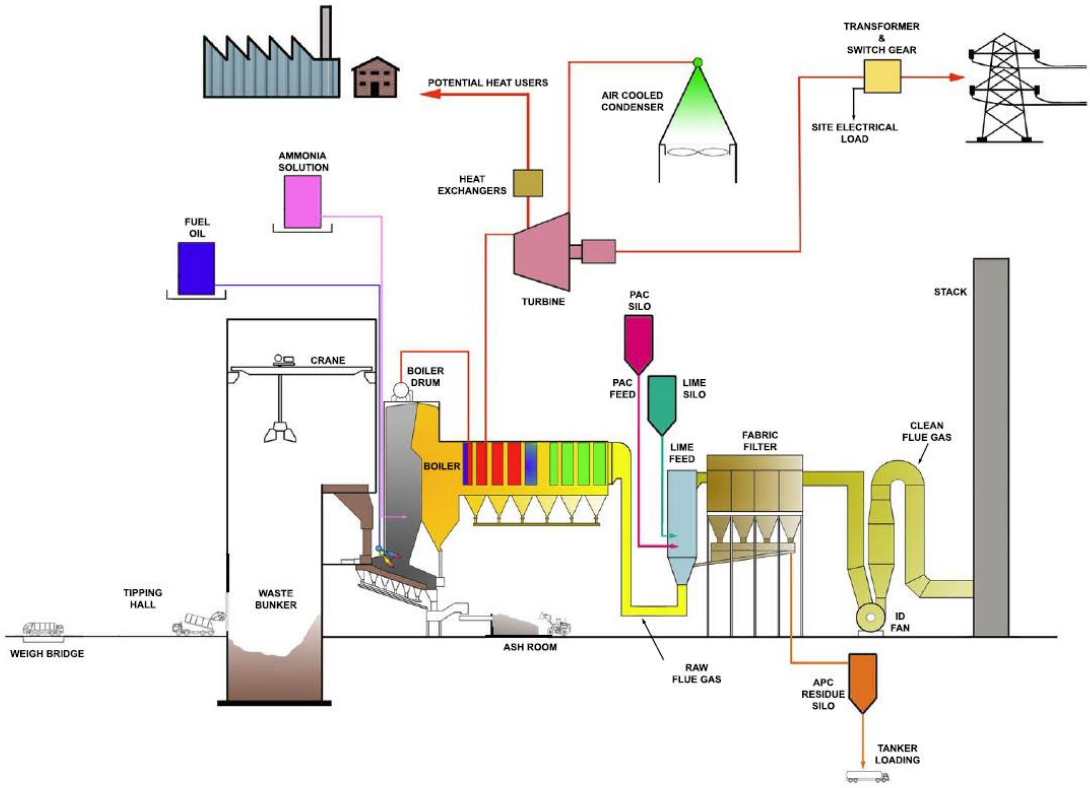
1. Two weighbridges (in and out);
2. Offices, control room and staff welfare facilities;
3. Site fencing and security barriers;
4. External hard standing areas for vehicle manoeuvring/parking;
5. Internal access roads and car parking;
6. Reagent and raw material tanks and silos;
7. Residue silos and storage areas;
8. Transformers;
9. Grid connection compound; and

10. Fire and raw water storage tank.

The conveyor from the adjacent MBT plant is planned to be included in a variation to the MBT permit and so is not included in the above list.

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

Figure 1: Indicative Schematic of the Waste Incineration process



The turbine has been designed to generate up to 28.6 MWe. The Facility will have a parasitic load of 2.97 MWe. Therefore, the export capacity of the Facility will be approximately 25.6 MWe.

The Facility has been designed to thermally treat waste with a range of net calorific values (NCVs). However, the nominal design capacity of the Facility is 30.9 tonnes per hour of waste with an average NCV of 10.5 MJ/kg. It is expected that the plant will have an availability of around 7,860 hours per annum. On this basis, the Facility will have a maximum design capacity of approximately 243,000 tonnes per annum.

A firing diagram demonstrating the range of capacities for the Facility is presented in Appendix A.

1.3.1 Raw materials

Incoming waste will be delivered to the Facility by enclosed road vehicles and/or via conveyor system from the adjacent MBT facility. If the conveyor is out of service waste from the adjacent MBT facility will be delivered by enclosed road vehicles.

Road vehicles delivering waste to the Facility will be weighed on a weighbridge before proceeding to the waste reception area which will be a fully enclosed building. The waste will then be tipped into the waste bunker. Waste which is delivered from the adjacent MBT facility will be transferred from the conveyor, via a feed hopper, into the waste bunker.

Waste will be loaded from the bunker to the furnace using a grab which will transfer the incoming waste to the furnace feed hopper. The grab will also be used to identify and remove any unsuitable or non-combustible items.

Having unloaded incoming waste into the waste bunker, road vehicles will be weighed again upon exit from the Facility in order to determine the mass of waste that has been delivered to the Facility.

Allowing for stacking within the bunker, the waste storage capacity of the bunker will be approximately 9,000 m^3 of waste, equivalent to approximately 5 days of waste processing capacity.

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 is presented in Section 2.1.3.

1.3.2 Combustion process

The combustion chamber will utilise a conventional moving grate technology which will agitate the fuel bed to promote a good burnout of the waste and a uniform heat release.

The furnace will be designed to ensure that the exhaust gases are raised to a minimum temperature of 850°C, with a minimum of 2 seconds flue gas residence time. This temperature and residence time will ensure the destruction of dioxins, furans, PAHs and other organics. An adequate air supply will be maintained to give the correct volume of oxygen for optimum combustion. The main source of airflow will be controlled through the grate. Gas temperatures will be continually monitored and recorded, and audible and visible alarms will trigger in the control room if the temperature starts to fall towards 850°C. The control system will regulate combustion conditions and control the boiler.

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 chamber beneath the grate. Secondary combustion air will be injected into the flame body above the grate to facilitate the combustion of waste on the grate and minimise levels of oxides of nitrogen (NOx) emissions. Further up the flue, above the combustion zone, ammonia solution will be injected. 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 required emission limits.

The combustion chamber will be provided with low NOx designed auxiliary burners, which will combust low sulphur fuel oil. The purpose of the auxiliary burners is to raise the combustion chamber temperature to the required 850°C prior to the feeding of waste into the combustion chamber. There will be interlocks preventing the charging of waste until the temperature within the combustion chamber has reached 850°C. During normal operation, if the temperature falls below 850°C, the burners will be initiated to maintain the temperature above this threshold. Air flow for combustion is controlled by measuring excess oxygen content in the flue gas. This is set to maximise the efficiency of the heat recovery process while maintaining the combustion efficiency.

1.3.3 Energy recovery

The heat released by the combustion of the incoming waste will be recovered by means of a steam boiler, which is integral to the furnace and will produce (in combination with superheaters) high pressure superheated steam at 430°C and approximately 76.5 bar(a). The steam from the boiler will then feed a high-efficiency steam turbine which will generate at the design point, with average ambient temperature, approximately 28.60 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 2.97 MWe, assuming no heat is exported, resulting in approximately 25.63 MWe of power available for export to the national grid 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 boiler.

The Facility will have the potential to export up to 4.33 MWth of heat to local heat users. 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. A detailed CHP Assessment is presented in Appendix G.

1.3.4 Flue gas abatement

The flue gas treatment system will consist of the following:

- selective non-catalytic reduction (SNCR);
- lime and activated carbon injection (dry system); and
- a fabric filter.

The abatement of oxides of nitrogen (NOx) will be achieved by SNCR. During the SNCR process, ammonia solution will be injected into the high temperature region of the boiler 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.

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. The activated carbon will abate emissions of mercury, organic compounds and dioxins. 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.

Following the injection of lime and activated carbon, the flue gas will then pass through the fabric filter, which will remove the particulates and reaction products, collectively known as Air Pollution Control residues (APCr). The residues cake the outside of the filter bags with the units periodically cleaned by a reverse jet of air, displacing the filtered solids into chutes beneath and recycling them back into the flue gas stream or storing them in a silo. As fresh reagents are dosed into the acid gas abatement system, an equivalent amount of residue collected from the bag filters will be removed.

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

The flue gas will be monitored for pollutants and discharged to atmosphere through a 75 m stack.

1.3.5 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 falls into the discharger, which comprises a water-filled trough (or ash quench). The purpose of the ash quench is to cool and moisten the bottom ash to limit particulate emissions (dust generation) and to ensure an airtight seal to the furnace 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 IBA storage area with capacity for the storage of roughly 910 m^3 of IBA (equivalent to approximately 6 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 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.

1.3.6 Liquid effluent and site drainage

The Facility will include separate drainage systems for foul and surface water.

Surface water run-off will be collected from areas of hardstanding and building roofs and discharged into the surface water drainage systems. All surface run-off will pass through a petrol interceptor prior to discharge into the attenuation pond, before final discharge into the Northacre Trading Estate drainage system.

Where practicable, process effluents will be re-used within the process. Process effluents will be stored within a ‘dirty water pit’ prior to reuse. In the unlikely event that excess process effluents are generated, such as during emptying of the boiler, these will require discharge. Excess process effluents will either be tankered off-site for treatment at a suitably licensed waste management facility, or discharged to foul sewer in accordance with a Trade Effluent Consent which will be issued by Wessex Water.

Domestic effluents from welfare facilities will be discharged to foul sewer.

1.3.7 Emissions monitoring and stack

Emissions from the stack will be continuously monitored, using a CEMS system, for the following pollutants:

- 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:

- 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 oxides;
- hydrogen fluoride;
- dioxins and furans; and
- dioxin-like PCBs.

Periodic measurements will be carried out four times in the first year and twice per year thereafter, with the exceptions of mercury, dioxins and furans and dioxin-like PCBs. These will be monitored monthly in the first year.

The Continuous Emission Monitoring System (CEMS) will be MCERTS approved. There will be a duty CEMS and one back-up CEMS system which will be available in the event of CEMS failure.

1.3.8 Ancillary operations

The Facility will require a water supply of approximately 4.4 m^3/hr. The primary requirement of mains water is to maintain the water level in the boiler system (steam cycle). A water treatment plant will produce high quality demineralised make-up water for the boiler.

Water would be primarily sourced from mains water but process wastewater may also be used in the ash quench system. The boiler feed water will be treated in an on-site water treatment plant.

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

A carbon filter system will be used to treat 'excess' odorous air from waste reception areas. Treated odorous air from waste reception and storage areas which has been treated in carbon filters will be released via a 40 m odour control stack.

[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 (>5 tonnes) raw materials which will be stored at the Facility are presented in Table 2. Information on the potential environmental impact of these 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 maximum storage capacity [m^3]	Estimated annual throughput [tonnes per annum]	Description
Primary Raw Materials				
Section 5.1 Part A (b)	Low sulphur fuel oil	200	260	Fuel for auxiliary burners
	Ammonia solution	26	770	Ammonium hydroxide, estimated 25% concentration
	Lime	238	4,450	Calcium hydroxide, $Ca(OH)_2$
	Activated carbon	64	70	Powdered
	Water treatment chemicals	N/A	<50	E.g. oxygen scavenger, pH corrector, corrosion inhibitor. Types to be confirmed during detailed design.

Table 3: Raw materials and their effect on the environment

Product	Chemical composition	Environmental medium			Impact potential	Comments
		Air	Land	Water		
Low sulphur fuel oil		100	0	0	Low impact	Fuel for start-up and shutdown of the Facility.
Hydrated Lime	$Ca(OH)_2$>95%	0	100	0	Low impact	Injected lime is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
Activated Carbon	C	0	100	0	Low impact	Injected carbon is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
Ammonia solution	NH_3(aq)	100	0	0	Low impact	Reacts with nitrogen oxides to form nitrogen, carbon dioxide and water vapour. Any unreacted ammonia (a chemical intermediate) is released to atmosphere at low concentrations.
Boiler water treatment chemicals	Oxygen scavenger, pH control, descaler etc	0	0	100	Low impact	E.g. oxygen scavenger, pH control, descaler 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, which will be used in small quantities will be required for the operation and maintenance of the Facility, including:

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

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

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

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

2.1.2 Reagent storage

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

Ammonia solution will be stored within a tank in a dedicated storage area, with secondary containment such as bunding.

Lime and activated carbon, used within the FGT process, will be stored within separate storage silos and will be dosed with separate dosing controls. Storage will be in dedicated steel silos with equipment for filling from a tanker through a sealed pipe work system. 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.

Fuel oil will be used as the start-up and shutdown fuel by the auxiliary support burners, and will be stored in a dedicated storage tank with suitable secondary containment.

Boiler make-up water will be supplied from an onsite 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).

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 hydrated lime ($Ca(OH)_2$) can be used in a wet FGT system. Quicklime (CaO) can be used in a semi-dry FGT system. Sodium bicarbonate ($NaHCO_3$) or hydrated lime 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). The two alternative reagents for a dry system – lime and sodium bicarbonate have therefore been assessed further.

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

Table 4: Reagent selection BAT – costs

Item	Unit	$NaHCO_3$	$Ca(OH)_2$
Mass of reagent required	Kg	109.0	67.0
Mass of residue generated	Kg	84.0	85.0
Cost of reagent	£/tonne	155	94
Cost of residue disposal	£/tonne	163	136
Overall Cost	£/op. hr/kmol	30.6	17.7
Ratio of costs		1.73	-

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

Source: Appendix F

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

- Lime has higher removal rates of acid gases than sodium bicarbonate, which is reflected in the quantities of reagent consumed;
- Lime based APCr has a lower leaching rate than sodium bicarbonate based APCr. Therefore, there are greater waste management options available for lime based APCr. there are different options for the recovery of materials from lime based APCr, i.e. it can be recovered into substitute products displacing virgin materials. GFC are aware that currently the only 'available' option for the management of sodium bicarbonate APCr is disposal in a landfill;
- The reaction temperature for lime systems match well with the optimum adsorption temperature for carbon, which is dosed at the same time;
- The lime system has a slightly lower global warming potential due to the reaction chemistry; and
- The costs per kmol HCl abated are more than 70% lower for a lime system than a sodium bicarbonate system.

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

2.1.3.2 NOx abatement

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

- 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 Sector Guidance on Waste Incineration considers all options as suitable for NOx abatement. Whilst the final selection of reagents to be used for NOx abatamenet will be subject to detailed design, for the proposes of the EP application it is proposed to use aqueous ammonia for the SNCR system, because the higher climate change impacts associated with the use of urea as a reagent in the NOx abatement systems outweigh the handling and storage issues associated with ammonia solution. The issues associated with the storage of ammonia can be overcome by good design of the ammonia tanks and pipework and the use of suitable procedures for the delivery of ammonia.

It is requested that a Pre-Operational Condition is included within the EP which requires the final decision on the NOx abatement technology and reagent to be confirmed following detailed design.

2.1.3.3 Auxiliary fuel

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

"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 gas (LPG);
2. fuel oil; or
3. natural gas.

Auxiliary burner firing on a well-managed waste combustion plant is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to 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 potential explosion risk associated with the storage of flammable gases, this is not considered to be a suitable auxiliary fuel for the Facility.

Natural gas can be used for auxiliary firing and is safer to handle than LPG. As stated previously, auxiliary firing will only be required intermittently. When firing this requires large volumes of gas, which would need to be supplied from a high-pressure gas main. NRE is not aware of a high-pressure gas main already being available at the Facility. Therefore, due to insufficient supply this is not considered to be an available fuel. However, this will be reviewed during detailed design of the Facility.

A low sulphur fuel oil tank can be easily installed at the Facility. Whilst it is acknowledged that fuel oil is classed as flammable, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of fuel oil will lead to 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 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 plant will be used to recover energy from MSW and C&I waste, with European Waste Catalogue Codes as follows:

Table 5: Waste to be processed in the Facility

EWC code	Description of waste
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 03	Plant tissue waste
02 06	**Wastes from the baking and confectionery industry**
02 06 01	Materials unsuitable for consumption or processing
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 cork
03 01 05	Sawdust, shavings, cutting wood, particle board, and veneer other than mentioned in 03 01 04
03 03	**Wastes from pulp, paper and cardboard production and processing**
03 03 01	Waste bark and wood
03 03 07	Mechanically separated reject from pulping of waste paper and cardboard
Wastes from the leather, fur, and textile industries	
04 02	**Wastes from the textile industry**
04 02 10	Organic matter from natural products (e.g. grease, wax)
04 02 21	Waste from unprocessed textile fibres
04 02 22	Waste from processed textile fibres
Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01	**Packaging (including separately collected municipal packaging waste)**

EWC code	Description of waste
15 01 01	Paper and cardboard packaging which is not suitable for recycling and would otherwise be transferred for disposal
15 01 02	Plastic packaging which is not suitable for recycling and would otherwise be transferred for disposal
15 01 03	Wooden packaging which is not suitable for recycling and would otherwise be transferred for disposal
15 01 05	Composite packaging
15 01 06	Mixed packaging
15 01 09	Textile packaging
Construction and demolition wastes (including excavated soil from contaminated sites)	
17 02	**Wood, glass and plastic**
17 02 01	Wood
17 02 03	Plastic which is not suitable for recycling and would otherwise be transferred for disposal
17 09	**Other construction and demolition wastes**
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02, and 17 09 03
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 physical/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)**
19 02 03	Premixed wastes composed only of non-hazardous wastes
19 05	**Wastes from aerobic treatment of solid wastes**
19 05 01	Non-composted fraction of municipal and similar wastes
19 05 02	Waste aerobic treatment of solid wastes from non-composted fraction of animal and vegetable waste
19 05 03	Off-specification compost
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 not suitable for recycling and would otherwise be transferred for disposal
19 12 04	Plastic and rubber
19 12 07	Wood
19 12 08	Textiles
19 12 10	Combustible waste (refuse derived fuel)
19 12 12	Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
20 01	Separately collected fractions (except 15 01)

EWC code	Description of waste
20 01 01	Paper and cardboard which is not suitable for recycling and would otherwise be transferred for disposal
20 01 10	Clothes
20 01 11	Textiles
20 01 38	Wood
20 01 39	Plastics which is not suitable for recycling and would otherwise be transferred for disposal
20 02	Garden and park wastes (including cemetery waste)
20 02 01	Biodegradable waste
20 03	Other municipal wastes
20 03 01	Mixed municipal waste
20 03 02	Waste from markets
20 03 03	Street cleaning residues
20 03 07	Bulky waste

. Waste plastics will be mixed with other wastes within the bunker to form a relatively homogeneous fuel feed into the furnace. The fuel feed will be within the capability of the flue gas treatment system and emissions from the Facility will be maintained within the limits set out within this application.

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. Where feasible, the weighbridge operator will undertake a visual inspection of waste to confirm it complies with the specifications of the waste transfer note (WTN).

For waste delivered in road vehicles, it will not be practical to inspect this waste before it is tipped into the bunker, since it will be compacted in the vehicles/storage vessels. The waste will be observed by the tipping hall operators as it is tipped and by the crane driver and control room operators as it is mixed. Unacceptable waste will be removed from the bunker for further inspection and quarantine, prior to transfer off-site to a suitable disposal/recovery facility.

The bunker design will incorporate a back-loading facility to enable the contents to be emptied into vehicles for removal from site in the event of unplanned periods of prolonged shut-down. This will comprise a feed chute, to be loaded by one of the waste feed cranes, and discharging into an articulated vehicle. The backloading facility will also remove any oversized items or non-combustible items identified within the bunker.

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

2.2.2 Waste handling

2.2.2.1 Waste acceptance and pre-acceptance procedures

Contracts will be held with waste suppliers that will supply incoming waste to the Facility, to ensure the incoming waste is in accordance with the fuel specification.

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. NRE would propose to provide the EA with a summary of the documented procedures prior to commencement of operation via pre-operational condition. This will include the agreement with the adjacent MBT plant.

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

Procedures will be implemented on site for the review of incoming wastes at the weighbridges (i.e. a review of the relevant documentation accompanying the waste) and for periodic inspections of incoming wastes in the waste reception area against the agreed specifications. This may include depositing waste loads onto the waste reception area floor for visual inspection. Crane drivers and other operatives will be trained in order to undertake these tasks.

2.2.2.2 Receiving waste

Prior to the receipt of waste at the Facility pre-acceptance and acceptance procedures will be developed which comply with the Indicative BAT requirements in the Sector Guidance Note, including the following.

1. A high standard of housekeeping will be maintained in all areas and suitable equipment will be provided and maintained to clean up spilled materials.
2. 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.
3. Fire-fighting measures will be designed by consultation with the Local Fire Officers, with particular attention paid to the waste storage area.
4. 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.
5. Incoming waste will be:
    a. delivered in covered vehicles or containers; and
    b. unloaded in the enclosed waste reception areas.
6. Design of equipment, buildings and handling procedures will ensure there is insignificant dispersal of litter.
7. 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.
8. Further inspection will take place by the plant operatives during vehicle tipping and waste unloading activities.

2.2.3 Waste minimisation (minimising the use of raw materials)

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

1. feedstock homogeneity;
2. dioxin & 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 plant, leading to reduced reagent use and reduced residue production. Incoming waste will originate from a variety of sources and suppliers. The mixing of fuels from different suppliers within the waste bunker will improve the homogeneity of fuel input to the furnace.

2.2.3.2 Dioxin & Furan reformation

As identified within EPR 5.01 and the Waste Incineration BREF, there are a number of BAT design considerations required for the boiler. The boiler has been designed to minimise the formation of dioxins and furans as follows.

- Slow rates of combustion gas cooling will be avoided via boiler design to ensure the residence time is minimised in the critical cooling section and to avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans.
- 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 furnace – i.e. an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction. As set out in section 2.6.2, an SNCR system to abate emissions of NOx is considered to represent BAT for the Facility.
- 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 following detailed design and prior to commencement of commissioning. It is proposed that this is allowed for via 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.

A balance will be maintained to ensure that the design measures listed above are not made at the expense of boiler efficiency.

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 Flue Gas Treatment control – acid gases

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

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

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

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

2.2.3.5 Flue gas treatment control – NOx

The SNCR system will require the injection of ammonia solution, into the radiation zone of the boiler 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 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.

2.2.3.6 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 stored and disposed of separately.

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

2.2.3.7 Waste charging

The Facility will meet the indicative BAT requirements outlined in the Incinerator Sector Guidance Note for fuel 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 thermal process will be continually monitored to ensure that optimal conditions are maintained and that the mandatory the IED emission limits are not exceeded. Auxiliary burners will be installed and will be used to maintain the temperatures required in the combustion chamber;

- The waste charging and feeding systems will be interlocked with furnace/boiler conditions so that charging cannot take place when the temperatures drop below 850°C, both during start-up and if the temperature falls below 850°C during operation;
- 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 chute full of waste and by keeping the furnace under negative pressure;
- A level detector will monitor the amount of waste in the feed chute and an alarm will be sounded if the fuel falls below the safe minimum level. Secondary air will be injected from nozzles in the wall of the furnace to control the combustion within the furnace; and
- In a breakdown scenario, operations will be reduced or closed down as soon as practicable until normal operations can be restored.

The feed rate to the furnace will be controlled by the combustion control system.

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 boiler. Other water-consuming processes will include the blow-down cooling and the SNCR system. The following key points should be noted:

- The water system has been designed with two key objectives:
  - minimal process water discharge; and
  - minimal consumption of potable water discharge into the drainage systems.
- Where practicable, waste waters generated from the process will be reused/recycled within the process, for example in the ash quench system.
- In the event that excess process effluents are generated, these will either be discharged to sewer in accordance with a trade effluent consent or tankered off-site to a suitably licensed waste management facility – this will be confirmed during detailed design of the 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, prior to storage in the on site attenuation pond and final discharge into the Northacre Trading Estate drainage system.
- 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.

2.3.2 Water supply

2.3.2.1 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 from showers, toilets, and other mess facilities will be discharged into a foul sewer system for discharge to sewer.

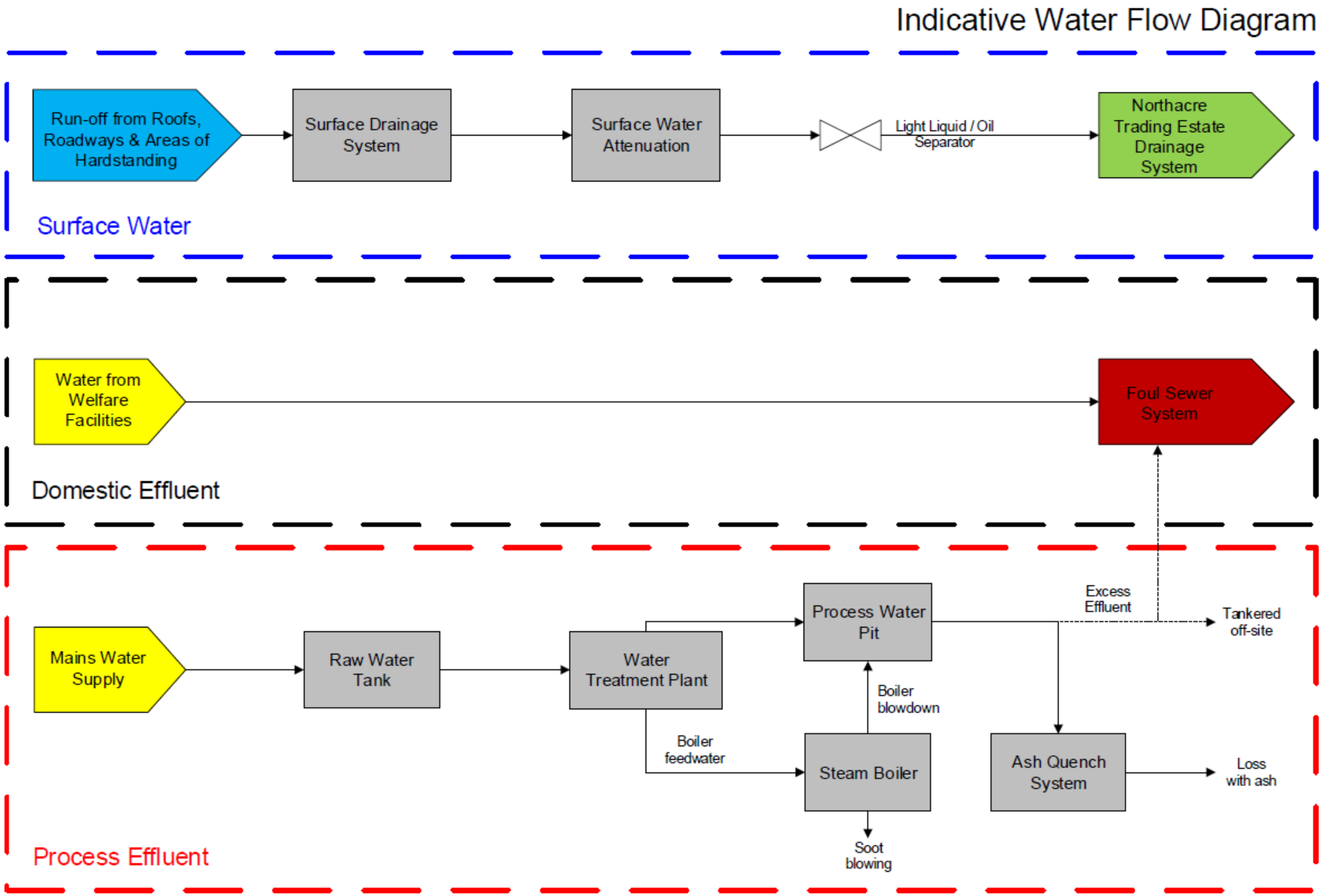
2.3.2.2 Process water

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. Wastewater from the water treatment plant will be re-used within the process, either within the FGT system or within the ash quench.

It is anticipated that the Facility will consume approximately 4.4 m^3 per hour of mains water.

The firewater/raw water tank will be a combined tank to supply raw water to the process and firewater to the fire-fighting systems. The tank will be designed as a split tank with the flanges on the off-take from the tank located to maintain the relevant capacity of water for both raw water and firewater purposes.

Figure 2: Indicative water flow diagram



2.4 Emissions

2.4.1 Emissions to air

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

Table 6: Proposed emission points

Emission Point Reference	Source
A1	Main stack
A2	Odour abatement stack

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

Table 7: Proposed emission limit values (ELVs)

Parameter	Units	Half hour average	Daily average	Periodic limit
Emission Point A1				
Particulate matter	mg/Nm^3	30	5	-
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10	-
Hydrogen chloride	mg/Nm^3	60	6	-
Carbon monoxide	mg/Nm^3	100	50	-
Sulphur dioxide	mg/Nm^3	200	30	-
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	120	-
Ammonia	mg/Nm^3	-	10	-
Hydrogen fluoride	mg/Nm^3	-	-	1
Cadmium & thallium and their compounds (total)	mg/Nm^3	-	-	0.02
Mercury and its compounds	µg/Nm^3	-	-	0.02
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3	-	-	0.3
Dioxins & furans	ng I-TEQ /Nm^3	-	-	0.04
Dioxin & furan-like PCBs	ng WHOTEQ/ Nm^3	-	-	0.06
Emission Point A2				
No limits proposed	-	-	-	-
All expressed at 11% oxygen in dry flue gas at standard temperature and pressure.				

2.4.2 Fugitive emissions to air

2.4.2.1 Waste handling and storage

Waste reception and handling will be undertaken in enclosed waste reception areas which prevent the release of litter and dusts. The waste will then be tipped into and stored within an enclosed bunker.

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

2.4.2.2 Silos

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

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

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

2.4.3 Emissions to water and sewer

The Facility will include separate drainage systems for foul and surface water.

Surface water run-off will be collected from areas of hardstanding and building roofs and discharged into the surface water drainage systems. Surface run-off from vehicle movement areas will pass through a petrol interceptor. All surface water run-off will discharge into the on site attenuation pond followed by final discharge into the Northacre Trading Estate drainage system.

Process effluents, which are not able to be reused within the Facility, will be discharged to foul sewer in accordance with a Trade Effluent Consent which will be issued by Wessex Water prior to commencement of operation. Domestic effluents will be discharged to the foul sewer system.

It is understood that the drainage system for the Northacre Trading Estate is designed and constructed as a dedicated network to serve all future highways and individual sites (roofs and paved areas) to be developed within the Northacre Trading Estate. This dedicated sewer network was subsequently adopted by Wessex Water. Furthermore, it is understood that when the Northacre Trading Estate was constructed the detention reservoir at the end of Stephenson Road was designed to provide dedicated storm water attenuation to surface water discharged from all existing, and future, developments within the Northacre Trading Estate.

An indicative drainage layout drawing is presented in Appendix A.

2.4.4 Emissions of 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 the EA Guidance Note H4: Odour Management. The Facility will include a number of controls to minimise odour from the installation during normal and abnormal operation.

2.4.4.1 Waste reception

The waste reception area, including the tipping hall, the tipping bunker and the waste storage bunker will be maintained under negative pressure, to ensure that no odours are able to escape the building. The negative pressure will be created by drawing process air from the waste reception areas. Where the demand for process air drops below the air flow required to maintain negative pressure, there will be a carbon filter system, which will be used to treat any 'excess air'. The treated air from the carbon filters will be released via an odour abatement stack. This stack will be 11 m in height, but will be situated on top of the Bunker Parapet, so will reach 43 m above ground level.

Bunker management procedures (mixing and periodic emptying and cleaning) will be developed and implemented to avoid the development of anaerobic conditions in the waste bunker, which could generate odorous emissions.

Prior to periods of planned maintenance of the Facility quantities of waste within the tipping bunker and the storage bunker will be run down to minimise the quantity of waste stored at the Facility.

During long periods of unplanned shutdown fuel deliveries to the Facility are stopped, and back-loading of the bunker could be done using crab crane maintenance opening if necessary.

2.4.4.2 Plant process

Emissions from the combustion process will be released from a stack.

The Industrial Emissions Directive (IED) requires that any combustion gases passing through a waste incineration plant must experience a temperature of 850°C or more for at least two seconds. Due to the high temperature experienced by the gases, most odorous chemicals would be destroyed.

The flue gases from the waste treatment/energy recovery process will pass through a flue gas treatment (FGT) system, which includes carbon dosing and bag filters. Any odorous chemicals would be absorbed by the activated carbon and be contained by the bag filters.

Ammonia solution is introduced into the furnace as part of the FGT system, which converts into ammonia during the process, and there may be some occasional "ammonia slip" during operation.

The release of the flue gases from the stack will assist with dispersion of the flue gases. Taking this into consideration, there will not be any malodorous air from the Facility that will be detectable at sensitive human receptors.

2.4.4.3 Boiler ash storage

Boiler ash is the residue collected in the boiler ash hoppers installed beneath the boiler pressure parts. Boiler ash will be stored in a silo. As boiler ash has reached temperatures 850°C, or higher, during combustion within the melting furnace, no organic or putrescible solid material would be present within the silo. Consequently, there will be no odour from the storage of boiler ash.

2.4.4.4 APCr storage

APCr is the residue which is collected in the bag filters and will be stored in a silo. This residue will consist of ash which will have reached a temperature of 850°C, or higher, during combustion within the melting furnace and the flue gas treatment chemicals (lime or activated carbon) injected within the FGT system. Therefore, no organic or putrescible solid material would be present within the APCr silo. Consequently, there will be no odour from the storage of APCr.

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). This ensures the provision of data of an equivalent scientific quality.

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

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

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

Once operational, in addition to the CEMS system emissions to air from the Facility will be subject to periodic surveillance tests by independent testing company's at frequencies to be agreed with the EA.

The following emissions from the Facility will also be monitored by means of spot sampling at frequencies agreed with the EA:

1. group 3 heavy metals [antimony (Sb), arsenic (As), lead (Pb); Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V)];
2. cadmium (Cd) and thallium (Tl);
3. mercury;
4. nitrous oxide;
5. hydrogen fluoride;
6. dioxins and furans; and
7. dioxin like PCBs.

The methods and standards used for emissions monitoring will be in compliance with guidance note EPR5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit.

It is anticipated that:

- Hydrogen chloride, carbon monoxide, sulphur dioxide, oxides of nitrogen and ammonia will be measured by an FTIR type multi-gas analyser;
- VOCs will be measured by an FID type analyser;
- Particulate matter will be measured by an opacimeter; and
- Oxygen will be monitored by a zirconium probe.

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.

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

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

All monitoring results 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.

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

Reliability

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

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

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

There will be one dedicated CEMS 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 the duty CEMS.

Start-up and shut-down

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

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

1. the feed chute damper is open and the feeder, flue gas cleaning plant, control systems, monitoring equipment, grate and ash extractors are all running;
2. the temperature within the combustion chamber is greater than 850°C in accordance with the requirements of the IED;
3. exhaust gas oxygen is less than 15% (wet measurement); and
4. the combustion grate is fully covered with fuel.

Shutdown begins when all the following conditions are met:

1. the feed chute damper is closed;
2. the waste remaining on the grate is burned out;
3. the flue gas treatment systems are running;
4. the auxiliary burner is in service; and
5. exhaust gas oxygen is equal or above 15% (wet measurement).

2.5.1.2 Monitoring Emissions to Sewer

Under normal operation, there will be no emissions of process effluent to water from the Facility. In the event that excess process effluents are generated, they will either be tankered off-site for disposal or discharged to sewer in accordance with a Trade Effluent Consent.

Monitoring requirements for discharges of process effluent will be agreed with Wessex Water within the Trade Effluent Consent. Monitoring of emissions to sewer will be undertaken in accordance with the requirements of the Trade Effluent Consent.

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 exit;
- flue gas composition at the stack;
- combustion process;
- boiler feed pumps and feedwater control;
- steam flow at the boiler outlet;
- steam outlet temperature;
- boiler drum level control;
- flue gas control;
- power generation; and
- steam turbine exhaust pressure.

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

The following process variables have particular potential to influence emissions.

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

2.5.2.1 Validation of combustion conditions

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 also 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 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, a correction factor will be applied to the measured temperature.

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

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

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

2.5.2.2 Measuring oxygen levels

The oxygen concentration at the boiler exit 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)

2.6.1 Combustion technology

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

The Waste Incineration BREF and the BREF for Large Combustion Plants identify a number of alternative technologies for the combustion of waste fuels. The suitability of these technologies 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, oscillating kiln units have a maximum processing capacity of 8 tonnes per hour; therefore, the Facility would require approximately 4 kilns to attain the maximum throughput.

Considering the proposed capacity of the Facility, this is considered impractical and would lead to significant efficiency loses. Therefore, rotary kilns have not been considered any 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 an RDF.

   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 derived fuels. However, there is limited operational experience of these technologies in the UK.

   Previously NRE was not able to secure an investment decision for a gasification technology for the site due to uncertainty over supply chains for a proposed gasification technology due to BREXIT constraints. The gasification technologies which are available at the waste processing capacity proposed for the Facility do not offer any discernible advantages in the abatement of emissions. Taking this into consideration, NRE does not consider that gasification is an ‘available’ technology for the Facility.

   Gasification and pyrolysis systems have not been considered further.

A quantitative BAT assessment for grate and fluidised bed technologies has been undertaken and is presented in Appendix F, Section 2. The conclusions of the assessment are summarised in the table below.

Table 8: BAT assessment – combustion techniques

Parameter	Unit	Grate	Fluidised bed
Global Warming Potential	t CO_2 eq pa	-70,500	-69,500
Ammonia consumption	tpa	800	600
Residues (total ash and sand)	tpa	61,890	64,860
Annual total materials costs (reagents & residues)	£ pa	£3,580,000	£3,920,000
Annual power revenue	£ pa	£10,504,000	£10,348,000

The grate has a similar global warming potential to the fluidised bed but would consume more ammonia during ‘typical’ operations. The use of a fluidised bed would generate a higher quantity of residues than a moving grate and would also have higher operating costs. Although these differences are noticeable, it is acknowledged that they are marginal.

The material costs are approximately 9.5% higher for the fluidised bed than the grate, whereas the grate system will have a slightly higher power revenue. It is acknowledged that these differences are marginal.

As stated within the qualitative BAT assessment (refer to Section 2.6.1 of the Supporting Information), 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:

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

1. Flue gas recirculation (FGR)

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

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

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

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

2. Selective non-catalytic reduction

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 boiler). 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. Ammonia solution will be used as the reagent within the SNCR system.

3. Selective catalytic reduction

The use of Selective Catalytic Reduction (SCR) has also been considered. 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.

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 considering SNCR and SCR, refer to Annex 5. The 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	tpa	170	70	170
NOx abated	tpa	380	480	320
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq pa	-6,500	-2,700	-6,500
Global Warming Potential	t CO2 pa	700	2,700	1,000
Ammonia solution	tpa	770	300	650
Annualised cost	£ pa	£296,000	£1,454,000	£395,000
Average cost per tonne NOx abated	£ p.t NOx.	£779	£3,029	£1,234

For the Facility, using SCR:

- increases the annualised costs by approximately £1.15 million;
- abates approximately an extra 100 tonnes of NOx per annum;
- reduces the benefit of the facility in terms of the global warming potential by 2,000 tonnes of CO_2;
- reduces the ammonia consumption by approximately 470 tonnes per annum; and
- costs approximately 3.9 times more per tonne of NOx abated when compared to SNCR.

The incremental cost for the additional abatement from SCR compared to SNCR is approximately £11,580 per additional tonne of NOx abated.

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 58%. It has no effect on the direct environmental impact of the plant, but it increases the impact on climate change by approximately 300 tonnes of CO_2 per annum while reducing ammonia consumption by approximately 120 tonnes per annum.

However, this is based on the assumption that FGR reduces the NOx generation within the furnace. This is not necessarily the case for all furnace manufacturers. Some designs can achieve lower levels of NOx without FGR. For these technology providers incorporating FGR into the design might even cause additional problems e.g. reduced availability of the plant.

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 following completion of detailed design. Therefore, taking the above into consideration, the use of SNCR with or without FGR is considered to represent BAT for the abatement of NOx within the Facility.

In the event that future regulatory requirements associated with the abatement of NOx are adopted in the UK, space within the flue gas treatment systems has been allowed for the installation of an SCR system to further abate emissions of NOx.

2.6.3 Acid gas abatement system

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

1. **Wet scrubbing**, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.
2. **Semi-dry**, involving the injection of quick lime as a slurry into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the quick lime. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boiler, making the steam cycle less efficient. The quick lime and reaction products are collected on a bag filter, where further reaction can take place.
3. **Dry**, involving the injection of solid hydrated 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 hydrated 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 emission limits required by the IED and both systems have been demonstrated to achieve the relevant emission limits on numerous operational throughout Europe. Furthermore, both are considered to represent BAT by Sector Guidance Note EPR5.01. The advantages and disadvantages of each technique are varied which makes assessment complex; therefore, the assessment methodology described in Horizontal Guidance Note H1 has been used and is detailed in Appendix F section 3.

For the purposes of this application we have undertaken a quantitative assessment of the available technologies for the proposed capacity using data obtained by Fichtner from a range of different projects using the technologies identified within this assessment.

The table below compares the options.

Table 10: BAT assessment – acid gas abatement

Parameter	Units	Dry	Semi-dry
SO_2 abated	Tpa	610	610
Photochemical Ozone Creation Potential (POCP)	t ethylene-eq pa	190	190
Global warming potential	t CO_2 eq pa	2,500	5,500
Additional water consumption compared to a dry system	Tpa	-	22,000
APC residues	Tpa	14,700	14,500
Annualised cost	£ pa	£4,858,000	£5,217,000

The performance of the options is very similar.

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

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

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

2.6.4 Particulate matter abatement

The Facility will use a multi-compartment fabric filter for the control of particulates. There are a number of alternative technologies available, but none offer the performance of the fabric filter. Fabric filters represent BAT for this type of 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 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 station, as the bag filters will be preheated allowing start-up without a bypass, which is considered to represent BAT.

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

2.6.5 Steam condenser

The Facility will operate an Air-Cooled Condenser (ACC) to condense the steam output from the turbine to allow return of the condensate to the boiler.

The two main alternatives to an ACC are a water-cooled condenser or an evaporative condenser and both are considered in Sector Guidance Note EPR5.01 as potential BAT solutions. The former uses a recirculating water supply to condense the steam and the latter uses water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling.

Water cooled and evaporative condensers require significant volumes of water and a receiving watercourse for the off-site discharge of the cooling water. There are no watercourses with a sufficient flow rate for water cooled systems to be considered an 'available' technology for condensing steam.

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. Furthermore, ACC's do not create a visual impact (visible plume), unlike that from evaporative cooling.

Taking the above into consideration, water-cooled and evaporative condensers are not considered to be an available alternative technology. Therefore, ACCs are considered to represent BAT for the Facility.

2.6.6 Odour abatement technology

The 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 – adsorption through a carbon filtration system.

Adsorption is a process in which gas molecules are removed from a gaseous stream via capture on the surface of a solid adsorbent. Adsorbents are chosen so that they preferentially adsorb specific chemical compounds. When a gaseous stream passes through a bed of appropriate adsorbent material, odorous molecules that contact the adsorbent surface are captured. Common adsorbents include granular activated carbon (GAC), zeolites, macro-porous polymer particles, silica gel, and sodium-aluminium silicates.

In general, adsorption is a relatively simple, robust, efficient and economic technology. Although the technology is sensitive to high temperatures (approximately 100°C), humidity, and high particulate content, this should not be a concern for air extracted from the waste reception area. The adsorbent typically has to be replaced after its surface is saturated. Due to the low frequency which the adsorbent will be used, it is estimated that it will require replacement every 12 months.

Adsorption is an appropriate odour abatement technique for gas streams with low concentrations of organic compounds, such as those associated with the Facility. Adsorption is used in various types of facilities for odour abatement, such as sewage treatment plants, petrol stations, and food processing facilities. Some operators of adsorption abatement systems have experienced problems with saturation of the filters; however, a preventative maintenance regime will minimise the chance of problems occurring.

It is understood that the EA consider the use of carbon filtration systems to represent BAT for the abatement of odours.

Taking the above into consideration, the use of an adsorption system is considered to be a proven technology for the abatement of odours compared to the alternative odour abatement technologies. Therefore, it has been accepted as representing BAT for other facilities.

On this basis, the use of an adsorption 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.

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

Table 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 2.7.2.
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 Site condition report within Appendix B.
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	Refer to section 2.2.1.

Article	Requirement	How met or reference
	account the categories of waste to be incinerated or co-incinerated;	
	(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 H.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to section 2.9.
	(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.
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.
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.
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 Appendices B, D and I.
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.	Refer to Appendix E.

Article	Requirement	How met or reference
	The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	
47	In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.	Refer to section 2.2.3.7.
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.
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.
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.
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 850°C for at least two seconds.	Refer to sections 2.1.3.3 and 2.2.3.7.
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	Refer to sections 2.1.3.3 and 2.2.3.7.

Article	Requirement	How met or reference
	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.	
50 (4)	Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached;	Refer to section 2.2.3.7.
	(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 2.2.3.7
	(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 2.2.3.7
50 (5)	Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable.	Refer to Appendix H.
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.
52 (2)	The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	Refer to section 2.2
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 sections 2.2.3 and 2.9.
53 (2)	Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as	Refer to section 2.9

Article	Requirement	How met or reference
	to prevent dispersal of those residues in the environment.	
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.

2.7.2 Requirements of the Waste Incineration BREF

The Final Draft Waste incineration (WI) BREF was published by the European IPPC Bureau in December 2018. The Final BAT conclusions were published on 3rd 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 may 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 below 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 The EMS will be developed throughout the development stage of the project. It is proposed that a pre-operational condition in included within the EP which requires NRE to provide a summary of the proposed EMS prior to commencement of operation.
2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.	As stated in the greenhouse gas assessment (refer to Appendix G), the gross electrical efficiency of the plant is calculated to be 31.73%. Therefore, NRE understands that 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.

#	BAT Conclusion	How met or reference
		There will be no emissions of water from FGC systems and there will be no bottom ash treatment undertaken at the Facility – therefore, the process parameters to be monitored for emissions to water as listed in BAT 3 do not apply to the Facility. NRE 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: <u>Continuous Monitoring</u> • Oxygen; • Carbon monoxide; • Hydrogen chloride; • Sulphur dioxide; • Nitrogen oxides; • Ammonia; • Volatile organic compounds (VOCs); and • Particulates. <u>Periodic Monitoring</u> • 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; • Hydrogen fluoride – once every six months; • Dioxins and furans - once every six months (except long-term sampling of PCDD/F once every month); and • Dioxin-like PCBs (once every six months for short-term sampling, once every month for long-term sampling). As set out in Section 2.5.1.1 of the Supporting Information, the methods and standards used for emissions monitoring will be in compliance with EPRS5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit. Sampling and analysis of all pollutants

#	BAT Conclusion	How met or reference
		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. NRE 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).	NRE understand that the UK regulatory agencies are currently consulting with the UK waste incineration industry on the definition of 'appropriate monitoring' of emissions to air during OTNOC. On this basis, NRE are not able to confirm how the Facility will comply with BAT 5. NRE propose that a Pre-Operational Condition is included within the environmental permit which requires confirmation of the proposals for monitoring of emissions to air during OTNOC.
6	BAT is to monitor emissions to water from Flue Gas Cleaning (FGC) and/or bottom ash treatment with at least the frequencies set out in BAT 6 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	As explained in section 1.3.4, the Facility will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGC systems. Furthermore, there will not be any emissions to water from the treatment or handling bottom ash. Therefore, it is understood that the requirements of BAT 6 are not applicable to the Facility.
7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards.	As explained in section 2.2.3.3, Total Organic Carbon (TOC) will be measured in the bottom ash to confirm that it is less than 3%, and/or Loss on Ignition (LOI) will be measured to confirm it is less than 5%. Measurements will be taken at least once every 3 months and will be in accordance with EN standards. NRE consider 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	The Facility will not incinerate hazardous waste. Therefore, NRE do not consider that the requirements of BAT 8 are applicable to the Facility.

#	BAT Conclusion	How met or reference
	significantly affect the POP content in the output streams.	
9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f).	As described in section 2.2, the Facility will employ the following techniques as required by the BREF: • Determination of the types of waste that can be incinerated. The Facility will incinerate waste in accordance with the list of EWC waste codes that will be listed in the permit, and waste that falls into the range of calorific values as per the firing diagram. The list of EWC codes will characterise the physical state, general characteristics and hazardous properties of the waste. • Implementation of waste acceptance procedures. The Operator will develop acceptance procedures for all wastes delivered to the Facility, in order to ensure that only the wastes which the Facility is permitted to receive are received at the Facility. Paperwork accompanying each delivery will be checked. Periodic inspections of the waste will be undertaken as part of the scope where practicable, prior to transfer into the bunker, to confirm that it complies with the specifications of the waste transfer note (WTN). Waste delivered in road vehicles will be inspected by the crane operator as it is tipped and mixed. • NRE will develop and implement waste pre-acceptance and acceptance procedures at the Facility. The waste acceptance procedures will identify the records required for wastes to be accepted at the Facility and where records associated with the waste should be retained in the document management system which will be employed at the Facility. • Waste acceptance procedures will be used to identify any unacceptable wastes which are not suitable for processing within the Facility and require quarantine and transfer off-site.

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

#	BAT Conclusion	How met or reference
		accordance with documented management procedures to be developed for the Facility. Adequate waste storage capacity will be available on site – the maximum waste storage capacity of the waste bunker will be clearly established and not exceeded. The quantity of waste will be visually monitored against the maximum storage capacity. During periods of planned maintenance, quantities of fuel within the bunker will be run down where possible. NRE consider that the proposed arrangements for environmental risks associated with the reception, handling and storage of waste comply with the requirements of BAT 11.
13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques as listed in BAT 13 of the BREF.	The Facility will not process clinical or hazardous waste. Therefore, NRE consider that the requirements of BAT 13 are not applicable to the Facility.
14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below:	Bunker crane mixing and advanced control systems will be employed at the Facility. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, will be utilised at the Facility to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in section 2.5.2, 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 exit; • flue gas composition at the stack (including HCl measurements); • combustion process; • boiler feed pumps and feedwater control; • steam flow at the boiler outlet; • steam outlet temperature; • boiler drum level control;

#	BAT Conclusion	How met or reference
		• 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. NRE consider that the proposed arrangements for ensuring the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste comply with the requirements of BAT 14.
15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste.	The Facility will be controlled from a dedicated control room, with an advanced control system to optimise the process. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system: for example, ammonia solution dosing will be optimised and adjusted to minimise ammonia slip. Lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring. Activated carbon dosing will be based on flue gas volume flow measurement. NRE consider that the proposed control systems will ensure that the Facility is designed to allow for the adjustment of the plant's settings to comply with the requirements of BAT 15.
16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	The Facility will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable. Waste will be kept at suitable levels in the waste bunker to maintain operation during holiday periods. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations. NRE considers that the operation of the Facility will limit as far as practicable shutdown and start-up operations to comply with the requirements of BAT 16.

#	BAT Conclusion	How met or reference
17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the wastewater treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability.	The FGC and wastewater treatment systems will be appropriately designed and operated within the design range. The FGC and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures. NRE considers that the design and operation of the FGC and wastewater treatment plants will ensure that emissions to air (and water where applicable) are reduced, and will ensure their optimal availability, to comply with the requirements of BAT 17.
18	In order to reduce the frequency of the occurrence of other than normal operating conditions (OTNOC) and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the EMS that includes the elements as identified in BAT 18 of the BREF.	It is currently understood that, at the time of writing, the approach to OTNOC (including definition, associated limits and required monitoring) is still to be determined between ESA and the EA. NRE would request that the EA confirm any conditions relating to OTNOC be updated or varied in-line with any required changes following finalisation of these discussions. It is anticipated that a risk-based OTNOC management plan will be incorporated into the Facility's EMS. This would include the following elements: • Identification of potential OTNOC, root causes and potential consequences. • Regular update of the list of identified OTNOC following periodic assessment. • Appropriate design of critical equipment (the Facility will utilise compartmentalisation of the bag filter and ensure that the bag filter is not bypassed during periods of start-up or shutdown). • Implementation of preventative maintenance plans for critical equipment. • Monitoring and recording of emissions during OTNOC and associated circumstances. • Periodic assessment of the emissions and circumstances occurring during OTNOC and implementation of corrective actions if necessary. NRE considers that the incorporation of a risk-based OTNOC management plan will ensure the Facility's compliance with BAT 18.

#	BAT Conclusion	How met or reference
19	In order to increase resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	The Facility will use a steam boiler to produce steam which is used to produce electricity. The Facility will also have the provision to export heat to local users. NRE considers that the use of a heat recovery boiler is in direct compliance with the requirements of BAT 19.
20	In order to increase energy efficiency of the incineration plant, BAT is to use an appropriate combination of techniques as listed in BAT 20 of the BREF.	The Facility will use the following techniques to increase the energy efficiency of the plant: • Minimise heat losses via the use of an integral furnace boiler – heat will be recovered from the flue gases by means of a steam boiler integral with the furnace; • Optimisation of the boiler design to improve heat transfer – the boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste fuel that is combusted; • High steam conditions (approximately 430°C and approximately 76 bar(a)), 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. NRE considers that the techniques listed above will increase the energy efficiency of the plant and ensure that the Facility will comply with the requirements of BAT 20.
21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to use the methods as stated in BAT 21 of the BREF.	In accordance with the BREF, the Facility will employ the following measures to reduce odour emissions. • Waste in the Facility will be stored in an enclosed bunker area under negative pressure. The extracted air will be used as combustion air for incineration. • The operation of the Facility will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed

#	BAT Conclusion	How met or reference
		or other suitable abatement system will not apply to the Facility. • Odour will be controlled during shutdown periods by minimising the amount of waste in storage. Waste will be run-down prior to periods of planned maintenance. In addition, doors to the bunker hall will be kept shut during periods of shutdown. An odour abatement system utilising carbon filters will be employed should odour be deemed a problem. The measures listed above to reduce odour emissions will ensure that the Facility will comply with the requirements of BAT 21.
22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	Gaseous wastes and liquid wastes will not be accepted at the Facility. Therefore, the requirements of BAT 22 do not apply to the Facility.
23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the EMS the following diffuse dust emission management features:	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 23 do not apply to the Facility. However, identification of the most relevant diffuse dust emissions, and definition and implementation of appropriate actions and techniques, will be included within the scope of the EMS at the Facility.
24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as given in BAT 24 of the BREF.	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 24 do not apply to the Facility. However, it can be confirmed that the following techniques will be employed at the Facility to minimise dust emissions: • All ash handling including conveying undertaken within enclosed buildings. • Where possible, minimising the height of ash discharge. • Use of a water ash quench to minimise the generation of dusts from ash handling activities.
25	In order to reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air:

#	BAT Conclusion	How met or reference
	combination of the techniques as listed in BAT 25 of the BREF.	• Bag filters – to reduce particulate content of the flue gas. • Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of lime to abate acid gases. The concentrations of metals and metalloids will be monitored in accordance with the permit for the Facility. It is considered by NRE that the techniques listed above to reduce channelled emissions to air will ensure that the Facility will comply with the requirements of BAT 25.
26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air, BAT is to treat the extracted air with a bag filter.	There will not be treatment of slags and/or bottom ashes undertaken on-site. Therefore, the requirements of BAT 26 do not apply to the Facility. The bottom ash hall will not be held under negative pressure, however the methods as listed in response to BAT 24 will enable dust emissions to be minimised from the handling of bottom ash.
27	In order to reduce channelled emissions of HCl, HF and SO_2 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.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce channelled emissions to air of HCl, HF and SO_2: • Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of lime to abate acid gases. It is considered by NRE that the use of dry sorbent injection to reduce channelled emissions to air of acid gases is in compliance with the requirements of BAT 27.
28	In order to reduce channelled peak emissions of HCl, HF and SO_2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use optimised and automated reagent dosage, or both the previous technique and the recirculation of reagents.	In accordance with the BREF, the following techniques will be employed at the Facility to reduce peak emissions of HCl, HF and SO_2 whilst limiting reagent consumption and residue generation from dry sorbent injection: • The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment, including automated reagent dosage. • A proportion of the APC residues will be recirculated to reduce the amount of unreacted reagent in the residues.

#	BAT Conclusion	How met or reference
		• The concentrations of HCl, HF and SO_2 released from the Facility will comply with BREF limits. The techniques listed above to reduce channelled peak emissions to air of acid gases will ensure that the Facility will comply with the requirements of BAT 28.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	The following elements have been incorporated into the design of the Facility: • Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14); • An SNCR system; and • Optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip). As justified in section 2.6.2, the use of flue gas recirculation will be confirmed during detailed design of the Facility. The design elements listed above to reduce channelled NOx emissions to air (whilst limiting emissions of CO, N_2O and NH_3) will ensure that the Facility will comply with the requirements of BAT 29.
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) as listed in BAT 30 of the BREF.	The Facility will employ the following techniques to reduce channelled emission to air of organic compounds: • Optimisation of the incineration process – the boiler will be designed to minimise the formation of dioxins and furans as follows: • Minimise residence time in critical cooling section to avoid slow rates of combustion gas cooling, minimising the potential for 'de-novo' formation of dioxins and furans. • Utilisation of an SNCR system which inhibits dioxin formation and promotes their destruction. • Apply CFD modelling to the design where appropriate to ensure gas velocities are in a range that negates the formation of stagnant pockets/low velocities.

#	BAT Conclusion	How met or reference
		• Minimise volume in critical cooling sections. • Prevent boundary layers of slow-moving gas along boiler surfaces via good design and regular maintenance. • Online and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler. • Dry sorbent injection using activated carbon and lime, in combination with a bag filter. The concentrations of dioxins and furans released from the Facility will comply with BREF limits. The techniques listed above to reduce channelled emission to air of organic compounds will ensure that the Facility will comply with the requirements of BAT 30.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at the Facility in combination with a bag filter. It is considered by NRE that the use of these techniques will ensure that the Facility will comply with the requirements of BAT 31.
32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	There will be separate foul/domestic water, process water and surface water drainage systems at the Facility. Foul effluents from domestic sources will be discharged to sewer in accordance with a Trade Effluent Consent. It can be confirmed that there will be no wastewater arising from flue gas treatment. Bottom ash handling will be undertaken in an enclosed building with a dedicated drainage system. The drainage in the Facility's waste reception, handling and storage areas will be contained and reused within the process. Uncontaminated water streams, such as surface water run-off, will be segregated from other wastewater streams requiring treatment. Surface water runoff from roadways and vehicle movement areas will pass through interceptors to contain oil and sediments prior to discharge.

#	BAT Conclusion	How met or reference
		An indicative water flow diagram depicting the segregation of different water streams for the Facility is presented in Figure 2 and Appendix A. It is considered by NRE that the segregation and treatment of different wastewater streams, as described above, will ensure that the Facility will comply with the requirements of BAT 32.
33	In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF.	In accordance with the BREF, the following techniques will be utilised at the Facility to reduce water usage and prevent wastewater generation: • Use of an FGC system that does not generate wastewater – by utilising dry sorbet injection of lime and PAC. • Where practicable process effluents will be re-used within the process. Excess amount of process effluent will require discharge, which will either be discharged to sewer or tankered off-site for treatment. It is considered by NRE that the techniques listed above to reduce water usage and prevent/reduce the generation of wastewater will ensure that the Facility will comply with the requirements of BAT 33.
34	In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 34 of the BREF, and to use secondary techniques as close as possible to the source in order to avoid dilution.	There will be no treatment of slags and bottom ashes undertaken on-site. In addition, there will be no emission to water from FGC. The risk of emissions to water from the storage of bottom ash at the Facility will be minimised – any overflow from the ash quench will be contained and reused within the process and hence there will not be any release of effluent from the ash quench system. In accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above. It is considered by NRE that the Facility will comply with the requirements of BAT 34 by reducing emissions to water from the storage of bottom ash as per the design measures described above.

#	BAT Conclusion	How met or reference
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, NRE consider that the Facility will comply with the requirements of BAT 35.
36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	There will be no bottom ash treatment undertaken at the Facility. Therefore, it is understood that the requirements of BAT 36 do not apply to the Facility.
37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques as listed in BAT 37 of the BREF.	In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the Facility to prevent or reduce noise emissions: • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. • Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Waste deliveries will take place primarily during daytime hours. • Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level. • Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. • Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. In addition, refer to the Noise Assessment presented in Appendix C. It is considered by NRE that the techniques listed above to reduce noise emissions will ensure that the Facility will comply with the requirements of BAT 37.

2.8 Energy efficiency

2.8.1 General

The Facility will utilise a steam boiler which will generate steam which will be used to supply a steam turbine to generate electricity. The Facility will supply electricity to the national grid via a power transformer which increases the voltage to the appropriate level. Commercial discussions are also ongoing with local users for the supply of private wire connections to directly supply electricity.

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.

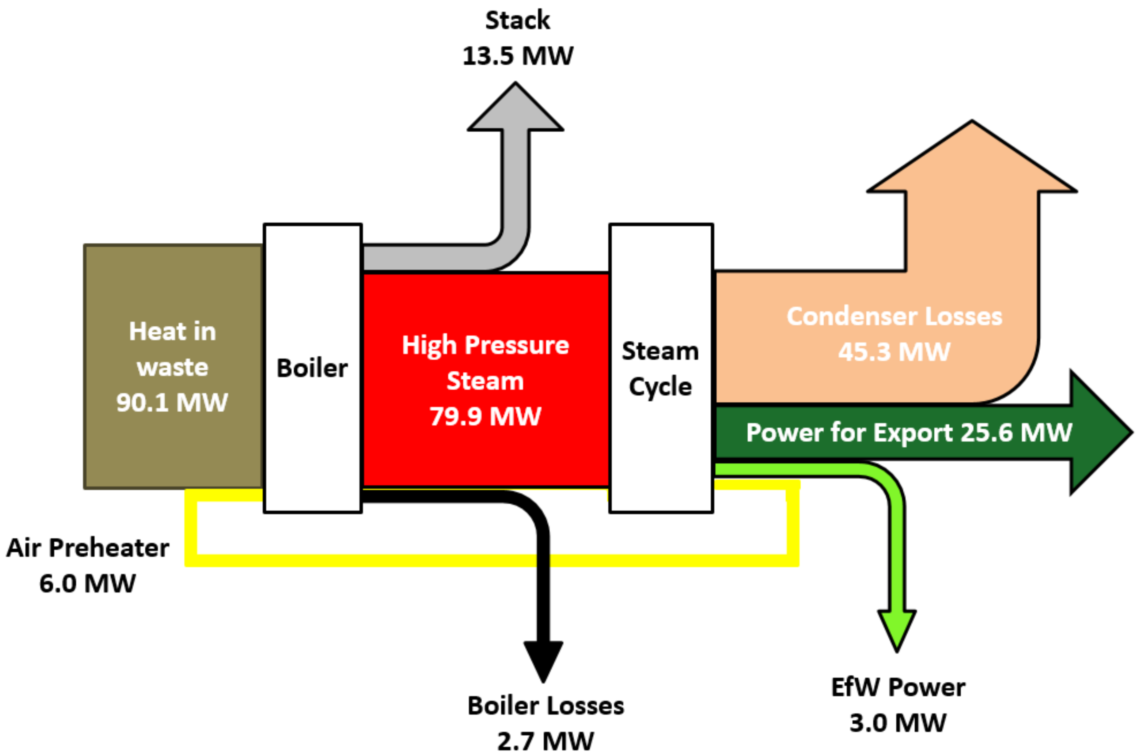
In considering the energy efficiency of the Installation, due account has been taken of the requirements of the Horizontal Guidance Note H2 on Energy Efficiency.

2.8.2 Basic energy requirements

The Facility has been designed to generate up to 28.6 MWe power. The Facility will have a parasitic load of 2.97 MWe, so the export capacity of the Facility will be approximately 25.63 MWe (assuming no heat export from the Facility).

An indicative Sankey diagram for the Facility 'no heat export' case is presented in Figure 3 below.

Figure 3: Indicative Sankey diagram (no heat export case)



The Facility will have the capacity to export up to 4.33 MWth of heat, subject to technical and economic feasibility. The export of heat would reduce the electrical output of the Facility but increase the overall thermal efficiency. The maximum heat capacity will be subject to the requirements of the heat consumers and confirmed during detailed design stage.

2.8.2.1 Energy efficiency benchmarks

The Facility will process up to 243,000 tonnes per annum (at the design capacity of 30.9 tph with an NCV of 10.5 MJ/kg and an availability of approximately 7,884 hours).

In the table below, these 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 (30.9 tph at 7,884 hours availability)	MWh/t waste	0.926	0.415-0.644
Net power generation, design capacity (30.9 tph at 7,884 hours availability)	MWh/t waste	0.829	0.279-0.458
Internal power consumption, design capacity (30.9 tph at 7,884 hours availability)	MWh/t waste	0.096	0.15
Power generation (assumed gross) for 100,000 tpa of waste	MWe	11.74	5-9

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

2.8.2.2 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; and
- fuel loading systems and residue conveying systems.

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

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

- The boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste fuel that is combusted;
- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- Low grade heat will be extracted from the turbine and used to preheat combustion air in order to improve the efficiency of the thermal cycle;
- Steady operation will be maintained where necessary by using 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 EPR5.01 and the Waste Incineration BREF.

2.8.2.3 Operating and maintenance procedures

During the commissioning phase, 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 all operational areas.
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.

2.8.2.4 Energy efficiency measures

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

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

2.8.3 Further energy efficiency requirements

In accordance with the requirements 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 are installed to recover flue gas heat, compatibly with the temperature requirements of the flue gas treatment system.
2. The boiler 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 H.

2.9 Waste recovery and disposal

2.9.1 Introduction

The main residue streams arising from the facility are:

1. Incinerator Bottom Ash; and
2. Air Pollution Control Residues.

As described below, the waste recovery and disposal techniques will be in accordance with the indicative BAT requirements.

Prior to the transfer of residues to 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, NRE will review the options for the recovery and recycling of all residues generated by the Facility.

2.9.2 Air Pollution Control residue (APCr)

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

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

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

APCr is classified as hazardous (due to its elevated pH) and requires specialist landfill disposal or treatment. It may be possible to send the residue to an effluent treatment contractor, to be used to neutralise acids and similar materials. Using the residues in this way avoids the use of primary materials. If these options are not available, then it will be sent to a suitably licensed hazardous waste landfill for disposal as a hazardous waste.

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

2.9.3 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.

Ferrous metals and oversize materials will be extracted from the IBA at the Facility. An oversize separator and a magnetic separator will be required at the end of the ash conveyor to remove these items. Storage will be provided for oversize and ferrous items requiring collection prior to transport off-site.

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. NRE intend to transfer IBA from the waste incineration plant to an off-site IBA processing facility. If a suitable recovery facility will not accept the residue, it may be transferred for disposal in an off-site non-hazardous landfill.

Ferrous metals will be transported to a suitably licensed metals recycling facility for recycling, whilst oversize material will be transported to a suitably licensed waste management facility for disposal.

All ash handling will be undertaken in enclosed buildings. 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.

2.9.4 Summary

The expected quantities and properties of the main residue streams generated from the operation of the Facility are summarised in Table 14 below.

Table 14: Key residue streams from the Facility

Source / Material	Properties of residue	Storage location	Future annual quantity of waste produced (est)	Disposal route and transport method	Expected frequency
IBA	Grate ash. This ash is relatively inert, classified as non-hazardous.	Enclosed ash room	52,610 tonnes	To be removed from site for processing and recycling into secondary aggregate.	1 – 7 days
Fly Ash / APCr	Ash from the boiler and flue gas treatment, may contain some unreacted lime.	Silo(s), 353 m^3 capacity	9,280 tonnes	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.	1 – 7 days

2.10 Management

2.10.1 Introduction

As defined in the Regulation 7 of the Environmental Permitting Regulations, the operator is 'the person who has control over the operation of a regulated facility'.

Bioenergy Infrastructure Group (one of the joint owners of NRE Ltd) currently operates two operational waste incineration facilities in accordance with documented management systems. NRE proposes to extend the existing management systems to create a documented management system to include for the operation of the Facility.

The EMS will form part of the Facility's management system that will establish an organisational structure, responsibilities, practices, procedures and resources for achieving, reviewing and maintaining the company's commitment to environmental protection.

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

2.10.2 Management systems

NRE will ensure that the EMS clearly defines the management structure as well as setting out roles and responsibilities of all staff. The EMS will include:

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

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

2.10.2.1 Scope and structure

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

The site EMS will contain procedures for accident management that comply with the requirements set out in EPR5.01 and the Waste Incineration BREF. This will be in the form of an accident management plan that will be developed before the plant is commissioned.

2.10.2.2 General requirements

NRE will ensure that the EMS objectives and scope are met by:

- Identifying potential environmental impacts;
- Documenting and implementing standard procedures to mitigate and control these impacts;
- Determining a procedural hierarchy that considers the interaction of the relevant processes;

- Ensuring adequate responsibility, authority and resources to management necessary to support the EMS;
- Establishing performance indicators to measure the effectiveness of the procedures;
- Monitoring, measuring and analysing the procedures for effectiveness; and

Implementing actions as required based on the results of auditing to ensure continual improvements of the processes.

2.10.3 Personnel

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

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

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

2.10.4 Competence, training and awareness

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

The EMS will contain a training procedure to make employees aware of:

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

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

2.10.4.1 Competence

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

2.10.4.2 Induction and awareness

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

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

2.10.4.3 Training

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

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

2.11 Closure

2.11.1 Introduction

The Facility is designed for an operational life of more than 25 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 may be adapted for an alternative use or demolished as part of a redevelopment scheme and cleared and left in a fit-for-use condition.

2.11.2 General

2.11.3 Site Closure Plan

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

To achieve this aim, a site closure plan will be prepared. NRE would propose to develop a site closure plan and submit to the EA for approval prior to the commencement of commissioning of the Facility.

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

2.11.3.1 General requirements

- 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 hazard 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;
- 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).

2.11.3.2 Specific details

- 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;
- 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
  - IBA and APCr.

2.11.3.3 Disposal routes

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

2.12 Improvement programme

NRE is committed to continual environmental improvement of all 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 below. It is understood that the proposed conditions are consistent with EPs which the EA has granted for waste incineration facilities in England.

2.12.1 Pre-operational conditions

Prior to commencement of commissioning of the Facility, NRE will comply with the typical Pre-Operational Conditions which will be included for this type of facility, 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 boiler. The report will demonstrate whether the BAT design stage requirements, given in the sector EPR5.01, have been completed. In particular, the report will demonstrate whether the residence time and temperature requirements will be met.
- Submit to the EA for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.
- Provide a written commissioning plan, including timelines for completion, for approval by the EA. The commissioning plan shall include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to the EA in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.

2.12.2 Post-commissioning

Following commissioning of the Facility, NRE will comply with the typical Post-Commissioning Conditions which will be included for this type of installation, as follows:

- Submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non-Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx) emissions.
- Carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnace whilst operating under the anticipated most unfavourable operating conditions. Results will be submitted to the EA.
- Provide a written proposal to the EA, for carrying out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air, identifying the fractions in the 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 EPR3.1 and Table EPR3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.
- Submit a written report to the EA on the commissioning of the Facility. The report will summarise the environmental performance of the Facility as installed against the design parameters set out in the Application.

Appendices

A Plans and drawings

B Site condition report

C Noise assessment

D Environmental risk assessment

E Air quality assessment

F BAT assessment

G Greenhouse gas assessment

H CHP assessment

I Fire prevention plan

J Planning Application

K R1 Application

ENGINEERING CONSULTING

FICHTNER
Consulting Engineers Limited

Kingsgate (Floor 3), Wellington Road North,
Stockport, Cheshire, SK4 1LW,
United Kingdom

t: +44 (0)161 476 0032
f: +44 (0)161 474 0618

www.fichtner.co.uk