SKELTON GRANGE ENERGY FROM WASTE FACILITY ENVIRONMENTAL PERMIT APPLICATION

Best Available Techniques & Operating Techniques

Prepared for: WTI EFW Holdings Ltd

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1.0 Introduction

1.1 Report Context

WTI EFW Holdings Ltd has instructed SLR Consulting Limited (SLR) to prepare an Environmental Permit (EP) application for the proposed Skelton Grange Energy from Waste facility (EfW) to be located at Stourton, Leeds. The facility will be operated by WTI UK Ltd (WTI).

The Environmental Permitting (England and Wales) Regulations (EPR) 2016 (as amended) require regulated facilities to be operated in accordance with an environmental permit. Regulated facilities include 'installations' as listed in Schedule 1 of the EPR. The proposed EfW falls under the following section of the EPR and requires an application for a bespoke installation permit:

- Schedule 1 Part 2 Section 5.1 Part A(1)(b) – the incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.

Activities defined as Installations are required to conform to best available techniques (BAT) requirements. The essence of BAT is that the selection of techniques to protect the environment should achieve an appropriate balance between the environmental benefits they bring, and the costs to implement them. In addition, it should be demonstrated that no significant pollution is caused by an assessment of the environmental impact of emissions from the activity as a whole.

This Best Available Techniques and Operating Techniques (BAT-OT) report is an integrated document which describes both the operating techniques that will be implemented at the facility to ensure compliance with the conditions of the Environmental Permit (EP), and also demonstrates compliance with BAT where applicable.

The report has been drafted to satisfy the requirements of European Commission, Defra and EA Guidance (where applicable), most notably:

- European Commission Joint Research Centre – Best Available Techniques Reference document on Waste Incineration (Final Draft December 2018);
- Environment Agency - Best available techniques: environmental permits (February 2016);
- Environment Agency – How to comply with your environmental permit. Additional guidance for: The Incineration of Waste (EPR 5.01, March 2009);
- Defra – Environmental Permitting Guidance: Waste Incineration (December 2015);
- Environment Agency - A1 installations: environmental permits (April 2018);
- Environment Agency - Develop a management system: environmental permits (January 2019); and
- Environment Agency - Control and monitor emissions for your environmental permit (November 2018).

1.2 Site Location and Access

The Site is situated at Skelton Grange, Leeds, West Yorkshire at National Grid Reference (NGR) 433423, 431179. It lies within an area predominately occupied by commercial/industrial premises and derelict land. Yorkshire Water Knostrop sewage treatment works lie to the north of the site. The River Aire and the Aire & Calder

Navigation lie to the south of the site beyond South Road. The Site is accessed via Skelton Grange Road and South Road to the south of the site.

The Site's location is illustrated on Drawing 001. The surrounding land uses and local receptors within 1km and cultural and natural heritage receptors within 2km are illustrated on Drawings 003 and 004.

1.3 Summary of Proposed Operations

The proposed facility will process municipal solid waste, commercial, industrial waste, sewage sludge and non-infectious clinical waste at a capacity of up to 410,0000 tonnes per annum. The technology will be based on conventional thermal incineration comprising moving grate furnace, steam boiler and turbine generator to produce electricity and with the potential to recover waste heat. Flue gases will be treated to minimise polluting emissions and solid residues will be transferred off-site for treatment and recovery.

Figure 1 provides a simple flow diagram of the process, and further detail of the technology is provided in the rest of this section.

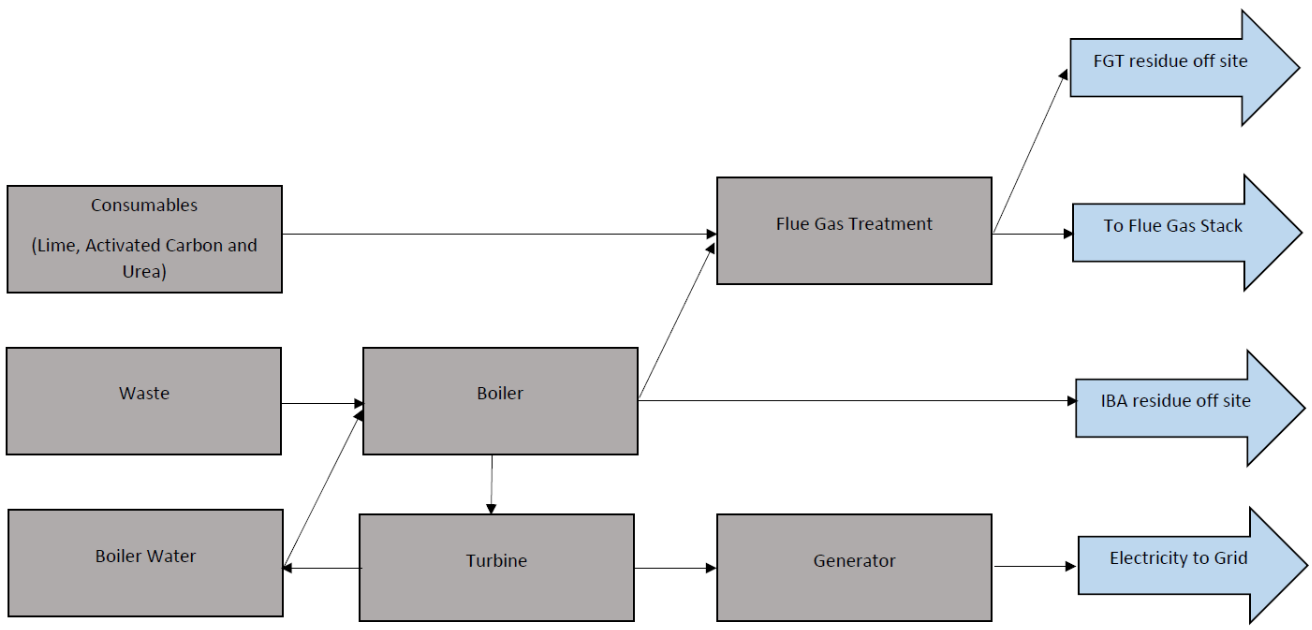


Figure 1
Simplified Process Flow Diagram for the Skelton Grange EfW Facility

1.3.1 Waste Reception and Storage

Up to 410,000 tonnes of waste per annum will be received in the waste reception hall where the waste delivery vehicles will discharge into a bunker for the temporary storage of waste. Waste will be mixed in the bunker and then fed into feed hoppers using an overhead crane.

The exception to this would be partially dried sludges from waste water treatment (dry solids content of approximately 20-25%). These would be delivered to the waste reception hall and unloaded in to a dedicated container for storage. From here they would be fed and metered into the feed chute separately to feedstock delivered from the bunker.

1.3.2 Thermal Processing and Energy Recovery

The waste will travel down the feed hoppers and adjoining feed chutes and be pushed onto the boiler grates by ram feeders. The facility will process waste using an air cooled, moving grate technology.

The boiler will comprise two combustion and steam generating units. In the combustion units, waste will undergo thermal treatment in line with the requirements of the waste incineration requirements of the Industrial Emissions Directive (IED). The combustion of waste will release thermal energy which will be captured by the boilers at various stages. The boilers use this energy to turn water into high pressure, high temperature steam. This steam will be used to produce electricity in the turbine-generator and/or to provide heat/steam for export.

The combustion of waste will release flue gases which will be treated in order to comply with the requirements of the IED.

Urea or ammonia will be added at various stages of the boiler's combustion chamber to reduce nitrogen oxides (NOx). Lime and powdered activated carbon (PAC) will be used within the flue gas treatment (FGT) system. The lime reduces acid gas emissions while the activated carbon reduces mercury and the formation of dioxins/furans. The by-products from both reactions are captured in the fabric filter as air pollution control residues (APCR). The treated flue gases then leave the facility through twin 90m stacks.

The energy recovered from the combustion of waste will be utilised in the form of high pressure steam to produce electrical power through a steam turbine and generator unit. The facility will also have combined heat and power (CHP) capability through a blanking flange and heat/steam export from the turbine.

The key components of the technology will include, but shall not be limited to:

- Twin-line furnace/boiler units incorporating moving grate technology and steam boiler with an energy recovery system;
- FGT system comprising selective non-catalytic reduction (SNCR), lime reactor and bag house filters;
- Steam turbine/generator set with the capability for CHP operation;
- Condensate system, including air cooled condensers (ACC);
- Residue handling and storage facilities;
- Electrical equipment associated with the facility and its connection to the national grid;
- Continuous emissions monitoring system (CEMS); and
- Auxiliary equipment.

The facility will be designed to generate approximately 41.6MW and export approximately 38MW of electricity (assuming zero heat off-take). The facility will be capable of exporting heat, thereby operating as a CHP facility, upon securing a suitable heat customer.

1.3.3 Handling of Solid Residues

Incinerator Bottom Ash (IBA) will remain after the combustion of the waste. This ash will be discharged from the end of the combustion grate directly into an ash quench bath. Ash from the first to fifth boiler pass will also discharge to the IBA bunker.

The IBA will be exported off site to a suitable re-processing facility for recovery as secondary aggregate.

Air Pollution Control Residues (APCR) will be stored in silos and sent off-site for treatment or disposal.

2.0 Management

This section describes the system of management that will be implemented at the site to ensure that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis.

2.1 Design and Construction Quality Assurance

All relevant elements of the facility will be designed in accordance with recognised standards, methodologies and practices.

The design process will use a risk-based approach and will be appropriately documented using drawings, specifications and method statements to provide an adequate audit trail.

Construction Quality Assurance (CQA) plans will govern all construction activities. These CQA plans will be prepared by competent and suitably qualified persons and will detail the assurance and validation process for relevant elements of the facility, which shall include:

- material selection;
- handling, storage and installation;
- conformance and performance testing; and
- Inspection and validation.

A competent and suitably qualified person will supervise the construction activities and prepare a validation report confirming that the construction activities have been carried out in accordance with the CQA plan.

WTI will require subcontractors to work within acceptable quality and environmental standards. The requirements will be set out in WTI's Integrated Management System which will be accredited to ISO14001 standard.

2.2 Environmental Issues

Environmental issues have and will be taken into account during the design, construction and operational phases of the plant. Emissions of contaminants and waste production will be kept to a minimum and the waste hierarchy will be adhered to at all times. Where possible, environmentally friendly products will be used.

The Environmental Risk Assessment, enclosed as Section 5 of the application, assesses the risk to the environment associated with operational activities and identifies corresponding measures to minimise these risks to within acceptable levels.

Details on waste streams, recycling opportunities, disposal routes and responsibilities will be included in a Site Waste Management Plan which will be implemented to cover all construction activities.

2.3 Management Systems

WTI will operate the site using an Environment Management System accredited to ISO14001 Standard. The EMS will be certified within 12 months of the site becoming operational.

The management system will ensure that:

- the risks that the activities pose to the environment are identified;
- the measures that are required to minimise the risks are identified;
- the activities are managed in accordance with the management system;
- performance against the management system is audited at regular intervals; and
- the environmental permit is complied with.

The management system will be reviewed as required in response to significant changes to the activities, accidents or non-compliance. The management system will be supplemented by this BATOT document which outlines the proposed operating techniques at the site and demonstrates conformance with the requirements of EA guidance.

A summary of WTI's environmental management system is included in Appendix B2_1 of the Application Forms (Section 2 of this EP application).

2.4 Management Structure and Responsibilities

The indicative management structure that will be responsible for the activities at the site is shown in Appendix BATOT - 1. The Site Manager (during construction) or Plant Manager (during operations) will have overall responsibility for the establishment of environmental policy, objectives and allocation of resources for the operation of the site.

The Site or Plant Manager will be responsible for ensuring that:

- operational personnel are trained and familiar with procedures and requirements;
- operations comply with regulation and permit conditions;
- activities conform with company policy;
- procedures, logs and records are followed and maintained, as required; and
- aspects for potential improvement are identified and reported back to the site manager.

The Site or Plant Manager will also be responsible for ensuring:

- awareness of potential environmental consequences of activities and operations;
- familiarity with site procedures and work instructions;
- working in compliance with procedures;
- reporting unsafe conditions and potential or actual release arising from unsafe or insecure operational procedures; and
- cleaning up and reporting spillages or releases.

2.5 Technically Competent Manager

The Site will be supervised by a technically competent manager with appropriate qualifications for the role.

2.6 Environmental Policy, Objectives and Targets

Details including environmental targets and objectives and the company's environmental policy and improvement programme will be contained within the management system.

2.7 Management Techniques

2.7.1 Operational Control, Preventative Maintenance and Calibration

Compliance with operating procedures will ensure effective control of site operations.

As part of the environmental management system, procedures will be established covering the following general topics:

- management and training;
- environmental protection and risk assessment;
- equipment registers and calibration;
- defects, non-conformance and complaints; and
- operations control and equipment maintenance.

A maintenance programme for all equipment will be implemented at the site. This will follow the inspection and maintenance schedule recommended by the manufacturer. The maintenance programme will be reviewed annually to ensure any necessary changes are implemented.

Also held on site will be any operation and maintenance manuals as provided by the equipment manufacturer covering:

- machinery associated with the operation of the EfW facility;
- routine maintenance procedures and requirements;
- environmental protection; and
- emergency procedures.

Where necessary, all monitoring and process control equipment will be calibrated in accordance with manufacturers' recommendations.

2.7.2 Monitoring, Measuring and Reviewing Environmental Performance

A formalised management structure will review environmental performance and ensure any necessary actions are taken.

The site manager will review the facility's environmental performance on a regular basis to ensure policy commitments are met, that policy remains relevant, and to ensure that actions to improve environmental performance are identified. Records of environmental performance will be maintained within an appropriate filing system at the site managers' allocated office (or appropriate alternative), or on an electronic system.

2.7.3 Staffing, Competence and Training

The Site or Plant Manager will be responsible for ensuring that training levels for operational staff are adequate, relevant and up to date.

All staff will be under the supervision of a technically competent manager at all times.

Staff employed on site will benefit from training, which will ensure their professional and technical development continues. There will be a commitment for staff at all levels to continual improvement, prevention of pollution and compliance with legislation. The training will ensure that staff are aware of:

- skills and competencies required for each job;
- regulatory implications of the permit for the site and activities;
- potential environmental effects from operations under normal and abnormal circumstances;
- prevention of accidental emissions and actions to be taken in response to accidents;
- control of point source and fugitive emissions to air;
- control of odour;
- waste handling, minimisation, recovery and/or disposal;
- noise;
- monitoring; and
- health and safety.

The management system and BATOT document will be available at all times for Site Personnel to access.

Training records will be maintained by the site manager and held in the site office.

2.7.4 Communication & Reporting of Actual or Potential Non-Compliance & Complaints

All staff will report non-compliances to the site manager, whose responsibility it will be to ensure that these are rectified and future incidents prevented. The following aspects will be considered:

- actual or potential non-compliance;
- suppliers or subcontractors breaking agreed operating rules;
- incidents, accidents, and emergencies; and
- other operational system failure.

The remedial actions taken in response to the non-compliance may include:

- obtaining additional information on the nature and extent of the non-compliance;
- discussing and testing alternative solutions;
- modifying procedures and responsibilities;
- seeking approval for additional resources and training;
- contacting suppliers and contractors to seek alterations to the way they operate; and

- informing the Environment Agency.

2.7.5 Auditing

The Site will benefit from regular auditing to ensure that it is compliant with the conditions of its permit, namely record keeping, monitoring and emission levels. The audit will be carried out by the Site Manager, or other Technically Competent Person and will confirm that all activities on Site are in accordance with the conditions of the EP. The outcome of the audit will be reviewed and tracked to identify any frequent non-compliances.

2.7.6 Corrective Action to Analyse Faults and Prevent Recurrence

The Site Manager will deal with all environmental complaints and other incidents of non-conformance. These include:

- system failure discovered at internal audit;
- incidents, accidents, and emergencies; and
- other operational system failures.

Environmental non-compliances, including remedial action taken and any changes to operation made to avoid re-occurrence will be recorded. Complaints will be reported to and investigated by the site manager and remedial measures implemented as required. Changes to prevent future complaints will be proposed and implemented where appropriate. Written records of non-conformances, complaints and other incidents will be maintained in the site log in which the date, time and nature of the event, together with the results of investigations and remedial action taken, will be recorded.

2.7.7 Reviewing and Reporting Environmental Performance

Senior management will review environmental performance annually and take actions to ensure that policy commitments are met and that policy remains relevant.

2.7.8 Managing Documentation and Records

The site manager will be responsible for ensuring commitments to site audits and reviews and for ensuring that documents relevant to the environmental permit are issued, revised and maintained in a consistent fashion.

An appropriate filing system will be maintained to ensure that all records relating to environmental monitoring, maintenance, reviews and audits are adequately maintained and updated. All records will be held within the site office.

3.0 Accident Management Plan

WTI recognise the importance of the prevention of accidents that may have environmental consequences and that it is crucial to limit those consequences.

An Accident Management Plan will be implemented and maintained at the site to ensure the site's staff are fully prepared for such incidents. The accident management plan will be reviewed at least every four years, or as soon as practicable after any reportable incident on Site. The document will be continually improved in these reviews to include best practice and minimise the risk of accidents occurring.

An initial assessment of the risk of accidents and abnormal operating conditions posed to the environment and site personal are identified in the Environmental Risk Assessment (ERA), enclosed in Section 5 of the application. The mitigation measures identified within the ERA will be implemented to limit the consequences of accidents on the environment and site personnel.

The following accident management plan describes the techniques that will be implemented to minimise the risks posed to the environment. Activities affecting the health and safety (H&S) of operatives, contractors and visitors are separately managed in compliance with H&S regulation and company H&S policy.

3.1 Action to Minimise the Potential Causes and Consequences of Accidents

Action will be taken at the site to minimise the potential causes and consequences of accidents. These actions will include:

- maintaining a list of substances that would harm the environment if they were to escape;
- raw materials and waste will be checked for compatibility with other substances with which they may come into contact;
- raw materials, products and wastes will be stored to prevent their escape into the environment;
- where appropriate, barriers will be constructed to prevent vehicles from damaging equipment;
- primary and secondary containment will be provided to prevent the escape of potentially polluting materials;
- tanks for the containment of fuels will be fitted with level measurements to prevent overfilling;
- site security will be installed to minimise the risk of unauthorised access;
- a log will be maintained of all incidents and near misses;
- responsibilities for managing accidents will be clearly defined. Clear instructions on the management of accidents will be maintained; and
- appropriate equipment will be maintained to limit the consequences of an accident.

3.2 Hazard Identification

The following hazards have been identified:

- waste storage failure;
- incoming waste or raw material handling/storage failure;

- waste charging failure;
- furnace control failure;
- residues handling/storage failure;
- air pollution control equipment failure;
- unauthorised waste receipt and processing:
- fire;
- explosion;
- asphyxiation and toxicity;
- loss of containment – spillage and leakage;
- security and vandalism; and
- flooding.

Information on how these risks will be mitigated at the facility are detailed in the ERA included in Section 5 of this application.

4.0 Authorised Activities

4.1 Permitted Activities

The waste management activities to be carried out at the site are detailed below:

- R1: Use principally as a fuel or other means to generate energy; and
- R13: Storage of wastes pending any of the operations numbered R1 to R12.

4.2 Directly Associated Activities

The following directly associated activities will also be undertaken at the Site:

- Receipt, Storage and Handling of Waste;
- Discharge of surface run-off to controlled waters;
- Emergency diesel generators;
- Storage and Handling of Products and Residues; and
- Storage of Raw Materials and Spent Reagents.

4.3 Permitted Waste Types

The full list of waste types to be accepted at the facility, according to European Waste Catalogue (EWC) code is provided in Appendix B3_1 to the Application Forms in Section 2 of this EP application.

4.4 Processing Capacity

The Site will accept up to 410,000 tonnes per annum of non-hazardous waste consisting of:

- municipal solid waste;
- commercial and industrial waste; and
- non-infectious clinical waste.

Sewage sludge may also be accepted up to a maximum limit of 15% of the Site's throughput.

4.4.1 Storage Capacity

In the event of plant shutdown, the waste bunker has the capacity to store up to five days of waste (at maximum plant capacity of 410,000 tpa). If it is anticipated that an outage will extend beyond this period, waste may be removed off site for treatment or disposal at an alternative permitted facility.

Maximum storage capacities of the different stages of the process are detailed in Table 1.

Table 1
Maximum Storage Capacities

Facility	Maximum Storage Capacity (Days)	Maximum Storage Capacity (m^3)
Waste Bunker	Up to 5 days at plant capacity	20,000
Incinerator Bottom Ash	Up to 8 days	2,000[2]
Air Pollution Control Residue	Up to 3 days	460[1]

[1] Based on APCR density 490kg/m^3
[2] Based on IBA density 1.2t/m^3

4.5 Operating Hours

The waste management process will operate continually for 24 hours a day, 365 days a year.

It is proposed that waste deliveries will be accepted 24 hours and 7 days a week.

5.0 Process Description and Performance

5.1 Selection of Furnace Type

A number of different types of furnace are available for the thermal treatment of waste, employing different combustion technologies.

It is proposed that the combustion technology for the plant will be a reciprocating grate which is designed to mix and transport waste as part of the combustion process. The grate is a sloped, reciprocating design with rows of static and moving bars. It will have the ability to process waste of varying CVs and throughputs and be constructed to allow complete combustion of the fuel. The grate will follow a modular design allowing adaptation to accommodate specific needs. This technology is widely used in EfW applications across Europe.

The Incinerator Sector Guidance Note (S5.01) and the European BAT Reference document discuss a number of alternative technologies for the combustion of waste.

1) Moving Grate Furnaces as stated in the Sector Guidance Note, these are designed to handle large volumes of waste.

2) Fixed Hearth: these are not considered suitable for large volumes of waste or wastes of variable composition. They are best suited to low volumes of homogenous waste.

3) Pulsed Hearth: has been used for municipal waste in the past, as well as other solid wastes. However, there have been difficulties in achieving reliable and effective burnout of waste and it is considered that the burnout criteria required by IED would be difficult to achieve.

4) Rotary Kiln: have achieved good results with clinical waste but have not been used in the UK for MSW. The energy conversion efficiency of a rotary kiln is lower than that of a moving grate due to the large areas of refractory lined combustion chamber.

An oscillating kiln is used for municipal waste at one site in England and a number of sites in France. The energy conversion efficiency is lower than that of a moving grate for the same reasons as for a rotary kiln. In addition, the capacity per unit is limited to 8tph and for this application would need up to five number furnaces to achieve the design throughput, which is not economically feasible.

5) Pyrolysis/Gasification: various suppliers are developing pyrolysis and gasification systems for the disposal of municipal waste. However, it is not considered that any of these technologies can be considered ‘proven’. Pyrolysis and gasification systems which generate a syngas can theoretically take advantage of gas engines or gas turbines, which are more efficient that a standard steam turbine cycle. However, losses associated with making syngas and the additional electricity consumption of the site due to the waste pre-treatment requirements means that the overall efficiency is no higher than for combustion plant and is generally lower. This means that a combustion plant will generally have a more beneficial effect on climate change.

Plasma gasification can theoretically produce a much more useful syngas than thermal gasification but has a much higher electrical parasitic load and is in the early stages of commercial development for municipal waste treatment. It has been used successfully for treatment of hazardous wastes (the European BAT reference document for waste incineration refers entirely to plasma gasification for destruction of gaseous CFCs and other ozone depleting substances). However, there are no reference plants in Europe for the recovery of energy from municipal waste (the only large-scale commercial plant constructed in Europe closed in 2004). A few plants worldwide operate using MSW but the largest plant only has capacity to treat a fraction of the 410,000 tonnes per annum waste throughput required of the Skelton Grange facility. Therefore, pyrolysis and gasification are not considered to be suitable alternatives to the current facility design.

6) Fluidised Bed: these are designed for the combustion of relatively homogeneous waste. For residual MSW, the waste would need to be pre-treated before feeding to the fluidised bed, which would lead to additional energy consumption and a larger building. The pre-treatment can also lead to higher quantities of rejected material. Where MSW is treated at a material recycling facility, the residues from the MRF may already be suitable for feeding to the fluidised bed. This does not apply to residues from kerbside collection schemes, which would need some pre-treatment, including shredding and metals removal as a minimum, before feeding to the fluidised bed.

Whilst fluidised bed combustion can lead to slightly lower NOx generation, the injection of ammonia or urea is still required to achieve the emission limits specified in the IED. Experience in the UK of fluidised bed combustion of MSW has been limited. Two plants are operational, but both have had significant operational problems. One is operating well below its design capacity while the other is still being commissioned. WTI do not consider that they can be considered a reliable technology at this stage.

In summary, a reciprocating grate technology is proposed for this plant as it is believed that it represents the best choice when balancing the factors of mechanical reliability, energy efficiency, environmental impact and costs.

5.2 Waste Processing and Electricity Production

Waste will enter the process via the facility tipping bays and will be stored in the waste bunker. The waste will be mixed and fed into the boiler waste feed hoppers using an overhead crane. The waste will travel down the feed hoppers and adjoining feed chutes and be pushed onto the boiler grates by ram feeders.

The boilers will comprise a combustion and steam generating unit. In the combustion units, waste will undergo thermal treatment in line with the IED requirements for waste incineration. The boiler steam generating units will comprise a piping network fed with demineralised water. The combustion of waste releases thermal energy which will be captured by the boiler water at various stages. The boilers will use this energy to turn water into high pressure, high temperature steam. This steam will be used to produce electricity in the turbine-generator and/or to provide heat/steam export.

5.3 Emissions Control and Process By-products

The combustion of waste releases flue gases which will be treated in order to comply with the emission limits set out under the IED and Best Available Techniques Associated Emission Levels (BAT-AELs) set out in the Waste Incineration Bref.

The facility will employ selective non-catalytic reduction (SNCR) to control oxides of nitrogen (NOx) using either urea or ammonia as a reagent. The reagent will be injected into the boiler’s combustion chamber. Lime and powdered activated carbon (PAC) will also be used within the Flue gas treatment (FGT) system. The lime reduces acid gas emissions while the activated carbon reduces mercury and the formation of dioxins/furans. The by-products from both FGT reactions are captured in the fabric filter as air pollution control residues (APCR). The treated flue gases then will leave the facility through the stack.

Incinerator bottom ash (IBA) will remain after combustion of the input waste. This ash will be discharged from the end of the combustion grate directly into the ash quench bath. The IBA will be mixed with the fly ash collected from the first to fifth boiler passes. The mixed ash will be stored pending transfer off site for further treatment and recovery.

The APCR will be conveyed to silos for storage, pending transfer off-site for further treatment/landfill.

5.4 Plant Capability

The facility will be operated at an annual availability of 8,000 hours. At the design point (DP) each boiler line at the facility will have an hourly throughput rate of approximately 24tph at a net calorific value (NCV) of 10.5MJ/kg of waste. This equates to a thermal load of 70MW for each boiler. See Figure 2 for the combustion diagram and Table 2 for data regarding the corresponding operating points.

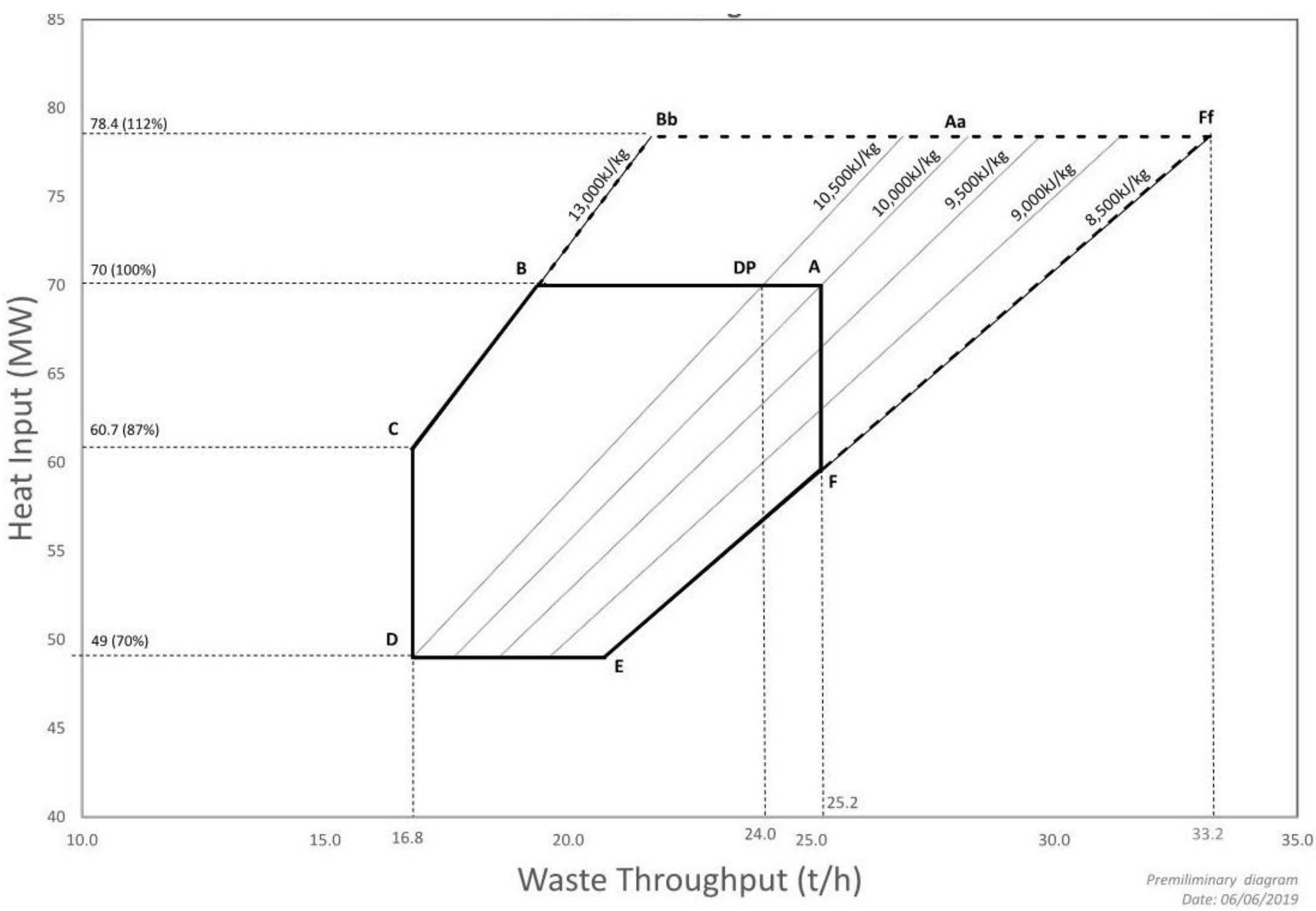


Figure 2
Combustion diagram for Skelton Grange EfW Facility

Table 2
Combustion Diagram Data Points (per line)

Data Point	Waste Throughput	Waste NCV	Waste Energy Input	
	t/h	kJ/kg	MWh/t	MW
DP	24.0	10,500	2.917	70
A	25.2	10,000	2.778	70
Aa	28.2	10,000	2.780	78.4
B	19.4	13,000	3.608	70
Bb	21.7	13,000	3.613	78.4
C	16.8	13,000	3.613	60.7
D	16.8	10,500	2.917	49
E	20.8	8,500	2.356	49
F	25.2	8,500	2.361	59.5
Ff	33.2	8,500	2.361	78.4

5.5 Facility Performance

Energy, water and mass balance modelling has been undertaken in the design process for the Skelton Grange EfW facility. A summary of key performance indicators is provided in Table 3.

Table 3
Energy Recovery Facility Plant Performance at Design Point (Total)

Parameter	Unit	Value
Annual Waste processing availability	tonnes	384,000
Calorific value	MJ/kg	10.5
Operating hours	hours	8,000
Throughput consumption	tph	48
No. of lines	No.	2
Total thermal load	MW	140
Gross power generated	MW	41.6
Gross plant efficiency	%	29.7
Bottom ash production	%	25
Air Pollution Control Residues	%	6

5.6 Detailed Process Description

5.6.1 Waste Reception

Authorised vehicles delivering waste to the EfW facility will be directed from the weighbridge to the manoeuvring area. Vehicles will manoeuvre and reverse into the tipping hall's enclosed tipping bays. Vehicles will then position in order to discharge waste into the bunker. A vehicle will enter a tipping bay only when the crane operator has ensured that the bunker is clear at the particular tipping position. This will ensure that the waste load can be safely tipped into the bunker without overflowing onto the tipping floor or compromising crane operations.

The waste will be mixed in the bunker in order to achieve a homogenous fuel and feed into the waste feed hopper using an overhead crane. Two cranes will be provided to perform this function with each crane rated at 100% in order to provide sufficient redundancy. This means that each crane will be able to perform all actions in order to maintain waste throughput, namely:

- clearing the tipping positions;
- mixing the waste; and
- delivering waste to the waste feed hopper.

Deliveries of non-infectious clinical waste (CW) will be tipped directly into the bunker. The frequency of delivery will ensure that the proportion of CW within the bunker is low and well mixed with other waste so as to avoid 'slugs' of CW being fed to the furnace.

The waste feed chute (Figure 3) will gravity feed the ram pusher which will in turn push the waste onto the air-cooled grate for combustion, see Figure 4.

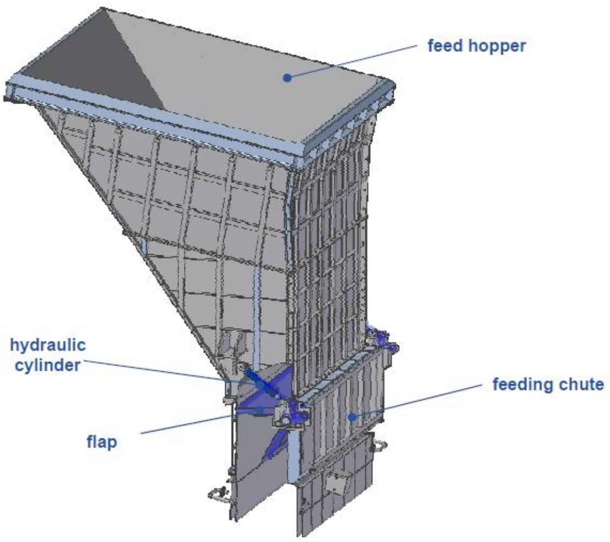


Figure 3
Waste Feed Hopper and Chute

Partially dried sludges from waste water treatment (dry solids content of approximately 20-25%) would be delivered to the waste reception hall and unloaded in to a dedicated container for storage. From here they would be fed and metered into the feed chute separately to feedstock delivered from the bunker.

5.6.2 Waste Processing

The waste will be burned on a reciprocating grate which is designed to mix and transport waste as part of the combustion process. It is widely used in Energy from Waste (EfW) applications across Europe.

Based on the projected contract waste and third party waste composition, an air cooled reciprocating grate will be utilised for the facility. The grate will be designed to process waste with a blended calorific value (CV) of 10.5MJ/kg. The grate will have the ability to process waste of varying CVs and throughputs within the boundaries of the firing diagram, see Figure 2. The grate will be constructed to ensure complete combustion of the fuel. The grate will follow a modular design allowing the adaptation of the grate in order to accommodate specific needs. The grate is a sloped, reciprocating grate with rows of static and moving bars. Please refer to Figure 4 for a diagram of the grate.

5.6.3 Combustion Control

Combustion control will take place using a number of different plant features. The main features will include the following:

- primary air system;
- secondary air system;
- waste feed system;
- additive dosing system; and
- auxiliary fuel firing system.

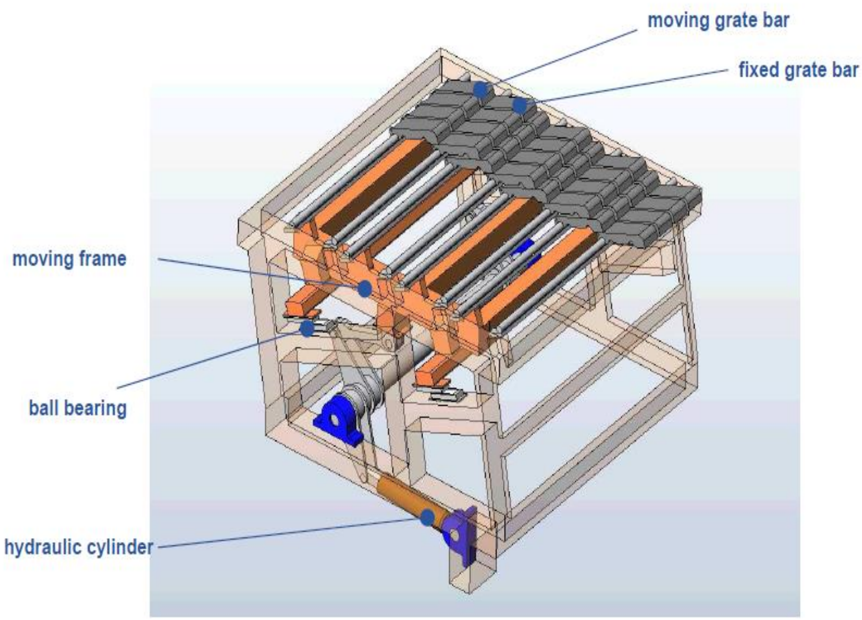


Figure 4
Air Cooled, Reciprocating Action Grate

5.6.4 Primary Air System

The primary air system comprises of the primary air fan and primary air pre-heater. The system controls and delivers primary combustion air to the boiler. Air is drawn in from the waste bunker and is delivered by the primary air fan to the underside of the individual grate zones. The air flow rate is variable across the grate zones and can be adjusted for optimum combustion for each individual grate zone.

If the CV of the waste is low, the air will be pre-heated thus allowing sufficient drying of fuel and subsequent combustion. The primary air pre-heater comprises a heat exchanger supplied with low pressure steam from the turbine.

5.6.5 Secondary Air System

The secondary air system delivers and regulates secondary combustion air to mix with the flue gases within the first boiler pass and complete the combustion process. This system comprises the air ducts from the intake to the secondary air nozzles in the combustion chamber. Secondary air is drawn from the top of the boiler house and is delivered into the combustion chamber. The secondary air system also comprises a heat exchanger to improve combustion.

5.6.6 Waste Feed

The boiler waste feed systems comprise the ram feeder and grate speed controllers. These enable the regulation of waste fed onto the grate to ensure optimal combustion. The speed of the ram feeder and grate forward stroke can be continuously controlled and adjusted. With each stroke the waste is pushed onto the grate.

5.6.7 Additive Dosing System

In order to control NO_x emissions, SNCR will be employed, using urea or ammonia as the reagent. The reagent will be injected into the front and side walls of the furnace at various levels and reacts with the NO_x yielding nitrogen (N_2), carbon dioxide (CO_2) and steam. Injecting reagent at varying heights in the furnace allows for efficient use of the reagent, while minimising NO_x emissions.

5.6.8 Auxiliary Fuel Firing System

No gas is anticipated to be used on-site. Instead, diesel oil will be used within the Facility, as detailed below.

Diesel oil will be used for the boiler burners and site vehicles. The boilers will have two auxiliary diesel fired burners, which will be utilised during start-up, shut down and abnormal operations. During abnormal operating conditions (e.g. feed chute blockage), diesel oil may be used to maintain the process furnace temperature within the required operational limits.

5.6.9 Power and Heat Production

Steam produced by the boilers will be sent to a steam turbine-generator unit. The turbine-generator converts thermal energy in the pressurised steam to mechanical energy in the turbine and electrical energy in the generator. This electrical energy is used within the facility (parasitic load) with excess power sold to the external national grid.

The EfW will be designed to generate approximately 41.6MW and export approximately 38MW of electricity without an external heat consumer. The facility will be capable of exporting heat; thereby operating as a CHP facility, upon securing a suitable heat customer. Please refer to the CHP-ready Heat Plan submitted with in Section 8 of this EP application for details of the heat load assessment and flexibility incorporated into the plant's design.

After the steam turbine, the expanded steam will be condensed in the air-cooled condenser. The condensate will be returned to the feed water tank for re-use within the system. In cases such as start-up, shutdown, overload or trip of the turbine, all or part of the steam will flow into the air-cooled condenser via the turbine bypass system. The thermal capacity of the air-cooled condenser will be high enough to condense the steam in bypass mode.

5.6.10 Energy Recovery

Energy transfer between the flue gases and the boiler will be undertaken via four vertical passes and one horizontal pass in the boiler, numbered in Figure 6. The height of the boiler will ensure that the minimum (2 seconds at over 850°C) residence time for the flue gas is achieved, in accordance with the IED requirements.

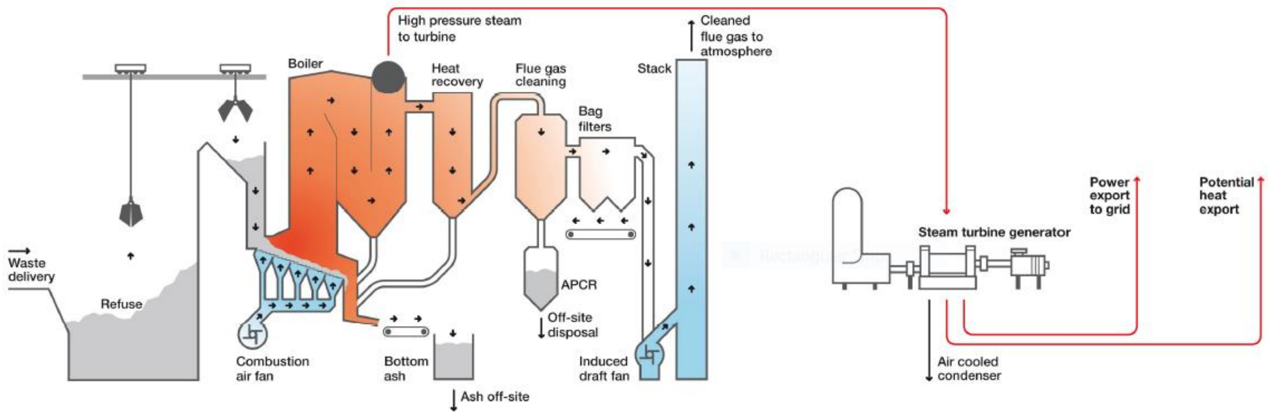


Figure 5
Heat Recovery

The boiler steam generating system will include, but not be limited to;

- First pass: vertical radiation pass made of evaporator membrane with refractory lining on flue gas side;
- Second/third pass: vertical radiation pass made of evaporator membrane walls;
- Fourth pass: horizontal convection pass made of membrane walls with bundles of superheater heat exchanger surfaces; and
- Fifth pass: vertical pass with bundles of economiser heat exchanger surfaces.

Steam will be generated within the evaporator sections of the boiler and the boiler drum. The saturated steam will be further heated in the superheaters. The economiser sections of the boiler will act to reduce the flue gas exit temperature to the optimum values required for the FGT process.

The boiler surfaces will be maintained clean to ensure consistent heat exchange. Boiler cleaning will be undertaken using different methods according to the area of the boiler:

- In the first, second and third passes (the radiant passes), a spray cleaning system will be applied;
- In the horizontal pass (the convective pass), there will be a pneumatically driven rapping system; and

- In the vertical pass (the economiser), soot blowers will be used.

5.6.11 Emissions Control & Monitoring

The FGT and NOx control measures will ensure that all stack emissions comply with the IED emission limits. In order to control NO_x emissions, SNCR will be utilised. Urea or ammonia will be injected into the front and side walls of the furnace at various levels, refer to Figure 8. The reagent reacts with the NO_x yielding nitrogen (N_2), carbon dioxide (CO_2) and steam. Injecting reagent at varying heights in the furnace allows for efficient use of the reagent, while minimising NO_x emissions.

SNCR is a proven, economical technology, widely used in the EfW industry which demonstrates the application of best available techniques (BAT) and is capable of meeting the BAT-associated emission limit (BAT-AEL) upper limit of 120mg/m^3 proposed in the December 2018 draft of the revised Waste Incineration Bref.

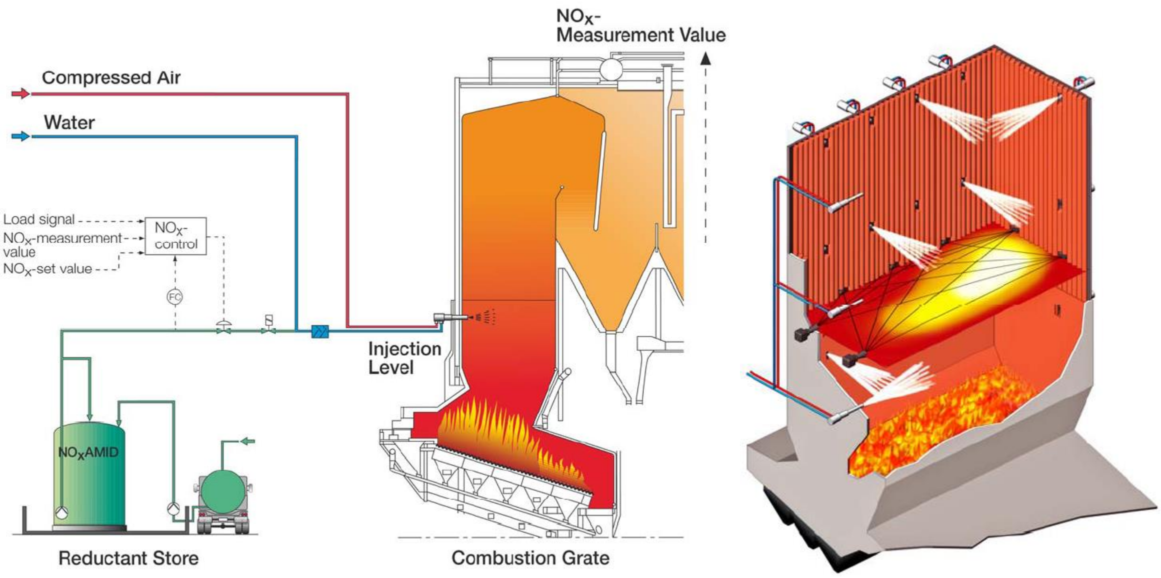
The EfW plant layout accommodates future inclusion of selective catalytic reduction (SCR) should changes in legislation require NO_x emissions to be below the capability of the SNCR technology.

The flue gases exit the boilers and enter the FGT plant at a temperature of between 160ºC (clean boiler) to 200ºC (fouled boiler). The FGT plant comprises an acid gas scrubbing reactor and fabric filter (see Figure 9).

An acid gas abatement report and NOx abatement report are appended to this report as Appendices BATOT-2 and BATOT-3 respectively.

The first stage of the FGT involves an acid gas scrubbing process. Hydrated lime is injected into the flue gases in order to absorb free acids, which include chlorine, fluorine and sulphur laden gases, see Figure 9. This early injection of lime also acts as corrosion protection for the next stage.

The second stage involves reducing the flue gas temperature to approximately 150^{o}C in order to optimise the reaction with the hydrated lime. Compressed air and water are injected for this purpose, see Figure 9 overleaf.



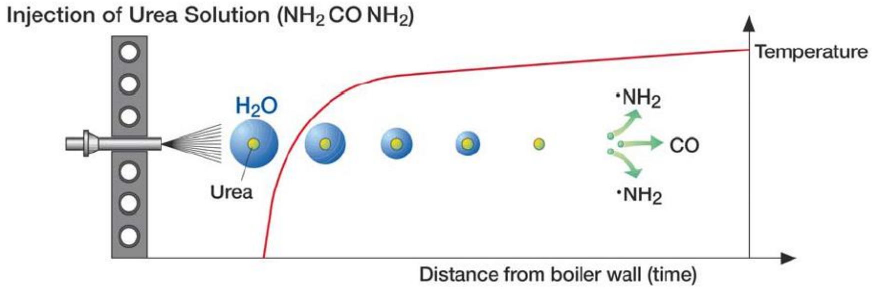


Figure 6
Urea Injection

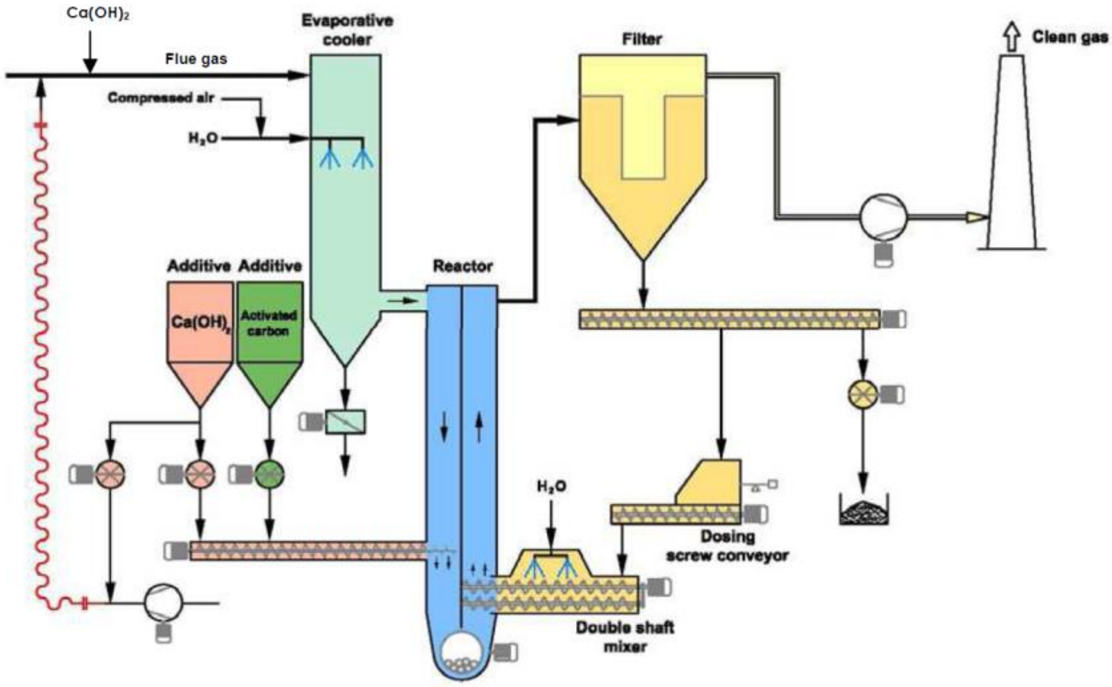


Figure 7
Flue Gas Treatment System

For the third stage of the treatment, additional hydrated lime and activated carbon are added. The activated carbon will capture heavy metals such as mercury as well as dioxins, furans and other high-molecular organic compounds. At this stage, particles captured from further downstream of the process are also re-circulated and reintroduced into the flue gases. The flue gas then passes through a conditioning rotor which breaks up large particles and creates a homogeneous distribution of particles (up to 200g/m^3).

The final stage of the FGT is the fabric filter. The fabric filter is comprised of vertical filter bags through which the flue gases flow. The induced draught fan will draw the flue gases through the filter bags. Particles are deposited on the outside of the bags and the clean flue gases flow through the bags. The particles captured on the outside of the filter bags also form a porous cake providing further filtration as the flue gases flow through it. Since the cake includes lime and activated carbon, a final chemical reaction takes place before the flue gases exit to the stack.

The filter bags are cleaned by pulses of compressed air (from the clean side) down the bag. As the bag expands the particles that have built up on the bag drop and collect in a hopper at the bottom of the fabric filter. Part of this residue is re-circulated back to the third stage, see above, in order to maximise the use of the lime and activated carbon injected.

Emission Monitoring System

Continuous emissions monitoring system (CEMS) analysers will be located on the stack in compliance with the IED and the Environmental Permit. The CEMS analysers shall be certified under the Environment Agency's monitoring certification scheme (MCERTS) with adequate spans to allow for accurate emissions monitoring and future calibrations, in line with quality assurance levels (QAL3) and annual surveillance tests (AST).

The CEMS will feed live emission data to the plant control system to ensure that emissions are compliant with the environmental permit by adjusting the combustion control process and chemical dosing.

The continuous emission monitoring system measures the following (to meet requirements of IED[1]):

- oxygen;
- dust;
- total organic compounds (TOC);
- SO_2;
- NO_2;
- NO[2];
- CO;
- HCl; and
- H_2O.

In addition, continuous CO_2 measurement will be provided.

5.7 Process Offtakes and Storage

The Skelton Grange EfW facility will produce the following products and residues:

- Incinerator bottom ash (IBA); and
- Air pollution control residues (APCR).

Upon leaving the combustion zone the IBA is quenched and then stored in the IBA bunker adjacent to the feed bunker before being transferred for further treatment / recovery off-site. The IBA includes ash from the grate combustion and also fly ash from all boiler passes, which is mechanically conveyed to the IBA quench.

The IBA will be transferred off-site for treatment for recovery, or disposal to landfill.

The APCR and will be conveyed to silos for storage pending transfer off-site for further treatment/landfill. APCR

[1] Continuous monitoring of HF is not included as this is not required under the EU IED if HCL abatement is employed.
[2] NOX is required to be reported under the EU IED and NO & NO2 are measured separately in order to calculate the NOx value, and can be individually displayed / reported.

shall be handled as a hazardous material when being transported for treatment or landfill.

5.8 Assessment of BAT against BREF Note for Incineration

Table 7 describes how the design and operation of the facility will conform to the requirements of the Best Available Technique Reference (BREF) Note for Waste Incineration Final Draft December 2018.

5.9 Assessment of BAT as described in the Best Available Techniques Reference Document on Waste Incineration (Final Draft, December 2018)

BAT Requirement	Specific Measure
General Conditions	
BAT 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 following features: i. commitment, leadership, and accountability of the management, including senior management, to the implementation of an effective EMS; ii. an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment; iii. development of an environmental policy that includes the continuous improvement of the environmental performance of the installation; iv. establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements; v. planning, and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks; vi. determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed; vii. ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training); viii. internal and external communication; ix. fostering employee involvement in good environmental management practices; x. establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records; xi. effective operational planning and process control; xii. implementation of appropriate maintenance programmes; xiii. emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations; xiv. when (re)designing a (new) installation or a part thereof, consider its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning; xv. implementation of a monitoring and measurement programme. If needed, information can be found	The facility will have a detailed EMS covering all aspects of the operation of the Installation and which includes the features described under BAT1. Please also refer to Section 2 of this BATOT document which provides an overview of the EMS to be implemented.

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations;
xvi. application of sectoral benchmarking on a regular basis;
xvii. periodic independent (as far as practicable), internal auditing and periodic, independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;
xviii. evaluation of causes for nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur;
xix. periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;
xx. following and taking into account the development of cleaner techniques.

Specifically, for incineration plants and, where relevant, bottom ash treatment plants, BAT is also to incorporate the following features in the EMS:

xxi. for incineration plants, waste stream management (see BAT 9);
xxii. for bottom ash treatment plants, output quality management (see BAT 10);
xxiii. residues management plan including measures aiming to: a) minimise the generation of residues; b) optimise the reuse, regeneration, recycling of, and/or energy recovery from the residues; c) ensure the proper disposal of residues;
xxiv. for incineration plants, OTNOC management plan (see BAT 18);
xxv. for incineration plants, accident management plan (see Section 5.2.4);
xxvi. for bottom ash treatment plants, diffuse dust emissions management (see BAT 23);
xxvii. odour management plan where an odour nuisance at sensitive receptors is expected and/or has been substantiated (see Section 5.2.4);
xxviii. noise management plan (see also BAT 37) where a noise nuisance at sensitive receptors is expected and/or has been substantiated (see Section 5.2).</td><td></td></tr>
<tr><td>BAT 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.</td><td>Performance testing will be completed following successful hot commissioning in accordance with the site’s Commissioning Plan.

Performance indicators will include:
• Waste throughput (tonnes per hour);
• Waste characterisation (NCV MJ/kg, moisture content % and sulphur, chlorine content %);
• Gross electrical generation (MW);</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td>Parasitic load (MW); and
Stack emissions (per Waste Incineration BREF, and IED requirements).</td></tr>
<tr><td>BAT 3. BAT is to monitor key process parameters relevant for emissions to air and water including those given below.

<table><tr><th>Stream/Location</th><th>Parameter(s)</th><th>Monitoring</th></tr><tr><td>Flue-gas from the incineration of waste</td><td>Flow, oxygen content, temperature, pressure, water vapour content</td><td rowspan="4">Continuous measurement</td></tr><tr><td>Combustion chamber</td><td>Temperature</td></tr><tr><td>Waste water from wet FGC</td><td>Flow, pH, temperature</td></tr><tr><td>Waste water from bottom ash treatment plants</td><td>Flow, pH, conductivity</td></tr></table></td><td>The plant will be fitted with Continuous Emissions Monitoring equipment for point source emissions to air which measure flow, oxygen content, temperature, pressure and water vapour content in the flue gases.

Temperature monitoring of the combustion chamber will be carried out to ensure that optimal conditions are maintained.

Wet FGC is not employed for gas clean up at the facility.

No bottom ash treatment will be undertaken at the facility.</td></tr>
<tr><td>BAT 4. BAT is to monitor channelled emissions to air with at least the frequency given [in the associated Table provided in 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.</td><td>Emissions to air will be monitored in accordance with the monitoring standards and methods detailed in Section 17 of this BATOT document.</td></tr>
<tr><td>BAT 5. BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).

<u>Description</u>
The monitoring can be carried out by direct emission measurements (e.g. for the pollutants that are monitored continuously) or by monitoring of surrogate parameters if this proves to be of equivalent or better scientific quality than direct emission measurements. Emissions during start-up and shutdown while no waste is being incinerated, including emissions of PCDD/F, are estimated based on measurement campaigns, e.g. every three years, carried out during planned start-up/shutdown operations.</td><td>The plant will be fitted with Continuous Emissions Monitoring equipment for point source emissions to air which will monitor and record emissions during OTNOC.</td></tr>
<tr><td>BAT 6. BAT is to monitor emissions to water from Flue Gas Condensation (FGC) and/or bottom ash treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or international standards that ensure the provision of data of an equivalent scientific quality.</td><td>Not applicable. No flue gas condensation or bottom ash treatment will be undertaken at the facility.</td></tr>
<tr><td>BAT 7. BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration</td><td>The total organic carbon content of bottom ashes/slags will be monitored at a minimum</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>plant with at least the frequency given below and in accordance with EN standards.
<table>
<tr><th>Parameter</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th><th>Monitoring Associated With</th></tr>
<tr><td>Loss on ignition(1)</td><td>EN 14899 and either EN 15169 or EN15935</td><td rowspan="2">Once every three months</td><td rowspan="2">BAT 14</td></tr>
<tr><td>Total organic carbon(1)(2)</td><td>EN 14899, and either EN13137 or EN 15936</td></tr>
<tr><td colspan="4">(1) Either the loss on ignition or the total organic carbon is monitored.
(2) Elemental carbon (e.g. determined according to DIN 19539) may be subtracted from the measurement result.</td></tr>
</table></td><td>frequency of once every three months in accordance with EN 13137 standards.</td></tr>
<tr><td>BAT 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, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.

<u>Description</u>
The POP content in the output streams is determined by direct measurements or by indirect methods (e.g. the cumulated quantity of POPs in the fly ashes, dry FGC residues, waste water from FGC and related waste water treatment sludge may be determined by monitoring the POP contents in the flue-gas before and after the FGC system) or based on studies representative of the plant.

<u>Applicability</u>
Only applicable for plants that:
incinerate hazardous waste with POP levels prior to incineration exceeding the concentration limits defined in Annex IV to Regulation (EC) No 850/2004 and amendments; and
do not meet the process description specifications of Chapter IV.G.2 point (g) of the UNEP technical guidelines UNEP/CHW.13/6/Add.1/Rev.1.</td><td>Not applicable: The facility will only accept non-hazardous waste.</td></tr>
<tr><td>BAT 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) given below, and, where relevant, also techniques (d), (e) and (f).</td><td>The facility has been designed to accept non-hazardous wastes from municipal, commercial and industrial, sewage sludge and non-infectious clinical waste sources. These waste types are known to be variable in composition. The facility has been specifically designed to optimise the performance of the combustion process. The waste will be of a CV suitable for treatment in the Skelton Grange EfW. Flexibility has been incorporated within the design to account for variability within the waste feedstock.</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>
<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>a</td><td>Determination of the types of waste that can be incinerated</td><td>Based on the characteristics of the incineration plant, identification of the types of waste which can be incinerated in terms of, for example, the physical state, the chemical characteristics, the hazardous properties and the acceptable ranges of calorific value, humidity, ash content, size.</td></tr>
<tr><td>b</td><td>Set-up and implementation of waste characterisation and pre-acceptance procedures</td><td>These procedures aim to ensure the technical (and legal) suitability of waste treatment operations for a particular waste prior to the arrival of the waste at the plant. They include procedures to collect information about the waste input and may include waste sampling and characterisation to achieve sufficient knowledge of the waste composition. Waste pre-acceptance procedures are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).</td></tr>
<tr><td>c</td><td>Set-up and implementation of waste acceptance procedures</td><td>Acceptance procedures aim to confirm the characteristics of the waste, as identified in the pre-acceptance stage. These procedures define the elements to be verified upon the delivery of the waste at the plant as well as the waste acceptance and rejection criteria. They may include waste sampling, inspection and analysis. Waste acceptance procedures are risk based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s). The elements to be monitored for each type of waste are detailed in BAT 11.</td></tr>
<tr><td>d</td><td>Set-up and implementation a waste tracking system and inventory</td><td>A waste tracking system and inventory aims to track the location and quantity of waste in the plant. It holds all the information generated during waste pre-acceptance procedures (e.g. date of arrival at the plant and unique reference number of the waste, information on the previous waste holder(s), pre-acceptance and acceptance analysis results, nature and quantity of waste held on site including all identified hazards), acceptance, storage, treatment and/or transfer off site. The waste tracking system is risk-based considering, for</td></tr>
</table>
</td><td>
Key risks associated with waste inputs at the Skelton Grange EfW facility will include:

physically large items which can block the feed chute;
high variability in moisture content and CV leading to combustion irregularities; and
unsuitable wastes such as hazardous waste which the facility has not been designed to process.

WTI will establish and maintain quality controls over the waste input to limit the potential for the above risks to be realised.
WTI will work with suppliers of commercial and industrial and non-infectious clinical wastes to the facility to improve incoming waste quality. At the pre-acceptance stage, WTI will provide suppliers with information regarding the types of waste which can be accepted at the site and will assess the suitability of waste streams for acceptance at the facility. This will include asking the supplier for a compositional analysis of the waste stream.
The majority of waste delivered to the facility will have undergone intermediate acceptance and bulking at third party waste transfer stations. The waste will therefore have already been subject to waste acceptance controls at these third-party facilities. Notwithstanding this, the Skelton Grange EfW facility will implement robust procedures to maintain quality control over waste input.
Standard operating procedures and the site EMS will be developed so that robust waste acceptance procedures are in place and only permitted wastes are accepted for treatment at the facility e.g. waste inspections and removal of oversize items.
Deliveries will be pre-notified to the site. At the point of delivery to the site, loads will be assigned unique identifiers and an associated record created. Associated with each load will be a record of the:

Date and time of delivery;
Customer;
Source site;
Job reference;
Description of waste;
Tonnage;

</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>
<table>
<tr><td></td><td></td><td>example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).
The waste tracking system includes clear labelling of wastes that are stored in places other than the waste bunker or sludge storage tank (e.g. in containers, drums, bales or other forms of packaging) such that they can be identified at all times.</td></tr>
<tr><td>e</td><td>Waste segregation</td><td>Wastes are kept separated depending on their properties in order to enable easier and environmentally safer storage and incineration. Waste segregation relies on the physical separation of different wastes and on procedures that identify when and where wastes are stored.</td></tr>
<tr><td>f</td><td>Verification of waste compatibility prior to mixing or blending of waste</td><td>Compatibility is ensured by a set of verification measures and tests in order to detect any unwanted and/or potentially dangerous chemical reactions between wastes (e.g. polymerisation, gas evolution, exothermal reaction, decomposition) upon mixing or blending. The compatibility tests are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).</td></tr>
</table>
</td><td>

Sampling requirements;
EWC code;
SIC code;
Pre-approval records including waste characterisation information,
compliance testing and waste compliance assessment;
On-site verification undertaken; and
Decision to approve / reject.

Records will be maintained within a database with links to associated documents such that information regarding any individual load can be readily called upon.

WTI will implement a waste tracking system and inventory, including all pre-acceptance and waste acceptance procedures and records as part of the sites operational management system.

Segregation of waste is not required as all wastes accepted are compatible. Only non-hazardous wastes will be accepted. Waste items not meeting the facility’s waste acceptance criteria will be quarantined in a designated area.
</td></tr>
<tr><td>BAT 10. In order to improve the overall environmental performance of the bottom ash treatment plant, as part of the waste stream management plan, BAT is to set up and implement an output quality management system (see BAT 1).</td><td>Not applicable. No bottom ash treatment will be undertaken at the facility.</td></tr>
<tr><td>BAT 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 BAT9c) including, depending on the risk posed by the incoming waste, the elements given below.

<table>
<tr><th>Waste Type</th><th>Monitoring</th></tr>
<tr><td>Municipal solid waste and other non-hazardous waste</td><td>Radioactivity detection.
Weighing of the waste deliveries.
Visual inspection.</td></tr>
</table>
</td><td>Standard operating procedures and the site EMS will be developed so that robust waste acceptance procedures are in place and only permitted wastes are accepted at the facility. Tonnage of all waste deliveries will be recorded by the weighbridge.

The primary feedstocks at the plant will be municipal waste and commercial and industrial waste, supplemented by sewage sludge and non-infectious clinical waste. Pre-acceptance procedures will be in place. Prior to processing:
waste will be visually inspected in the bunker; and
spot checking of individual deliveries will be undertaken.
</td></tr>
</table>

BAT Requirement		Specific Measure
	• Periodic sampling of individual deliveries and analysis of key properties/substances (e.g. calorific value, content of halogens and metals/metalloids). For municipal solid waste, this involves separate unloading.	Where visual inspections or spot checking identify wastes which are unsuitable or not permitted for acceptance at the facility, for example oversize materials, these will be segregated and stored within a designated quarantine area prior to removal off-site to a suitably licensed facility.
Sewage sludge	• Weighing of the waste deliveries (or measuring the flow if the sludge is delivered via pipeline). • Visual inspection, as far as technically possible. • Periodic sampling and analysis of key properties/substances (e.g. calorific value, content of water, ash and mercury).	
Hazardous waste other than clinical waste	• Radioactivity detection. • Weighing of the waste deliveries. • Visual inspection, as far as technically possible. • Control and comparison of individual waste deliveries with the declaration of the waste producer. • Sampling of the content of: - All bulk tankers and trailers. - Packed waste (e.g. in drums, intermediate bulk containers (IBCs) or smaller packaging). And analysis of: - Combustion parameters (including calorific value and flashpoint). - Waste compatibility, to detect possible hazardous reactions upon blending or mixing wastes, prior to storage (BAT 9f). - Key substances including POPs, halogens and sulphur, metals/metalloids.	
Clinical waste	• Radioactivity detection • Weighing of the waste deliveries • Visual inspection of the packaging integrity	
BAT 12. In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below.		(a) Waste reception, handling and storage areas of the site will benefit from impermeable surfacing. Surface water run-off from this area is collected in a separate sealed drainage system and is either discharged under a trade effluent consent or tankered off-site for treatment. The site's EMS includes procedures for the routine inspection of integrity of the drainage infrastructure and remediation of any non-conformances identified. (b) The facility bunker has been designed to store up to 5 days of the projected waste

	Technique	Description
a	Impermeable surfaces and segregated drainage	Depending on the risks posed by the waste in terms of soil or water contamination, the surface of the waste reception, handling and storage

BAT Requirement	Specific Measure
<table><tr><td></td><td></td><td>areas is made impermeable to the liquids concerned and fitted with an adequate drainage infrastructure (see BAT32). The integrity of this surface is periodically verified, as far as technically possible.</td></tr><tr><td>b</td><td>Adequate waste storage capacity</td><td>Measures are taken to avoid accumulation of waste, such as: • the maximum waste storage capacity is clearly established and not exceeded, taking into account the characteristics of the wastes (e.g. regarding the risk of fire) and the treatment capacity; • the quantity of waste stored is regularly monitored against the maximum allowed storage capacity; and • for wastes that are not mixed during storage (e.g. clinical waste, packed waste), the maximum residence time of waste is clearly established.</td></tr></table>	volume at the maximum plant capacity of 410,000 tonnes per annum. The facility is equipped with a weighbridge to monitor the capacity of waste delivered into the bunker. Standard operating procedures and the site EMS will be developed so that under normal operating conditions, waste will only be accepted for treatment at the facility if there is sufficient storage capacity available. During times of plant shutdown for over 5 days, WTI will seek to divert waste to an alternative suitably permitted facility to prevent the accumulation of waste within the bunker. All waste received will be mixed within the bunker. To minimise the length of time that any waste remains in the waste bunker, the Operations Manager will establish a waste bunker turnover procedure and ensure that each day the shift team leaders and their respective teams carry out the requirements of the procedure. Each day operating personnel will stack the incoming waste in designated areas of the waste bunker and feed waste from other waste bunker sections first.
BAT 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 given below. <table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>a</td><td>Automated or semi-automated waste handling</td><td>Clinical wastes are unloaded from the truck to the storage are using an automated or manual system depending on the risk posed by this operation. From the storage area the clinical wastes are fed into the furnace by an automated feeding system.</td></tr><tr><td>b</td><td>Incineration of non-reusable sealed containers, if used</td><td>Clinical waste is delivered in sealed and robust combustible containers that are never opened throughout storage and handling operations. if needles and sharps are disposed of in them, the containers are puncture-proof as well.</td></tr><tr><td>c</td><td>Cleaning and disinfection of reusable</td><td>Reusable waste containers are cleaned in designated cleaning area and disinfected in a facility specifically designed for disinfection. Any leftovers</td></tr></table>	Not applicable: the only clinical waste which will be accepted is non-infectious clinical waste coded under EWC 18 01 04 “wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers).”

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>
<table><tr><td></td><td>containers, if used</td><td>from the cleaning operations are incinerated.</td></tr></table>
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<tr><td>
BAT 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.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Waste blending and mixing</td><td>Waste blending and mixing prior to incineration include for example the following operations:
• bunker crane mixing;
• using a feed equalisation system;
• blending of compatible liquid and pasty wastes. In some cases, solid wastes are shredded prior to mixing.</td><td>Not applicable where direct furnace feeding is required due to safety considerations or waste characteristics (e.g. infectious clinical waste, odorous waste, or waste that are prone to releasing volatile substances).

Not applicable where undesired reactions may occur between different types of waste (See BAT9 f).</td></tr>
<tr><td>b</td><td>Advanced control system</td><td>The use of a computer-based automatic system to control the combustion efficiency and support the prevention and/or reduction of emissions. This also includes the use of high-performance monitoring of operating parameters and of emissions.</td><td>Generally applicable</td></tr>
<tr><td>c</td><td>Optimisation of the incineration process</td><td>Optimisation of the temperature, flow rates and points of injection of the primary and secondary combustion air to effectively oxidise the organic compounds while reducing the generation of NOX. Optimisation of the design and operation of the combustion chamber (e.g. flue-gas temperature, flue-gas and waste residence time, oxygen level, waste agitation).</td><td>Optimisation of the design is not applicable to existing furnaces</td></tr>
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Wastes received by the facility will be mixed in the bunker using an overhead crane in order to achieve a homogeneous fuel.

As described in Section 5 of this BATOT, the facility has been specifically designed to adapt to the variability of a municipal waste stream's composition. Figure 2 and Table 3 in Section 5.1.3 of this BATOT identify how the facility will be able to adjust waste flow rate with respect to the waste input's CV and the heat throughput rating of the furnace within the boundaries identified in the firing diagram. Waste with a CV between 8.5 MJ/kg and 13.0 MJ/kg can be processed as per the combustion diagram.

The facility will employ a moving grate air-cooled technique. This is a well-developed technique which is proven for the recovery of energy from municipal and other heterogeneous solid wastes as identified in Section 2.3.1 of the 2018 Final Draft Waste Incineration BREF. Computational Fluid Dynamic (CFD) modelling will be employed to assist in designing the combustion chamber.

During normal operation, the facility is intended to operate with a waste thermal input of 140 MWth. Municipal waste is, however, frequently subject to significant short-term fluctuations in CV, increasing or decreasing the thermal loading on the plant and auxiliary equipment. To accommodate this variability, the facility has a maximum continuous thermal capacity of 156.8MWth, with a 12% overload condition for short periods. This means that under normal operation, the facility will operate at a design point lower than the boiler maximum continuous thermal capacity.

Changes in the composition of municipal waste will be compensated for by adjusting input volumes of the other waste types. This will limit the impact of changes in the municipal waste's composition.

Waste will be mixed within the bunker and upon the grate and, in addition, WTI will have control of combustion conditions and flue gas treatment via the plant control system. The control of combustion and flue gas treatment is discussed in further detail in Section 5.1.5 of this BATOT.

Should the composition of the waste fluctuate, the plant control system will adjust the
</td></tr>
</table>

BAT Requirement	Specific Measure
BAT-associated environmental performance levels for unburnt substances in slags and bottom ashes from the incineration of waste. **Parameter** | **Unit** | **BAT-AEPL** TOC content in slags and bottom ashes([1]) | Dry wt-% | 1-3([2]) Loss on ignition of slags and bottom ashes([2]) | Dry wt-% | 1-5 ([2]) ([1]) Either the BAT-AEPL for TOC content or the BAT-AEPL for the loss on ignition applies. ([2]) The lower end of the BAT-AEPL range can be achieved when using fluidised bed furnaces or rotary kilns operated in slagging mode. The associated monitoring is in BAT 7.	combustion and flue gas treatment parameters (waste feed rate, air injection, regulation of consumables etc.) in order to maintain stable combustion and operation to ensure compliance with permit conditions. This system will adjust combustion parameters should general waste features such as moisture content change or there are variations in the amount of paper and plastic. Temperature profile within the furnace and close to the grate surface will be monitored to optimise combustion and emissions control e.g. NOx. Continuous emissions monitoring system (CEMS) analysers will be located on the stack in compliance with the IED and the Environmental Permit. The CEMS will feed live emission data to the plant control system to ensure that emissions are compliant with the Environmental Permit by adjusting the combustion control process and chemical dosing. This includes regulating air flows, waste feed and grate speed. For further details regarding the facility's combustion control philosophy, refer to Section 5.1.5 of this BATOT. Combustion control will take place using a number of different plant features. The main features will be the primary air system, secondary air system, waste feed system, additive dosing system and auxiliary fuel firing system. These features will be used to control combustion so as to ensure that the BAT-Associated Environmental Performance levels for ash are achieved. The secondary air injection will be at a level in the combustion chamber to ensure optimum combustion (as reflected in the modelling). The primary and secondary air flows can be individually adjusted to ensure optimum air supply stoichiometry. The boiler design incorporates five passes (four vertical and one horizontal) which will increase turbulence and good burnout. The height of the boiler will ensure that the minimum (2 seconds at over 850°C) residence time for the flue gas is achieved, in accordance with the IED requirements, and will be verified by CFD modelling.
BAT 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 (see description above), as and when needed and practicable, based	The plant will be fitted with a Control and Monitoring System (CMS) which will ensure adequate control of the process and prevent the development of abnormal operating conditions.

BAT Requirement	Specific Measure
on the characterisation and control of the waste. (see BAT11).	The CEMS will feed live emission data to the plant control system to ensure that emissions are compliant with the Environmental Permit by adjusting the combustion control process and chemical dosing. This includes regulating air flows, waste feed and grate speed.
BAT16. 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 site's waste supply contracts will ensure that waste is received at regular intervals to prevent unplanned outages due to shortage of feedstock. The facility is intended to be run continuously rather than as a batch operation. All plant will be subject to a planned preventative maintenance (PPM) programme recorded on a Computerised Maintenance Management System (CMMS) to reduce emissions and minimise unplanned shut downs.
BAT 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 waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability.	Flue gas treatment options have been selected to provide optimum performance and availability. Options appraisals for the flue gas abatement systems have been undertaken to demonstrate that these are BAT for the facility. The systems will be designed with consideration given to the continuous nature of the operations at the site and the characteristics of the gases being treated. There is no process effluent generated from the facility or emissions to water.
BAT18. In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the environmental management system (see BAT 1) that includes all of the following elements: • identification of potential OTNOC, (e.g. failure of equipment critical to the protection of the environment ('critical equipment')), of their root causes and of their potential consequences, and regular review and update of the list of identified OTNOC following the periodic assessment below; • appropriate design of critical equipment (e.g. compartmentalisation of the bag filter, techniques to heat up the flue-gas and obviate the need to bypass the bag filter during start-up and shutdown, etc.); • set-up and implementation of a preventive maintenance plan for critical equipment (see BAT1); • monitoring and recording of emissions during OTNOC and associated circumstances (see BAT 5); and • periodic assessment of the emissions occurring during OTNOC (e.g. frequency of events, duration, amount of pollutants emitted) and implementation of corrective actions if necessary.	The facility will have a detailed EMS covering all aspects of the operation of the Installation including a risk-based Other Than Normal Operating Conditions (OTNOC) management plan. This will be based on a review of environmentally critical equipment and OTNOC scenarios for the facility and will include actions to be taken in the case of failure, stoppages or disturbances to CEMS and pollution abatement equipment. The EMS and Standard Operating procedures will detail the preventative maintenance regime for the site. The CEMS system will monitor and record emissions to air during OTNOC periods. Assessment of emissions during the periods will be undertaken and corrective actions will be implemented if necessary.

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<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Energy Efficiency</td></tr>
<tr><td>BAT 19 in order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.

<u>Description</u>
The energy contained in the flue-gas is recovered in a heat recovery boiler producing hot water and/or steam, which may be exported, used internally, and/or used to produce electricity.

<u>Applicability</u>
In the case of plants dedicated to the incinerating of hazardous waste, the applicability may be limited by:
- the stickiness of the fly ashes; and
- the corrosiveness of the flue-gas.</td><td>The boiler steam generating system will include, but not be limited to:
• First pass: vertical radiation pass made of evaporator membrane with refractory lining on flue gas side. The first pass (where the grate combustion takes place) has been designed with water wall tubes. A section of the pass will be covered with refractory to ensure two second residence time over 850◦C is achieved. Upper section of the first pass will be covered in inconel to protect the tubes, but allow heat recovery;
• Second/third pass: vertical radiation pass made of evaporator membrane walls. The second and third passes, which are also water wall tubes, are refractory free and largely unclad (may be a small amount of cladding to be determined at detailed design) and are primarily used for heat recovery before the flue gases reach the furnace (horizontal pass);
• Fourth pass: horizontal convection pass made of membrane walls with bundles of superheater heat exchanger surfaces. Flue gases entering the fourth pass will have been sufficiently cooled to prevent damage to the high temperature tube bundles. Further protection is offered to the highest steam temperature bundle in the form of an evaporator bundle in front (in the direction of flue gas travel) of this bundle; and
• Fifth pass: vertical pass with bundles of economiser heat exchanger surfaces. The economiser undertakes the last of the heat recovery before flue gases exit the boiler and this is used to primarily control the flue gas exit temperature.

Steam will be generated within the evaporator sections of the boiler and the boiler drum. The saturated steam will be further heated in the superheaters. The CHP-ready plan provided in Section 8 of the application provides an assessment of the opportunities to maximise heat recovery.</td></tr>
<tr><td>BAT 20. In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given below.

<table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a</td><td>Drying of sewage sludge</td><td>After mechanical dewatering, sewage sludge is further dried using for example</td><td>Applicable within the constraints associated with the</td></tr></table></td><td>No sewage sludge is burned at the facility.

Computational Fluid Dynamic (CFD) modelling will be undertaken to predict gas flows. The modelling will enable WTI to select a design that optimises gas flows to encourage effective combustion conditions and avoid long gas residence times. The modelling will be employed to:
• Optimise furnace and boiler geometry to improve combustion performance;</td></tr>
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<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
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<tr><td></td><td></td><td>low-grade heat, before it is fed to the furnace. The extent to which sludge can be dried depends on the furnace feeding system.</td><td>availability of low-grade heat</td></tr>
<tr><td>b</td><td>Reduction of the flue-gas flow</td><td>The flue-gas flow is reduced through, e.g.:
• improving the primary and secondary air distribution;
• flue-gas recirculation.

A smaller flue-gas volume reduces the energy demand of the plant (e.g. for induced draft fans).</td><td>For existing plants, the applicability of flue-gas recirculation may be limited due to technical constraints (e.g. pollutant load in the flue-gas incineration conditions).</td></tr>
<tr><td>c</td><td>Minimisation of heat losses</td><td>Heat losses are minimised through e.g.:
• use of integral furnace-boilers, allowing for heat to also be recovered from the furnace sides;
• thermal insulation of furnaces and boilers;
• flue-gas recirculation; and
• recovery of heat from the cooling of slags and bottom ashes.</td><td>Integral furnace-boilers are not applicable to rotary kilns or to other furnaces dedicated to the high-temperature incineration of hazardous wastes</td></tr>
<tr><td>d</td><td>Optimisation of the boiler design</td><td>The heat transfer in the boiler is improved by optimising, for example, the:
• flue-gas velocity and distribution;
• water/steam circulation;
• convection bundles; and
• on-line and off-line boiler cleaning systems in order to minimise the fouling of the convection bundles.</td><td>Applicable to new plants and to major retrofits of existing plants</td></tr>
<tr><td>e</td><td>Low temperature flue-gas heat exchanges</td><td>Special corrosion-resistant heat exchangers are used to recover additional energy from the flue-gas at the boiler exit and after an ESP, or after a dry sorbent injection system.</td><td>Applicable within the constraints of the operating temperature of the downstream FGC system. In the case of existing plants, the</td></tr>
</table>
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• Optimise air and flue gas recirculation injection points to ensure good distribution; and
• Optimise the reagent injection points for SNCR NOx abatement.

Primary and secondary air flows can also be adjusted to ensure optimum air supply stoichiometry.

The boiler design incorporates 5 passes which will increase turbulence. The height of the boiler ensures that the minimum (2 seconds at over 850°C) residence time for the flue gas is achieved, in accordance with the IED requirements.

The facility has an integrated furnace/boiler design to maximise heat recovery and which are insulated to minimise heat losses.

The boiler steam generating system will include, but not be limited to:
• First pass: vertical radiation pass made of evaporator membrane with refractory lining on flue gas side. The first pass (where the grate combustion takes place) has been designed with water wall tubes. A section of the pass will be covered with refractory to ensure two second residence time over 850°C is achieved. The upper section of the first pass will be covered in inconel to protect the tubes, but allow heat recovery;
• Second/third pass: vertical radiation pass made of evaporator membrane walls. The second and third passes, which are also water wall tubes, are refractory free and largely unclad (may be a small amount of cladding to be determined at detailed design) and are primarily used for heat recovery before the flue gases reach the furnace (horizontal pass);
• Fourth pass: horizontal convection pass made of membrane walls with bundles of superheater heat exchanger surfaces. Flue gases entering the fourth pass will have been sufficiently cooled to prevent damage to the high temperature tube bundles. Further protection is offered to the highest steam temperature bundle in the form of an evaporator bundle in front (in the direction of flue gas travel) of this bundle; and
• Fifth pass: vertical pass with bundles of economiser heat exchanger surfaces. The economiser undertakes the last of the heat recovery before flue gases exit the boiler and this is used to primarily control the flue gas exit temperature.
• Steam will be generated within the evaporator sections of the boiler and the boiler drum. The saturated steam will be further heated in the superheaters.
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<tr><th colspan="4">BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td></td><td></td><td>applicability may be limited by a lack of space.</td><td rowspan="5">The boiler surfaces will be kept clean to ensure consistent heat exchange. Boiler cleaning will be carried out using water sprays, mechanical rappers and shot cleaning as appropriate to the area to be cleaned.

The boiler steam outlet temperature and pressure has been selected to provide a high plant efficiency without unreasonable maintenance costs. Special attention has been given to the areas of high wear which are prone to chlorine attack, namely the final super heater boiler. The superheaters used in the Skelton Grange facility will be pendant type superheaters located within the horizontal (4th pass) of the boiler. Pendant types comprise loops of tubing with more spacing between adjacent tubes. These are designed to take advantage of the more controlled flue gas conditions for the required steam generation. Pendant types operate by convection and as proposed would be located in a less severe area of the boiler flue gas stream allowing a longer material lifetime.

Potential opportunities for CHP will continue to be investigated and where the economic case can be justified, consideration will be given to implementation. Refer to the CHP-Ready Plan in Section 8 of this application.

Through a combination of the above, the boiler design will be capable of meeting the BAT-associated energy efficiency levels in the Bref.</td></tr>
<tr><td>f</td><td>High steam conditions</td><td>The higher the steam conditions (temperature and pressure), the higher the electricity conversion efficiency allowed by the steam cycle. Working at increased steam conditions (e.g. above 45 bar, 400°C) requires the use of special steel alloy or refractory cladding to protect the boiler sections that are exposed to the highest temperatures.</td><td>Applicable to new plants and to major retrofits of existing plants, where the plant is mainly oriented towards the generation of electricity.

The applicability may be limited by:
• the stickiness of the fly ashes;
• the corrosiveness of the flue-gas.</td></tr>
<tr><td>g</td><td>Cogeneration</td><td>Cogeneration of heat and electricity where the heat (mainly from the steam that leaves the turbine) is used for producing hot water/steam to be used in industrial processes/activities or in a district heating/cooling network.</td><td>Applicable within the constraints associated with the local heat and power demand and/or availability of network.</td></tr>
<tr><td>h</td><td>Flue-gas condenser</td><td>A heat exchange or a scrubber with a heat exchanger, where the water vapour contained in the flue-gas condenses, transferring the latent heat to water at a sufficiently low temperature (e.g. return flow of a district heating network). The flue-gas condenser also provides co-benefits by reducing emissions to air (e.g. of dust and acid gases). The use of heat pumps can increase the amount of energy recovered from flue-gas condensation.</td><td>Applicable within the constraints associated with the demand for low-temperature heat, e.g. by the availability of a district heating network with a sufficiently low return temperature.</td></tr>
<tr><td>i</td><td>Dry bottom ash handling</td><td>Dry, hot bottom ash falls from the grate onto a transport system and is cooled down by ambient air. Useful energy is recovered by using the cooling air for combustion.</td><td>Only applicable to grate furnaces. There may be technical restrictions that prevent retrofitting to existing</td></tr>
</table>

BAT Requirement	Specific Measure
furnaces. The associated monitoring is in BAT 2.	

BAT-AEEL (%)				
Plant	Municipal Solids Waste, Other Non-hazardous Waste and Hazardous Wood Waste		Hazardous Waste Other Than Hazardous Wood Waste	Sewage Sludge
	Gross Electrical Efficiency (²) (³)	Gross Energy Efficiency (4)	Boiler Efficiency	
New plant	25-35		60-80(5)	60-70(6)
Existing plant	20-35			

(¹) The BAT-AEEL only applies where a heat recovery boiler is applicable
(²) The BAT-AEEL for gross electrical efficiency only apply to plants or parts of plants producing electricity using a condensing turbine
(³) The higher end of the BAT-AEEL range can be achieved when using BAT 20 f.
(4) The BAT-AEELs for gross energy efficiency only apply to plants or part of plants producing only heat or producing electricity using a back-pressure turbine and heat with the stream leaving the turbine.
(5) A gross energy efficiency exceeding the higher end of the BAT-AEEL range (even above 100%) can be achieved where a flue-gas condenser is used.
(6) For the incineration of sewage sludge, the boiler efficiency is highly dependent on the water content of the sewage sludges fed into the furnaces.

Emissions to Air

Diffuse Emissions

BAT Requirement	Specific Measure
BAT 21. In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to: - **Store solid and bulk pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled sub atmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion;** - **Store liquid wastes in tanks under appropriate controlled pressure and duct the tank vents to the**	The waste tipping area, bunker and handling area takes place within an enclosed building. Air from the waste reception area will be drawn into the combustion chamber and hence odour will be managed via combustion. No liquid wastes are accepted at the facility.

BAT Requirement	Specific Measure
combustion air feed or to another suitable abatement system; - **Control the risk of odour during complete shutdown periods when no incineration capacity is available, e.g. by:** • **Sending the vented or extracted air to an alternative abatement system, e.g. a wet scrubber, a fixed adsorption bed;** • **Minimising the amount of waste in storage, e.g. by interrupting, reducing or transferring waste deliveries, as a part of waste stream management (see BAT 9);** • **Storing waste in properly sealed bales.**	To minimise the length of time that any waste remains in the waste bunker, the Operations Manager will establish a waste bunker turnover procedure and ensure that each day the shift team leaders and their respective teams carry out the requirements of the procedure. The waste bunker turnover procedure will ensure that older, more odorous material is processed as soon as possible. Each day operating personnel will stack the incoming waste in designated areas of the waste bunker and feed waste from other waste bunker sections. During times of plant shut-down for over 10 days, WTI will seek to divert waste to an alternative suitably permitted facility to prevent the accumulation of waste within the bunker and risk of odour emissions. During a planned outage, bunker capacity will be maintained by coordinating boiler downtime i.e one line will be processing waste while the other will be undergoing maintenance. This method will provide sufficient storage capacity for the duration of the outage. When an unplanned outage occurs, operational staff will assess the nature of the problem, specifically considering the estimated duration of the outage and bunker capacity, to determine the best course of action for non-contracted industrial and commercial wastes. That is whether the facility should immediately stop accepting the industrial and commercial waste or whether it could continue to be accepted for the repair period. The assessment would also consider the best course of action for the contracted municipal waste, for example whether the Odour Management Plan's (OMP) contingency plan should be implemented to also divert this waste stream from the facility. This course of action may require that a small proportion of the waste (the local authority direct deliveries) is delivered to the facility and then loaded onto other vehicles for disposal. Under this circumstance additional odour monitoring and control measures would be implemented. For planned and unplanned outages should the capacity of the bunker be exhausted, all waste will be diverted from the facility and the contingency plans of the OMP put in place. As a minimum both the tipping hall and bunker doors would be closed thus creating a double seal and minimising any odours. If possible, the induced draught fan would also

BAT Requirement	Specific Measure
	be operated to maintain the slight negative pressure in the tipping hall and bunker; thus further mitigating odours. Additional measures may be brought in, in line with the OMP, which will be dependent on the volume and type of waste in the bunker and the nature of the outage. The odour management plan would require the operators to continually assess the situation and undertake the necessary actions to mitigate odour issues. Finally, as a last resort the facility has the capability of unloading the waste bunker. This activity would normally be avoided as the agitation of the waste will generate additional odours and would only be considered if the outage would be excessively long.
BAT 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. <u>Description</u> For gaseous and liquid waste delivered in bulk waste containers (e.g. tankers), direct feeding is carried out by connecting the waste container to the furnace feeding line. The container is then emptied by pressuring it with nitrogen or, if the viscosity is low enough, by pumping the liquid. For gaseous and liquid waste delivered in waste containers suitable for incineration (e.g. drums), direct feeding is carried out by introducing the containers directly into the furnace. <u>Applicability</u> May not be applicable to the incineration of sewage sludge depending, for example, on the water content and on the need for pre-drying or mixing with other wastes.	No gaseous or liquid wastes will be processed at the facility, only solid wastes.
BAT 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 environmental management system (see BAT 1) the following diffuse dust emissions management features: • **Identification of the most relevant diffuse dust emissions sources (e.g. using EN15445);** • **Definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.**	No treatment of slags and bottom ashes takes place at the facility.
BAT 24. In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use appropriate combination of the techniques [described in the Bref].	No treatment of slags and bottom ashes takes place at the facility.

BAT Requirement	Specific Measure
Channelled Emissions	
Emissions of Dust, Metals and Metalloids	
BAT 25. In order to reduce channelled emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given below: **a. Bag filter** **b. Electrostatic precipitator** **c. Dry sorbent injection** **d. Wet Scrubber** **e. Fixed- or moving-bed adsorption**	A flue gas treatment system comprising lime and activated carbon injection, combined with bag filtration, will be employed to remove acid gases, dust, metals and metalloids from the flue gases.
BAT 26. In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 f), BAT is to treat the extracted air with a bag filer. BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air. Parameter / BAT – AEL (mg/m^3) / Averaging Period: Dust / 2- 5 / Average over the sampling period The associated monitoring is in BAT 4.	No bottom ash treatment will be undertaken at the facility.
Emissions of HCl, HF and SO_2	
BAT 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 given below. **a. Wet scrubber** **b. Semi wet absorber** **c. Dry sorbent injection** **d. Direct desulphurisation** e. **Boiler sorbent injection**	The facility proposes to use a scrubbing system to reduce acid gas emissions. Please refer to the Acid Gas Abatement Options Appraisal in Appendix BATOT 2 for further information.
BAT 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	In order to achieve the BAT-AELs for HCl, HF and SO_2, the operation of the acid gas scrubber will be optimised by the following techniques.

BAT Requirement

and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given below.

	Technique	Description	Applicability
a	Optimisation and automated reagent dosage	The use of continuous HCl and/or SO_2 measurements (and/or of other parameters that may prove useful for this purpose) upstream and/or downstream of the FGC system for the optimisation of the automated reagent dosage.	Generally applicable
b	Recirculation of reagents	The recirculation of a proportion of the collected FGC solids to reduce the amount of unreacted reagent(s) in the residues. The technique is particularly relevant in the case of FGC techniques operating with a high stoichiometric excess.	Generally applicable to new plants. Applicable to existing plants within the constraints of the size of the bag filter.

BAT-associated emission levels (BAT-AELs) for channelled emissions to air of HC1, HF and SO2 from the incineration of waste.

Parameter	BAT-AEL (mg/Nm^3)		Averaging Period
	New Plant	Existing Plant	
HC1	<2-6 (1)	<2-8 (1)	Daily average
HF	<1	<1	Daily average or average over the sampling period
SO2	5-30	5-40	Daily average
(1) The lower end of the BAT-AEL range can be achieved when using a wet scrubber; the higher end of the range may be associated with the use of dry sorbent injection.			

The associated monitoring is in BAT 4.

Specific Measure

Continuous emissions monitoring system (CEMS) analysers will be located on the stack in compliance with the IED and the Environmental Permit. The CEMS will feed live emission data to the plant control system to ensure that emissions are compliant with the environmental permit by adjusting and optimising the combustion control process and chemical dosing.

In addition, residues collected in the filter bags will be re-circulated to maximise the use of the lime and activated carbon injected.

BAT Requirement	Specific Measure
Emissions of NOx, N_2O, CO and NH³	
BAT 29. In order to reduce channelled NOx emissions to air while limiting the emissions of CO and N2O from the incineration of waste and the emissions of NH³ from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given below: **a. Optimisation of the incineration process** **b. Flue-gas recirculation** **c. Selective non-catalytic reduction (SNCR)** **d. Selective catalytic reduction (SCR)** **e. Catalytic filter bags** **f. Optimisation of SNCR/SCR design and operation** **g. Wet scrubber**	In order to meet the BAT-AELs for NOX, whilst limiting the emissions of CO and NOx, the following techniques will be employed: In order to control NO_x emissions, flue gas recirculation and secondary techniques based on the use of SNCR will be utilised. SNCR will use urea or ammonia injected into the front and side walls of the furnace at various levels. The reagent reacts with the NO_x yielding nitrogen (N_2), carbon dioxide (CO_2) and steam. Injecting the reagent at varying heights in the furnace allows for efficient use of the reagent, while minimising NO_x emissions. CFD modelling will be used to optimise the secondary air, flue gas recirculation and reagent injection points for SNCR. CEMS analysers will be located on the stack in compliance with the IED and the Environmental Permit. The CEMS will feed live emission data to the plant control system to ensure that emissions are compliant with the Environmental Permit by adjusting the combustion control process and chemical dosing. This includes regulating air flows, waste feed and grate speed. For further details regarding the facility's combustion control philosophy, refer to Section 5.1.5 of this BATOT.
Emissions of Organic Compounds	
BAT 30. In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below. **a. Optimisation of the incineration process** **b. Control of the waste feed** **c. On-line and off-line boiler cleaning** **d. Rapid flue-gas cooling** **e. Dry sorbent injection** **f. Fixed- or moving-bed adsorption**	The boiler will be designed for the minimisation, rather than abatement, of dioxin and furan formation. There are a number of ways in which dioxin formation will be minimised at the Skelton Grange EfW facility. Destruction of the precursors to dioxin and furan formation will be maximised by the implementation of an effective and controlled combustion process. The combustion control process (described in Section 5.1.5 of the BATOT) and the boiler design will ensure a combustion temperature of 850ºC for two seconds with sufficient turbulence to ensure uniform heat distribution and the complete destruction of waste and the precursors to

BAT Requirement	Specific Measure
g. SCR **h. Catalytic filter bags** **i. Carbon sorbent in a wet scrubber**	dioxin and furan formation. Following the destruction of dioxin and furan precursors, the minimisation of dioxin reformation will be achieved by rapidly cooling flue gases temperature within the boiler to minimise the potential for the de novo formation of dioxins and furans which primarily occurs in the 200ºC to 450ºC temperature range. Maximising the rate of flue gas temperature decrease will be achieved by: • designing the boiler's surface area and water flow rates so that the water temperatures in the economiser are sufficiently low to rapidly cool the flue gases through the de novo temperature range; • using CFD modelling to confirm that there will be no areas of low velocity gas flows; • successively decreasing the volume of each boiler pass so that gas velocity increases progressively; and • preventing boundary layers or slow-moving gas along boiler surfaces. The boiler will be designed such that flue gases will exit the boiler at a temperature of between 160ºC and 200ºC. Only non-hazardous wastes suitable for treatment within the facility will be accepted, according to the site's pre-acceptance and waste acceptance procedures. The waste types are non-homogenous and consist of a wide range of materials. The individual waste deliveries are mixed within the reception bunker to avoid 'slugs' from one source and to minimise variability of overall CV and composition. Fouling of the boiler can catalytically enhance dioxin formation. Whilst a certain amount of boiler fouling is to be expected, the boiler surfaces will be maintained clean. The following cleaning systems within the boiler will be used to prevent the accumulation of deposits: • In the first, second and third passes (the radiant passes), a spray cleaning system is applied; • In the horizontal pass (the convective pass), there will be a pneumatically driven rapping system; and

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td>• In the vertical pass (the economiser), soot blowers are used.

Techniques to abate NOx will be employed at the facility which may also help to minimise dioxin emissions. For further information on NOx abatement to be employed at the facility, please refer to Appendix BATOT 3.

The addition of activated carbon will provide an additional control measure to minimise dioxin, furan and mercury releases, in order to meet the BAT-AELs.</td></tr>
<tr><td colspan="2">Emissions of Mercury</td></tr>
<tr><td>BAT 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 given below.
a. Wet scrubber (low pH)
b. Dry sorbent injection
c. Injection of special highly reactive activated carbon
d. Boiler bromine addition
e. Fixed- or moving-bed adsorption</td><td>Activated carbon injection will be provided for the control of Hg emissions in order to meet the BAT-AEL.</td></tr>
<tr><td colspan="2">Emissions to Water</td></tr>
<tr><td>BAT 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.

<u>Description</u>
Waste water streams (e.g. surface run-off water, cooling water, waste water from flue-gas treatment and from bottom ash treatment, drainage water collected from the waste reception, handling and storage areas (see BAT12 (a)) are segregated to be treated separately based on their characteristics and on the combination of treatment techniques required. Uncontaminated water streams are segregated from waste water streams that require treatment. When recovering hydrochloric acid and/or gypsum from the scrubber's effluent, the waste waters arising from the different stages (acidic and alkaline) of the wet scrubbing system are treated separately.

<u>Applicability</u>
Generally applicable to new plants. Applicability to existing plants within the constraints associated with the configuration of the water collection system.</td><td>No liquid process effluent is produced by the facility during normal operation.

Clean surface water (rainwater) from roofs will be captured and stored in tanks within the main building for use in the process.

Water from roadways will be passed via silt and oil interceptors to a surface water attenuation pond, prior to discharge to a receiving surface water body (River Aire). A surface water attenuation lagoon is proposed between the site entrance and the existing electricity substation to the south-west of the installation, at the lowest point of the site.

There will be a separate system to collect surface water from waste handling areas which will be connected to sealed tanks prior to discharge under a trade effluent consent or tankered for treatment off-site. A separate foul sewer connection or package treatment plant will service the domestic facilities.

Process water will be re-used within the process as far as possible. There will be no</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td>routine process water discharge from the installation except during times of planned maintenance when discharge from the facility will be collected by the drainage system which serves the waste handling areas. Effluent from this system will be either discharged to sewer under a trade effluent consent or removed via tanker to a suitably licensed facility for treatment.

There are no point source emissions to groundwater or direct to land from the ERF facility.</td></tr>
<tr><td>BAT 33. In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Waste-water-free FGC techniques</td><td>Use of FGC techniques that do not generate waste water (e.g. dry sorbent injection or semi-wet absorber)</td><td>May not be applicable to the incineration of hazardous waste with a high halogen content.</td></tr>
<tr><td>b</td><td>Injection of waste water from FGC</td><td>Waste water from FGC is injected into the hotter parts of the FGC system.</td><td>Only applicable to the incineration of municipal solid waste.</td></tr>
<tr><td>c</td><td>Water reuse/recycling</td><td>Residual aqueous streams are reused or recycled.

The degree of reuse/recycle is limited by the quality requirements of the process to which the water is directed.</td><td>Generally applicable</td></tr>
<tr><td>d</td><td>Dry bottom ash handling</td><td>Dry, hot bottom ash falls from the grate onto a transport system and is cooled down by ambient air. No water is used in the process.</td><td>Only applicable to grate furnaces. There may be technical restrictions that prevent retrofitting to existing incineration plants.</td></tr>
</table></td><td>The primary use of waste water arising on the site is for bottom ash quenching. In addition, rainwater collected from roofs and clean areas of the site will be used for the FGT process and for washing down areas. More information on water usage at the facility can be found in Section 7.2.2 of this report.</td></tr>
<tr><td>BAT 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 given [in the Bref] and to use secondary techniques as close as possible to the source in order to avoid dilution.</td><td>No liquid process effluent is produced by the facility.

No bottom ash treatment will be undertaken at the facility.</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td></td><td>Refer to BAT 14 and BAT 29 for measures in place to minimise the presence of organic compounds including PCDD/F, ammonia/ammonium.</td></tr>
<tr><td colspan="2">Material Efficiency</td></tr>
<tr><td>BAT 35. In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.</td><td>The APCR will be conveyed to silos for storage. These silos will be emptied with the APCR sent for further treatment/landfill. APCR shall be handled as a hazardous material when being transported for treatment or landfill.

The IBA will be mixed with fly ash collected from the boiler passes. Assessment of the level of contaminants within the ash will be made at regular intervals to review whether this approach is suitable.</td></tr>
<tr><td>BAT 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 given [in the Bref] based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.</td><td>No treatment of slags and ashes is carried out at the facility.</td></tr>
<tr><td colspan="2">Noise and vibration</td></tr>
<tr><td>BAT 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 given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Appropriate location of equipment and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>Generally applicable to new plants. In the case of existing plants, the relocation of equipment may be restricted by lack of space or by excessive costs</td></tr>
<tr><td>b</td><td>Operational measures</td><td>These include:
• improved inspection and maintenance of equipment;
• closing of doors and windows of</td><td>Generally applicable</td></tr>
</table></td><td>Buildings will be constructed to attenuate noise in line with the planning permission for the site. The site is also located in an area which has few sensitive noise receptors.
A noise impact assessment has been carried out for the facility and is presented in Appendix ERA-3. Noise levels associated with the operation of the Installation will be low enough to ensure that complaints from local residents will be unlikely.
The EMS for the site will contain noise management measures and the Standard Operating Procedures will contain details as to how the process should be operated to minimise noise.
Mitigation to reduce the impact to receptors that may be affected by noise emissions from the site are described in detail in the Noise Impact Assessment (NIA) provided in appendix ERA 4 to Section 5 of this application and include, but are not limited, to:
• Operational hours for the site will be 24/7.
• Opening of doors will be kept to a minimum and fast acting roller shutter doors will be installed where appropriate.
• Quiet plant options will be used wherever possible to ensure noise is kept to a</td></tr>
</table>

<table>
<tr><th>BAT Requirement</th><th>Specific Measure</th></tr>
<tr><td>
<table>
<tr><td></td><td></td><td>enclosed areas, if possible;
• equipment operated by experienced staff;
• avoidance of noisy activities at night, if possible; and
• provisions for noise control during maintenance activities.</td><td></td></tr>
<tr><td>c</td><td>Low-noise equipment</td><td>This includes low-noise compressors, pumps and fans</td><td>Generally applicable when the equipment is new or replaced</td></tr>
<tr><td>d</td><td>Noise attenuation</td><td>Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings.</td><td>Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space.</td></tr>
<tr><td>e</td><td>Noise-control equipment/ infrastructure</td><td>This includes:
• noise-reducers;
• equipment insulation;
• enclosure of noisy equipment; and
• soundproofing of buildings.</td><td>Generally applicable to new plants. In the case of existing plants, the applicability may be restricted by lack of space</td></tr>
</table>
</td><td>minimum.
• Plant and equipment will be maintained regularly to minimise noise resulting from deterioration and inefficient operation. If any items of plant are found to give rise to unacceptable noise levels, consideration will be given to their replacement with quieter designs. If equipment continues to generate unacceptable noise levels, consideration will be given to modification to incorporate noise suppression equipment or replacement components.</td></tr>
</table>

6.0 Infrastructure and Equipment Inventory

6.1 Site Identification Board

An easily accessible and legible site identification board will be placed at the site entrance.

The board will display the following information:

- Site Name and Address;
- Name of Permit Holder;
- Permit Number;
- Emergency Contact Name and Telephone Number;
- Site Manager Name and Telephone Number;
- Environment Agency Telephone Number; and
- Opening Times for Receipt of Waste.

The identification board will be inspected once per week as a minimum. In the event of damage or defect that compromises the legibility of the board, it will be repaired as soon as practicable.

6.2 Engineered Containment System

6.2.1 Surfacing

Operational areas of the site will benefit from an engineered containment system comprising an impermeable concrete surface.

6.2.2 Sub Surface Structures

The precise locations of subsurface drains, pipework and interceptors will be established and recorded and relevant documentation maintained in the site office. An inspection and maintenance programme for all subsurface structures will be followed and records will be maintained by the site manager.

6.2.3 Bunds

Bunds and or double skinned walls will be provided for all tanks containing liquids whose spillage could be harmful to the environment. Containment bunds or double skinned walls will be provided to make sure that any leaks/spillages will be contained in the event of a leak of the primary containment. As such, containment measures will be:

- capable of containing at least 110% of the volume of the largest tank within the bund;
- constructed of materials which are impermeable and resistant to the stored materials in accordance with relevant material safety data sheets (MSDS);
- constructed to the appropriate British Standard and Health and Safety Executive (HSE) guidance;
- of a type suitable for the containment of the materials in the event of leak or spill;
- pipework will be routed within bunded areas so that no penetration of walls or base of the bund takes

place; and

- connection points will be located within the bund.

6.2.4 Management and Operational Techniques

Containment engineering will prevent the release of potentially polluting liquids to surface water and groundwater. Plant operatives will undergo awareness training to ensure a full understanding of the containment engineering which will minimise the environmental impact of the site. The engineered containment system will be subject to routine visual inspection. Identified breaches in the engineered containment will be remedied to ensure continued integrity of the facility, and to prevent pollution of surface or groundwater. Records of inspection and maintenance will be maintained by the site manager.

6.3 Engineered Drainage and Surface Water Management System

The site drainage system is shown in Drawing 05 Site Drainage Layout.

Clean surface water (rainwater) from roofs will be captured and stored in "clean water" tank/s for use in the process and the admin building. Water from roadways will pass via silt and oil interceptors and will be directed to a surface water attenuation pond prior to discharge to the River Aire. Water run offs from all potentially contaminated areas (such as the FGT) will be captured and stored in "dirty water" tank/s for use in the process.

There will be a foul water connection to the sewer or an onsite sewage package treatment plant servicing welfare facilities. The package treatment plant's water will be stored in the dirty water tank/s whereas the solid by-product will be processed with the waste.

6.4 Plant and Equipment

The key items of process plant and equipment that will be used at the site are detailed below. All items of plant and equipment will be maintained in accordance with the manufacturer's recommendations.

The key components will include, but not be limited to:

- waste crane and waste storage bunker;
- 2 x furnace/boiler units incorporating moving grate technology, SNCR and a steam boiler with an energy recovery system;
- FGT system comprising lime reactor and bag house filters;
- steam turbine/generator set with the capability for CHP operation;
- condensate system, including air cooled condensers (ACC);
- residue handling treatment and storage facilities;
- electrical equipment associated with the facility and its connection to the national grid;
- CEMS; and
- auxiliary equipment.

7.0 Raw Materials

7.1 Inventory of Raw Materials

The principal raw materials that will be used on Site are detailed in Table 7.

The waste processing plant will be supplied by external manufacturers and will have recommended maintenance programmes that will dictate the use of replacement parts and oils.

The principal and any other raw materials will be recorded and assessed for their environmental impact prior to use.

A Control of Substances Hazardous to Health (COSHH) assessment will be undertaken prior to the use of chemicals, and if the chemical is found to present a hazard to health, it will be added to the COSHH inventory.

Safety Data Sheets (SDS) for any potentially hazardous materials or chemicals will be kept on site together with the COSHH register. The SDS will give information on how chemicals should be handled, stored and disposed of, and what to do in the event of an accident.

Table 4
Principal Raw Materials

Material	Consumption		Maximum Stored On-site (m^3)	Storage Type/Location
	kg/h	t/a		
Waste fuel	48,000	384,000	20,000	Concrete bunker
Urea	98	784	80	1 Silo
Activated carbon	18	144	140	1 Silo
Lime	576	4,608	300	2 Silos
Diesel	61	500	150	Fuel oil tank

7.2 Raw Materials Selection

Wherever possible, raw materials will be selected that minimise environmental impact. Consideration will be given to such factors as degradability, bioaccumulation potential and toxicity. Reviews will be frequently undertaken to ensure that all raw materials are appropriate for use, that consumption is optimised and that opportunities for reduction and improvements are implemented through an action plan.

Alternative raw materials will be evaluated for their environmental impact on an on-going basis and, where there is no overriding quality requirement substitution will be given appropriate consideration. The on-going programme of professional and technical development for all site personnel will ensure awareness of new developments in product availability and their implication.

7.2.1 Waste Minimisation Audit (minimising the use of raw materials)

The overall objective of the site is the recovery of waste, thereby minimising the volume sent to landfill for disposal. Notwithstanding this, there will be waste produced by the processes undertaken at the site.

As described above, the nature of the proposed installation dictates that material usage follows a programme dictated by the plant manufacturer and it is considered that the potential for further minimisation of materials usage will be limited.

As stated in the IPPC Sector Guidance S5.06 waste minimisation can be defined as ‘a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste’. The efficiency of the processes at the site is dealt with in other sections of this report; where it can be seen that effective methods will be implemented to reduce waste.

Notwithstanding this, the waste generation at the site will be reviewed annually and where necessary an appropriate improvement programme will be implemented.

7.2.2 Water Use

The main uses of water at the facility are;

- process water (demineralised water system, ash handling and Air Pollution Control system);
- sanitary fittings and installations (toilets, kitchens, washrooms etc);
- facility wash down;
- safety showers and eyebaths; and
- fire water.

A separate water supply connection may be required to provide fire-fighting water on-site.

The use of rainwater within the facility will reduce the requirement for mains water.

The proposed facility incorporates an air-cooled condenser and the steam / condensate system is a closed circuit requiring minimal water supply resources. Using air cooling, instead of water cooling, saves precious water resources, which would otherwise be consumed in an evaporative condensing system.

The use of water will be regularly reviewed to ensure maximum efficiency and ensure that any further potential for reduction in consumption and recycling opportunities are identified.

7.2.3 Indicative BAT for Raw Materials

Waste Characteristics and Facility Design

The primary feedstock to the plant will be municipal waste supplemented with similar industrial and commercial wastes. As received, municipal waste has the potential to vary in terms of composition with respect to its combustion characteristics for example CV and moisture content but is non-hazardous and does not require specialised handling and storage procedures beyond those detailed within section 5.1.5.

Standard operating procedures and the site EMS will be developed so that robust waste acceptance procedures are in place and only permitted wastes are accepted for treatment at the facility, e.g. waste inspections and removal of oversize items.

Prior to processing:

- waste will be visually inspected in the bunker;
- spot checking of individual deliveries will be undertaken; and
- waste will be weighed upon the weighbridge as delivered.

The facility has been specifically designed to adapt to the variability of a municipal waste stream's composition. Figure 2 and Table 3 in Section 5.1.3 identify how the facility will be able to adjust waste flow rate with respect to the waste input's CV and the heat throughput rating of the furnace within the boundaries identified in the firing diagram. Waste with a CV between 8.5 MJ/kg and 13.0 MJ/kg can be processed as per the combustion diagram.

During normal operation, the 2-line facility is intended to operate with a waste thermal input of 70 MW_{th} for each line. Municipal waste is, however, frequently subject to significant short-term fluctuations in CV, increasing or decreasing the thermal loading on the plant and auxiliary equipment. To accommodate this variability, the facility has a maximum continuous thermal capacity of 78.4MW_{th}, with a 12% overload condition for short periods. This means that under normal operation, the facility will operate at a design point lower than the boilers' maximum continuous thermal capacity.

Changes in the composition of municipal waste will be compensated for by adjusting commercial and industrial waste input volumes. This blending of commercial and industrial waste with municipal wastes will limit the impact of changes in the municipal waste's composition.

Waste will be mixed within the bunker and upon the grate and, in addition, WTI will have control of combustion conditions and flue gas treatment via the plant control system. The control of combustion and flue gas treatment is discussed in further detail in Section 5.1.5.

Should the composition of the waste fluctuate, the plant control system will adjust the combustion and flue gas treatment parameters (waste feed rate, air injection, regulation of consumables etc.) in order to maintain stable combustion and operation to ensure compliance with permit conditions. This system will adjust combustion parameters should general waste features such as moisture content change or there are variations in the amount of paper and plastic.

Feedstock Homogeneity

Upstream Waste Management

WTI will work with suppliers of commercial and industrial wastes to the facility to improve incoming waste quality. At the pre-acceptance stage, WTI will provide suppliers with information regarding the types of waste which can be accepted at the site and will assess the suitability of waste streams for acceptance at the facility. This will include asking the supplier for a compositional analysis of the waste stream.

Procedures for the Removal of Problem Wastes

Standard operating procedures and the site EMS will be developed so that robust waste acceptance procedures are in place and only permitted wastes are accepted for treatment at the facility e.g. waste inspections and removal of oversize items.

Prior to processing:

- waste will be visually inspected in the bunker;
- spot checking of individual deliveries will be undertaken; and

- waste will be weighed upon the weighbridge as delivered.

Where visual inspections or spot checks identify wastes, which are unsuitable or not permitted for acceptance at the facility, for example oversize materials, these will be segregated and stored within a designated quarantine area prior to removal off-site to a suitably licensed facility.

On or Off-site Waste Treatment/Mixing

Wastes will be mixed within the bunker and upon the combustion grate to homogenise the waste prior to combustion.

Furnace Conditions

The combustion grate is a well proven technology, compliant with 3% TOC criteria. The combustion grate will allow sufficient agitation of the waste for burn out. This will be demonstrated through regular sampling and analysis as required by the environmental permit.

To prevent ammonia, slip to ash, the dosing rate of reagent will be optimised with respect to nitrous oxide concentration within the furnace and temperature as illustrated in Figure 8 and explained in Appendix BATOT 3 NO_x Abatement Assessment. The presence of ammonia within the ash will be analysed through regular sampling and analysis as required by the environmental permit.

Flue Gas Treatment Conditions

Wet scrubbing systems have been considered within Appendix BATOT 2 Acid Gas Abatement Assessment. In summary, the facility will be designed to minimise water consumption with little or no effluent discharge. As a wet scrubbing system would require a significant change in approach to the design of the site, it is not considered to represent a best available technique (BAT) for the facility and has not been selected.

The dosing rate of urea/ammonia will be optimised with respect to nitrous oxide concentration within the furnace and temperature.

Please refer to the Emissions Control & Monitoring section, Figure 8 and Figure 9 of Section 5.1.5 Detailed Process Description, Appendix BATOT 2 Acid Gas Abatement Assessment and Appendix BATOT 3 NO_x Abatement Assessment for further details.

Waste Management

Incinerator bottom ash (IBA) will be stored separately from APCR so as to enable its recovery. The IBA will be mixed with the fly ash collected from the boiler passes.

The APCR will be conveyed to silos for storage. These silos will be emptied with the APCR sent for further treatment/landfill.

8.0 Waste Handling, Recovery or Disposal

Waste present at the Site falls into two categories:

- waste delivered to Site for processing; and
- waste generated from on-site processes.

The principle objective of the site is to optimise recovery of waste in both categories, with only residual materials incapable of further recovery being sent for disposal to landfill.

All solid waste will be managed and disposed of in accordance with the Duty of Care and where applicable the EP Regulations.

All waste recovered or generated during the processes undertaken at the site will be removed to a suitable licensed processing or disposal site.

The categories of waste, their storage arrangements on site, and recovery / disposal options are outlined in Table 5 below.

Table 5
Waste Storage, Recovery & Disposal

Waste Material	Storage Arrangements	Disposal (D) or Recovery (R)
Wastes delivered to site for processing		
Residual municipal waste	Within waste bunker	R
Low risk industrial and commercial waste	Within waste bunker	R
Non-infectious clinical waste	Within waste bunker	R
Wastes generated from on-site processes		
Incinerator bottom ash	Within IBA storage area	R
Air pollution control residues	Within enclosed silos	D & R
Waste parts from maintenance or repair of equipment	Containers / skips located on drip trays	D & R
Waste oils	Bunded storage tank	R
Redundant oil containers	Containers / skips	R
Oily contaminated residues from plant maintenance	Containers / skips	D
Office waste	Containers / skips	D & R
Process water	Bunded storage tank	D & R

Waste storage on the site will be protected from vandalism by site security fencing around the site. The gates will be securely locked in accordance with the site's security policy.

8.1 Waste minimisation

8.1.1 Bottom Ash Handling

IBA will be quenched and stored pending transfer off-site for treatment or disposal at a suitably permitted facility. The IBA produced by the facility will be of a quality suitable for recovery as a secondary IBA aggregate (IBAA) following treatment off-site.

8.1.2 Fly Ash and Air Pollution Control Residues

Fly ash collected from the boiler passes (also known as boiler ash) will also be capable of recovery. The fly ash will be mixed with IBA and kept separate from APCR. The mixed ash will be transferred by means of conveyor to the IBA storage bunker prior to transfer of the mixed ash off-site for further processing.

The APCR will be conveyed to silos for storage. These silos will be emptied with the APCR sent for further treatment/landfill. During silo and container filling, displaced air will be ducted to suitable dust arrestment equipment.

8.1.3 Rejected Feedstock

WTI will work with suppliers of commercial and industrial wastes to the facility to improve incoming waste quality. At the pre-acceptance stage, WTI will provide suppliers with information regarding the types of waste which can be accepted at the site and will assess the suitability of waste streams for acceptance at the facility. This will include asking the supplier for a compositional analysis of the waste stream.

Standard operating procedures and the site EMS will be developed so that robust waste acceptance procedures are in place and only permitted wastes are accepted for treatment at the facility e.g. waste inspections and removal of oversize items.

Prior to processing:

- waste will be visually inspected in the bunker;
- spot checking of individual deliveries will be undertaken; and
- waste will be weighed upon the weighbridge as delivered.

Where visual inspections or spot checks identify wastes which are unsuitable or not permitted for acceptance at the facility, these will be segregated and stored within a designated quarantine area prior to removal off-site to a suitably licensed facility as soon as practicably possible.

8.1.4 Recovered Waste Fractions

Please refer to Section 5.1.6 of this BATOT for a description of process off-takes including their storage and onward routes for recovery and disposal as appropriate.

The key methods of ensuring that waste minimisation occurs on site will be;

- the ongoing identification and implementation of waste prevention opportunities;
- the active participation and commitment of staff in all areas of the business, including staff suggestion schemes; and

- monitoring of materials usage and reporting against key performance measures.

WTI will take appropriate measures to ensure that:

- the waste hierarchy (referred to in Article 3 of the Waste Framework Directive) is applied in the generation of waste on site by the activities (see Figure 4 below);
- any waste generated by the activities is treated in accordance with the waste hierarchy; and
- where disposal is necessary, as opposed to recovery, that it is undertaken in a manner which minimises its impact on the environment.

Figure 10 below illustrates the Waste Hierarchy, which will be applied by WTI to the generation of the waste. There are six possible methods of waste disposal, from the most favoured to the least favoured, with the prevention of waste being the most and the disposal of waste being the least:

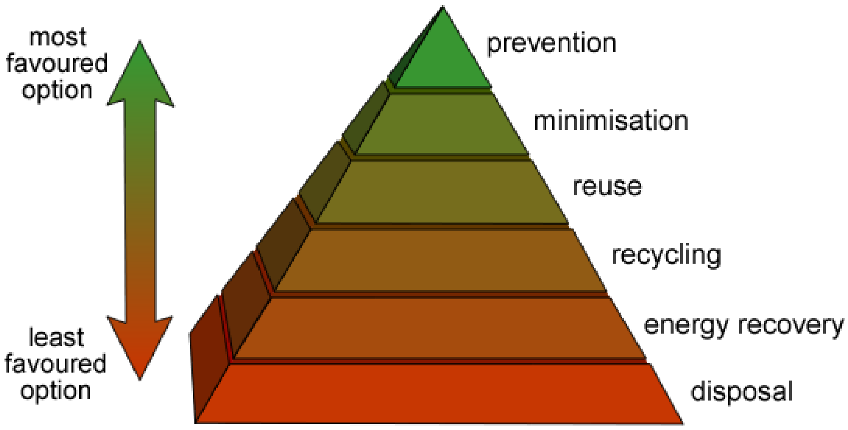

Figure 8
Waste Hierarchy

WTI will review and record at least every four years whether changes to those measures should be made and take any further appropriate measures identified by the review. Waste production will be avoided wherever possible. Any waste produced on site will be recovered, unless there are instances whereby it is not technically or economically practicable to do so.

On an annual basis, WTI will complete a waste minimisation audit.

The audit will include:

- waste produced at the site;
- where the waste goes;
- can it be recovered or recycled;
- is it being stored correctly on site;
- are Duty of Care requirements being met; and
- any further comments for future reference.

9.0 Energy

9.1 Energy Generation & Consumption

Without an external heat customer, the EfW will generate approximately 41.6MW of renewable electricity when fully operational, of which 38MW will be exported annually to the National Grid. The remaining 3.6MW of electricity will be used to run the facility.

The energy requirements are detailed in full in the Global Warming Potential assessment which is provided in Appendix ERA 6.

The installation will not be part of a Climate Change Agreement.

9.2 Energy Management Measures

A number of features have been incorporated within the design of the site in order to minimise energy use, including:

- low energy light fittings will be used where practicable;
- to optimise energy efficiency, equipment will be maintained and serviced as required. Plant and equipment will be subject to regular maintenance to ensure it continues to operate at optimum energy efficiency and that energy consumption does not increase due to inefficient performance;
- energy use will be monitored and recorded and periodically reviewed to identify areas of improvement and to ensure that any inefficiency is investigated, and appropriate actions taken;
- energy use and energy minimisation will be included within the management system for the control of resources. Within the management system the review process will identify energy use by source for the different site operations. The results will be used to identify potential measures for improving energy efficiency; and
- staff will undergo awareness training in energy efficient practices.

Due to the nature of the activities to be undertaken at the site, opportunities for further energy efficiency measures will be limited. However, WTI recognises the importance of minimising energy consumption and so future consideration may be given to further energy saving techniques.

9.3 Indicative BAT for Energy Efficiency

Please refer to the Global Warming Potential Assessment and Combined Heat and Power Readiness Assessment and associated appendices for a description of energy efficiency techniques which will be employed at the facility to demonstrate how the facility will apply BAT with respect to energy efficiency.

10.0 In-Process Controls

10.1 Waste Acceptance

The only wastes that will be accepted at the site are:

- residual household waste from kerbside collections;
- commercial and industrial wastes;
- sewage sludge; and
- non-infectious clinical waste.

No other waste will be accepted.

All wastes delivered in refuse collection vehicles (RCV's) will be required to report to the weighbridge facility and site control office. The weighbridges will comply with current Weights and Measures Regulations and will be maintained and calibrated regularly. Should the weighbridges be out of order all loads will be recorded by volume and previous average load weights or appropriate conversion factors will be used to determine the weight of the loads.

Duty of Care documentation will be checked at the site office. From there vehicles will be directed to the appropriate operational area.

Designated personnel will be responsible for liaising with both the driver of the waste collection vehicle and the plant operatives to ensure the waste is deposited in the correct tipping bay.

Each load of waste will be visually inspected by trained personnel following discharge. Wastes will only be accepted if they conform to the description in the documentation supplied by the producer and holder.

In the event that non-conforming waste is identified these will be segregated and placed in a designated quarantine area for off-site disposal. Waste pre-acceptance checks will be undertaken for clinical waste producers in accordance with Section 2.2 of EA Guidance How to comply with your Environmental Permit: Additional guidance for Clinical waste (EPR 5.07).

10.2 Material Storage and Handling

Arrangements for the storage of raw materials are detailed in Section 7.0, and waste storage arrangements are detailed in Section 8.0 of this report.

Table 6 below provides details on the tanks/containers that will be located on the site. The table details the tanks/containers, their contents, capacity and construction material and storage arrangements.

Table 6
Treatment Tanks/Containers

Tank/Container	Contents	Total Max Capacity (m^3)	Storage & Secondary Containment Arrangements
Urea silo	Pelletised urea/ or big bag system for SNCR abatement system.	80	Enclosed silo. No secondary containment necessary as urea is pelletised.

Tank/Container	Contents	Total Max Capacity (m^3)	Storage & Secondary Containment Arrangements
Carbon silo	Activated carbon for use in flue gas clean-up.	140	Enclosed silo. Open bund designed for 110% of the contents.
Lime silos	Hydrated lime for FGT system.	2 x 150	2 x enclosed silos. Open bund designed for 110% of the contents.
APCR silo	Residues from FGT.	760	Enclosed silo. Open bund designed for 110% of the contents.
Diesel Tank	Diesel fuel for start-up /auxiliary burners.	150	Double skinned tank 110% capacity.
IBA bunker	IBA from the grate plus fly ash from first – third boiler passes.	1,300	N/A
Waste Feed bunker	Municipal, C&I and non-infectious CW.	20,000	N/A
Clean water tank	Clean water	200 m^3	
Dirty water tank	Potentially contaminated water	200 m^3	
Surface water balancing pond	Surface rain water	3,000 m^3	
Fire break tank	Clean water for fire fighting	2,700 m^3	
Sodium Chloride container	Sodium Chloride	2 m^3	Either has a temporary bund (110% capacity of containers' contents) or is located within a build in containment system (in excess of 110% capacity)
Sodium Hydroxide container	Sodium Hydroxide	2 m^3	Either has a temporary bund (110% capacity of containers' contents) or is located within a build in containment system (in excess of 110% capacity)
Hydrochloric Acid container	Hydrochloric Acid	2 m^3	Either has a temporary bund (110% capacity of containers' contents) or is located within a build in containment system (in excess of 110% capacity)
Ammonia tank	Ammonia	1.5 m^3	Either has a temporary bund (110% capacity of containers' contents) or is located within a build in containment system (in excess of 110% capacity)
Trisodium Phosphate tank	Trisodium Phosphate	1.5 m^3	Either has a temporary bund (110% capacity of containers' contents) or is located within a build in containment system (in excess of 110% capacity)
Light Fuel Oil Tank	Light Fuel Oil	See diesel tank above	

Tank/Container	Contents	Total Max Capacity (m^3)	Storage & Secondary Containment Arrangements
Urea Tank	Urea Solution	See Urea silo above	

The storage procedures that will be implemented on site are considered to be best practice for the following reasons:

- all storage tanks will be designed to be fit for purpose, taking into account the nature of the material to be stored and the required design life;
- tanks will be fully quality assured and tested for leakage prior to commissioning;
- storage areas will be clearly marked;
- procedures will be in place for the regular inspection and maintenance of storage areas with any repairs being undertaken as soon as is practicable;
- liquid levels within storage tanks will be continuously monitored by pressure sensors which will alert the operator to high levels and operate interlocks, where applicable. Float switches will also be in place that act to switch off pumps if a high level is reached;
- bulking and mixing will only take place under instruction from appropriately trained personnel; and
- written records of all tanks will be kept, detailing:
    - capacity;
    - construction, including materials;
    - maintenance schedules and inspection results;
    - fittings; and
    - materials stored in the vessel.

10.3 Process Control Monitoring

The waste treatment processes will benefit from a number of process control features which will ensure adequate control of the treatment process and prevent the development of abnormal operating conditions. Specific measures are detailed in Section 5.0 of this document alongside details of the treatment processes, however, additional information is provided below.

10.3.1 Control and Monitoring System

The plant will be fitted with its own Control and Monitoring System (CMS). The Facility CMS shall be fully configured, both hardware and software, with the plant and its various controllers. The key function of the CMS shall be to control, monitor and report the activities of the plant through the direction of the operators. The operators shall interact with the CMS via a Human Machine Interface (HMI) system of the work stations. Normal operation and supervision of the Facility will be performed from workstations located in the Control Room. Plant start-up and normal shutdown as well as operation of 'balance of plant' equipment, auxiliary and ancillary systems will be carried out either from the local control panels or from the Control Room depending on the application.

For example, the CMS will control and monitor detailed liquid level control by alarm, boiler water maintenance by automatic blow down and critical process conditions that can activate emergency shutdown procedures.

10.4 Inspection, Maintenance and Monitoring

Infrastructure and equipment within the site will be inspected on a regular basis and maintained and repaired as necessary. In addition, the operator will undertake visual checks on all plant and equipment at least once a week and, if deemed necessary, bring forward any planned maintenance or undertake remedial works.

Records of all visual and scheduled inspections and details and certificates (where appropriate) of any maintenance work will be regularly updated and maintained. Maintenance schedules for equipment will be regularly reviewed and updated.

In the event of damage or deterioration being detected, all maintenance work will be carried out in conformance with WTI's Health and Safety Policy.

Monitoring and recording of conditions within the plant will be carried out on a continuous basis by the comprehensive network of sensors and instrumentation as discussed above and displayed via the process control system. This will enable continuous mapping of the process in order to ensure efficiency of the process.

11.0 Control of Noise

WTI recognises that the site should be operated in a manner that minimises or prevents noise and / or vibration nuisance.

11.1 Noise Sources

Details of the locations, sources, frequency and estimated noise levels that will be associated with operations at the site have been addressed as part of the Noise Impact Assessment, a copy of which is provided in Appendix ERA 4 in Section 5 of this environmental permit application.

11.2 Noise Assessment

The noise assessment carried out considered the potential for the operations to give rise to noise impacts at the closest noise-sensitive receptors.

The assessments have been conducted in accordance with BS 4142:2014, the IEMA '*Guidelines for Environmental Noise Impact Assessment'* and the EA *'Environmental permitting: H3 Horizontal Guidance for Noise Part 2 – Noise Assessment and Control'* document.

An assessment of noise generated by plant at the Facility has indicated that there is only a 'negligible' risk of adverse impact. For most receptors, the predicted specific noise level is very low and is unlikely to be noticeable against the residual noise environment. The assessment also demonstrates compliance with the conditions imposed within the planning consent.

Furthermore, with respect to noise from HGVs and staff cars travelling in and out of the site and onto surrounding roads, there is again only a 'negligible' risk of adverse impact.

Therefore, noise should not pose a material constraint to gaining the Environmental Permit for the proposed Facility.

11.3 Noise Mitigation and Management Measures

Mitigation to reduce the impact to receptors that may be affected by the noise emissions from the site are detailed below.

11.3.1 Operating Hours

Operational hours for the site are 24/7. The noise impact assessment demonstrates that under normal operating conditions, noise impacts are negligible during both daytime and night-time hours. Any intermittent activities which could cause increased risk of noise impacts will be carried out in daytime hours only.

11.3.2 Building and Plant Design

The site location is in a predominantly industrial and commercial area and there are few receptors that are potentially sensitive. Buildings will be constructed to attenuate noise in line with the planning permission for the site.

To minimise noise levels, opening of doors will be kept to a minimum and fast-acting roller shutter doors will be installed where appropriate.

11.3.3 Plant Selection

Quiet plant options will be used wherever possible to ensure noise is kept to a minimum.

Plant and equipment will be maintained regularly to minimise noise resulting from deterioration and inefficient operation. If any items of plant are found to give rise to unacceptable noise levels, consideration will be given to their replacement with quieter designs. If equipment continues to generate unacceptable noise levels, consideration will be given to modification to incorporate noise suppression equipment or replacement components.

11.3.4 Summary of Mitigation Measures

An assessment of noise generated by plant at the Facility has indicated that there is only a ‘negligible’ risk of adverse impact. For most receptors, the predicted specific noise level is very low and is unlikely to be noticeable against the residual noise environment.

Based on the results of the assessment, further mitigation measures to reduce any potential noise impacts at the nearby noise-sensitive receptors are considered un-necessary.

11.3.5 Management Measures

The site manager will be responsible for ensuring that nuisances arising from the site noise are minimised. All site personnel will be trained in the need to minimise site noise and will be responsible for monitoring and reporting excessive noise when carrying out their everyday duties.

11.3.6 Noise Action Plan

In the event that noise is found to be causing a problem, action will be taken to determine the source and to take remedial actions as follows:

- shut down, replace, service or repair equipment to reduce noise levels; and
- modify plant to incorporate noise suppression equipment.

Records relating to the management and monitoring of noise will be maintained and include:

- inspections undertaken;
- noise problems (including date, time, duration, prevailing weather conditions and cause of the problem);
- complaints received; and
- corrective action taken and changes to operational procedures to prevent future occurrences.

12.0 Control of Odour

The handling and processing of biodegradable wastes at the facility has the potential to generate odour.

An Odour Management Plan (OMP) has been prepared in accordance with the EA H4 guidance note and is appended as Appendix ERA 2. Please refer to the OMP for a detailed account of odour sources and abatement technologies contained in the odour treatment equipment at the site. However, a short summary is given below.

12.1 Odour Sources

The release points for the odour sources identified above are described in Table 7. The release points consider all unintentional non-emergency releases that may occur.

Table 7
Potential Odour Emissions

Source/Release Point	Odour Risk	Equipment Required to Reduce Odour Pollution
Delivery of waste	High	Covered/sheeted or otherwise contained delivery vehicle
Unloading of waste	High	Tipping hall fast acting roller shutter doors
Storage of waste	High	Waste bunker doors / containment with negative pressure
Removing IBA from Site	Low	None, Non-odorous waste.
Surface water drainage	Low	Separate drainage and collection system for potentially contaminated areas for use in the process.

12.2 Mitigation Measures

12.2.1 General Principles

Odour management at the EfW facility will be based on the following principles:

- the facility will be designed to be enclosed with the waste bunker and treatment occurring within the confines of the building;
- the building will be designed and constructed to minimise fugitive emissions; and
- operation of the EfW Facility will be carried out to prevent and mitigate nuisance from odours.

These general measures will be supplemented by additional measures if deemed necessary to achieve effective odour control.

12.2.2 Controlling Odour from Waste Inventory

All waste accepted on Site will be subjected to strict waste acceptance procedures to ensure all waste conforms to the agreed acceptance quality. Waste deliveries will be subject to routine inspections to identify potentially odorous materials. Waste deemed potentially odorous will be prioritised for processing.

The holding time of waste material stored prior to processing is a significant factor in a Site's potential odour generation. The waste bunker can hold a maximum of 5 days of waste deliveries during normal operation.

Combustion air for the furnace is extracted from the tipping hall and all flue gas emissions are ultimately released through the main stack. In this way negative pressure is maintained within the building and odours cannot escape the building envelope.

The tipping floor shall be cleaned regularly.

12.2.3 Containment

It is essential that the integrity of the fabric of the main process building is maintained continuously, other than during periods of essential maintenance. The effective operation of rapid reaction roller doors will therefore be checked routinely.

Routine inspections will be carried out across the facility to ensure complete containment and identify any fugitive emissions.

12.2.4 Summary

There is no requirement for any further ('end of pipe') dedicated odour control system.

12.2.5 Management and Operational Techniques

The Plant manager will be responsible for odour control and daily olfactory monitoring carried out at the site. This includes ensuring that suitable checks are in place for system integrity, ensuring that ventilation systems are fully operational and, where appropriate, carrying out olfactory monitoring. Records will be maintained of odour emissions, odour complaints and remedial action taken.

In the event that odour is found to be causing a problem, as determined by off-site complaints or during routine on-site monitoring, the following actions will be taken:

- investigations by the Plant manager to establish the cause of the problem;
- appropriate actions to mitigate the problem; and
- all necessary actions required by the permit.

As detailed above please refer to the supporting Odour Management Plan submitted as Appendix ERA 3.

13.0 Control of Emissions to Air

13.1 Point Source Emissions

The combustion of waste in the facility will give rise to emissions of a number of pollutants including:

- Carbon dioxide;
- Water vapour;
- Particulate matter (PM);
- Acid gases: sulphur dioxide, hydrogen chloride and hydrogen fluoride;
- Oxides of nitrogen (NOx);
- Carbon monoxide;
- Volatile organic compounds (VOCs);
- Heavy metals; and
- Dioxins and furans.

The EfW facility employs primary and secondary pollution control techniques which are designed to ensure that emissions comply with the limit values (BAT-AELs) for significant pollutants as specified in the Waste Incineration Bref (December 2018). Following abatement, the exhaust gases will be emitted from two 90m stacks, one for each line.

An air quality risk assessment which includes a detailed dispersion model has been carried out in accordance with EA guidance and is included as Appendix ERA2 in Section 5 of the application. Please refer to the assessment for a detailed account of emission points, emission rates and abatement technologies provided.

The specific pollutants associated with the different sources are detailed in Table 8. The locations of the point source emission points to air are detailed on Drawing 002.

Table 8
Emissions from Point Sources (as considered in Appendix ERA 1)

Emission Point	Pollutants
A1 & A2	Particles, TOC, HCl, HF, SO_2, NO_x, CO, Group 1,2 and 3 metals, Dioxins and Furans

13.2 Mitigation Measures

Mitigation measures for the point source pollutants will be 'designed in' to the source. For example, combustion pollutants in the flue gas will be treated prior to being released through an elevated stack.

Mitigation measures for the point source pollutants have been designed to achieve BAT in accordance with the standards set out in the Waste Incineration Bref (December 2018). These are described in detail in previous sections. In addition, Appendix BATOT 2 and BATOT 3 present detailed Acid Gas Abatement and NOx abatement reports, respectively.

14.0 Control of Dust and VOC

14.1 Dust Emissions

The handling and processing of wastes at the site has the potential to generate dust and bio-aerosols. However, due to the enclosed nature of the process and the mitigation measures employed, the need for a quantitative bio-aerosol risk assessment has been screened out.

The operations that may potentially generate dust are summarised in Table 9.

Table 9
Potential Dust and Bio-aerosol Emissions

Process	Discharge	Frequency
Receipt and tipping of waste in the reception hall	Fugitive	During operational hours[1]
Storage of waste	Fugitive	Continuous
Transport of IBA	Fugitive	Continuous
Removal of APCR offsite	Fugitive	During operational hours[1]

[1] Potentially continuous if required for operational reasons

14.2 Mitigation Measures

14.2.1 Building Design

The design of the buildings is based on the principles of containment, extraction and treatment in order to prevent the fugitive release of dust.

14.2.2 Housekeeping

Given the high degree of designed-in mitigation in the form of containment of potential sources of dust and litter from the proposed operations, there are limited sources of dust exposed to the ambient atmosphere, consequently the potential for fugitive release of dust is low.

Good housekeeping will be implemented across the site in order to mitigate the potential for dust emissions, including the use of a road sweeper. Water bowsers will also be used if appropriate. Hard surfaced areas including access roads will be subject to a regular programme of cleaning.

The following mitigation measures have been designed into the proposed Skelton Grange EfW facility to control dust and litter:

- materials (waste, bottom ash) imported or exported from the site will be transported in enclosed vehicles. Incoming waste vessels that are not fully-enclosed will be sheeted (or netted) to ensure no escape of waste materials during transit;
- incoming waste to the site will be unloaded directly into the waste bunker inside the waste reception building;
- all vehicle movements will take place on hard standing and a programme of periodic road

sweeping/cleaning will be in place;

- all storage and handling of Air Pollution Control residues and consumables, both raw and used, will be undertaken within the building in enclosed vessels and silos, and transported from site in enclosed tankers; and
- the bottom ash from the incineration process will be quenched and stored prior to transfer off-site for further treatment/recovery.

14.2.3 Volatile Organic Carbon Emissions

There will not be significant fugitive emissions of VOCs because:

- hydrocarbon usage will be minimal and such materials will be fully contained;
- the combustion and flue gas treatment process will be fully contained such that the emissions will be restricted to the stack as described above;
- inspection and maintenance programmes will ensure continued integrity of equipment;
- provision of standby plant will ensure equipment bypass time is minimised; and
- a spillage action plan will require clean up as soon as possible.

15.0 Control of Emissions to Groundwater, Surface Water & Sewer

15.1 Point Source & Fugitive Emissions to Groundwater

The containment measures in place at the site are described in Section 6.3. These will ensure there are no point source or fugitive emissions to groundwater.

Accordingly, there will be no direct or indirect discharges of contaminating materials into groundwater from the site.

15.2 Point Source Emissions to Surface Water

There are no process effluents discharged to surface water.

Surface water run-off will be managed in accordance with the principles of Sustainable urban drainage systems (SUDS) so that the current (pre-development) rate of run-off will be reduced by 30%. Clean surface water (rainwater) from roofs will be captured and used within the admin building. Water from roadways will be passed via silt and oil interceptors to a surface water attenuation pond, prior to discharge from the site. Water from potentially contaminated areas will be captured and stored in tank/s and used in the process.

A surface water attenuation lagoon is proposed to be located between the site entrance and the existing electricity sub-station to the south west at the lowest point of the site. The lagoon will be excavated and graded to natural falls without impinging on the root zone of the trees, to provide an area for water attenuation capable of holding 1,500m^3 of excess surface water from the site prior to discharge to the River Aire.

In summary, the surface water management scheme is as follows:

- Surface water management would seek to control the drainage from the development using sustainable drainage techniques (SUDS);
- Where possible rainfall run-off will be harvested for use in on-site processes;
-
- Clean surface waters will be discharged to the River Air via an attenuation pond;
- Run-off from areas of external kerbed hardstanding will be passed through a hydrocarbon and silt interceptor prior to discharge, following attenuation, to the River Aire;
- Drainage from all potential contaminated areas will be captured and used in the process;
- Water for fire-fighting will be discharged either to the foul sewer or diverted to the attenuation pond;
- An emergency shut-off valve will be provided to the attenuation pond so that in the event of a fire, the firewater can be contained in the pond;

Discharge from the attenuation pond will be to the adjacent River Aire will be regulated by the EA.

15.2.1 Monitoring and Reporting of Emissions to Surface Water

An environment permit condition to regulate the discharge of surface water will be agreed with the EA prior to commencement of operations. It is anticipated that the relevant condition will set limits for suspended solids, oil and grease such that no breaches of environmental standards are likely to occur.

15.3 Fugitive Emissions to Surface Water

The containment measures in place at the site are described in Section 6.2 and 6.3. These will ensure there are no fugitive emissions to surface water.

Good housekeeping measures as described in 14.2.2 are in place to minimise the risk of fugitive dust emissions entering surface water run-off.

15.4 Point Source Emissions to Sewer

A sewer connection may be considered for discharge of effluent from the process area as an alternative to collection and tankering off-site for treatment.

15.5 Fugitive Emissions to Sewer

The proposed drainage and containment arrangements for the site are described in Section 6 of this BATOT. These will ensure there are no fugitive emissions to sewer.

16.0 Control of Litter, Mud & Pests

16.1 Litter

In order to maintain the site in a tidy condition and prevent the escape of litter onto surrounding land the following measures will be in place:

- the site manager and operatives will inspect the site and surrounding area on a regular basis and will collect any litter and return it to the main waste storage areas;
- fast shutting doors will assist in the prevention of litter escaping the buildings;
- fencing which will surround the site will act to prevent litter escaping from the site. If necessary, additional netting will be erected to reduce the escape of wind-blown litter; and
- litter arising from the activities will be cleared from affected areas outside the site as soon as practicable.

Fencing will be in place around the perimeter of the site.

16.2 Mud and Debris

In order to prevent the deposition or tracking of mud or debris from the site onto public areas and highways the following measures will be in place:

- areas of concrete and hard standing will be maintained free of significant quantities of mud and debris and free of standing water;
- all operational areas will be subject to monitoring by staff throughout the working day to identify accumulations of mud requiring remedial action;
- where necessary road cleaning equipment will be deployed to prevent the tracking of mud and debris onto the highway; and
- all waste / commercial vehicles leaving operational areas will, before leaving the site, be cleaned as necessary and will be checked to ensure that they are clear of loose waste and that any products being exported from the site are secure.

In the event that mud, debris or waste arising from the site is deposited onto public areas outside the site measures will be taken to clear any such sources as soon as practicable.

16.3 Pests

In order to prevent infestation by pests the following measures will be in place:

- the site will be inspected by both site management and operatives for infestations of pests, vermin and insects on a regular basis;
- in the event that specific waste is found to be responsible for attracting scavengers or pests, this waste will be removed from site as soon as practicable or within a maximum of 12 hours of receipt, or will be prioritised for processing; and
- a nominated sub-contractor for the control and monitoring of pests will be appointed.

17.0 Monitoring

The site will be subject to a comprehensive programme of monitoring to ensure the site operates to the specified design standards and does not give rise to unacceptable environmental impact.

Monitoring will comprise of the following:

- general observations
- monitoring of infrastructure and equipment;
- monitoring of process variables; and
- emissions monitoring.

17.1 General Observations

Routine observations and monitoring will be undertaken daily by site personnel to ensure that the Site operates correctly and without giving rise to unacceptable levels of emissions.

Routine regular observations will include qualitative assessment of noise, dust, litter, mud on the road and odour at the installation, the results of which will be entered in the site diary.

17.2 Monitoring of Infrastructure & Equipment

Infrastructure and equipment will be subject to regular visual inspection. In the event of deterioration or damage, appropriate remedial action will be taken to restore the infrastructure and equipment to a satisfactory condition.

17.3 Monitoring of Process Variables

Monitoring of process conditions and variables is discussed in Section 10.3.

17.4 Emissions Monitoring

17.4.1 Monitoring Emissions to Surface Water

Routine visual inspection of the clean surface water drainage system and attenuation pond for oil and grease will be carried out as part of operational procedures.

17.4.2 Monitoring Emissions to Sewer

If a connection to sewer is installed (as an alternative to tankering effluent off-site for treatment) then the effluent will be discharged under a trade effluent consent from Yorkshire Water.

17.4.3 Monitoring Emissions to Air

Emissions to air will be subject to a routine monitoring programme, as described below in Table 10. The applied emission rates have been calculated from the process conditions and are detailed in the Air Emissions Risk Assessment in Section 5 of the environmental permit application. Emission limits will meet the limits set out in the IED.

Table 10
Emission Limits and Monitoring Programme

Pollutant	Emission Limit (mg/Nm^3) [(A)]	Reference Period	Monitoring Frequency	Monitoring Method
Total Dust	10	Daily Average	Continuous Measurement	BS EN 13284-2
	30	½ hour Average		
Total Organic Carbon (TOC)	10	Daily Average	Continuous Measurement	BS EN 12619:1999
	20	½ hour Average		
Hydrogen Chloride (HCl)	10	Daily Average	Continuous Measurement	ASTM D6348-03
	60	½ hour Average		
Hydrogen Fluoride (HF)	1	Periodic over minimum 1-hour period	Quarterly in first year, then bi-annual	ASTM D6348-03
Sulphur Dioxide (SO_2)	50	Daily Average	Continuous Measurement	EA TGN M21 (AM for BS EN14791 or ASTM D6348-03
	200	½ hour Average		
Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	200	Daily Average	Continuous Measurement	BS EN 14792 or ASTM D6348-03
	400	½ hour Average		
Carbon Monoxide (CO)	50	Daily Average	Continuous Measurement	BS EN 15058:2006 or ASTM D6348-03
	100	½ hour Average		
Group 1 Metals – Cadmium and Thallium and their compounds	0.05	Periodic over minimum 30-minute, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 14385
Group 2 Metals – Mercury and its compounds	0.05	Periodic over minimum 30-minute, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 13211
Group 3 Metals – Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	0.5	Periodic over minimum 30-minute, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 14385
Dioxins / furans (I-TEQ)	0.0000001	Periodic over minimum 6-hours, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 1948-1:2006 and MID 1948
Ammonia	10	½ hour and/or Daily Average	Continuous Measurement	BS EN 14791

Pollutant	Emission Limit (mg/Nm^3) (A)	Reference Period	Monitoring Frequency	Monitoring Method
PCBs	0.005	Periodic over minimum 6-hours, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 1948-1:2006 and MID 1948
PAHs	0.01	Periodic over minimum 6-hours, maximum 8-hour period	Quarterly in first year, then bi-annual	BS EN 11338-1:2003
Water vapour content (%)	N/A	N/A	Continuous. However, water vapour monitoring to be replaced with pre-analysis drying of exhaust gas samples.	BS EN 14790 or ASTM D6348-03
Notes: (A) Concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.				

17.5 Monitoring Standards & Techniques

Monitoring will be undertaken in compliance with recognised techniques or using 'standard methods'. Monitoring equipment will be calibrated, serviced and maintained in line with manufacturer recommendations.

17.5.1 Monitoring Stack Emissions

Emissions monitoring will be undertaken in accordance with the requirements of the EA's MCERTS scheme and M1 guidance note. Prior to undertaking stack emissions monitoring a Site-specific protocol (SSP) will be prepared to ensure the monitoring is carried out in accordance with EA Technical Guidance Note M1, Sampling Requirements for Stack Emissions Monitoring and TGN M2 Monitoring of Stack Emissions to Air. Specifically, the SSP will consider the following aspects:

- selection of the sampling position, sampling plan and sampling points;
- access, facilities and services required; and
- safety considerations.

The SSP will ensure that a representative sample is obtained from the stack.

The sampling approach, technique, method and equipment that are chosen will ensure:

- a safe means of access to the sampling position;
- a means of entry for sampling equipment into the stack;
- adequate space for the equipment and personnel; and
- provision of essential services such as electricity.

17.6 Monitoring Action Plan

In the event that the monitoring programme identifies a potentially significant release the following actions will be undertaken:

- the Plant manager will be informed immediately;
- actions to isolate and contain the source of release will be undertaken; and
- the causes of the release will be evaluated, and where possible, procedures put in place to prevent a recurrence.

In the event that abnormal monitoring results are identified, site personnel will inform the site manager and appropriate action will be taken to reduce the process to normal operating conditions. An inspection of the treatment facility will be undertaken to identify the cause and necessary remedial action will be taken.

17.7 Management, Reporting and Training

All monitoring results will be recorded and stored electronically. The Plant manager or his nominated deputy will inspect the monitoring records monthly to ensure monitoring is being undertaken in accordance with procedures. Results will be examined annually as part of the site's management review.

Staff involved in sampling and monitoring will be trained sufficiently to carry out the set procedures and will be trained in the reporting requirements of the environmental permit.

18.0 Closure

18.1 Operations During EP Permit

The waste management and combustion operations at the site should not lead to a deterioration of the land by the introduction of any polluting substances due to the containment and control measures that will be implemented to ensure the processes are contained within the appropriate structure / containers.

In the unlikely event of a potentially polluting incident, which impacts the site, the Plant manager will record the details of the incident together with any further investigation or remediation work carried out. This will ensure that there is a coherent record of the state of the site throughout the period of the permit.

18.2 Design of Site

Records will be maintained of the location of facilities, services, and sub-surface structures. During any modifications or alterations on site, care will be taken to update these records to ensure easy closure of the site.

The design ensures that:

- there are no underground tanks for the containment of potentially polluting substances;
- there is provision for the draining and clean out of vessels and pipe work prior to dismantling; and
- materials used are recyclable, if practicable (having regard for operational and other environmental protection objectives).

All supporting equipment manuals and documentation will be maintained in duplicate in hard copy ring binder and one electronic version of all documentation and manuals will be maintained on CD and kept in the Site office.

18.3 Site Closure Plan

Definite closure will occur when the site stops accepting waste. Actions that will be taken at this point to avoid pollution risk and return the site to a satisfactory condition are set out below.

18.3.1 Communication

WTI will inform the EA in writing of the date of the cessation of waste acceptance. This will enable the EA to inspect the Site, approve the closure and agree upon the actions that should occur post-closure.

18.3.2 Access & Security

Security provision will be audited to ensure that the Site is in a secure condition and that unauthorised access is avoided. Site security will be maintained through the use of perimeter fencing and lockable gates. Regular inspections of the fencing and gates will be carried out, and damage will be repaired as soon as practicable. If necessary temporary repairs will be implemented until permanent repairs can be carried out.

18.3.3 Restoration

Substances will be removed in such a way as to protect land and groundwater from potentially harmful contents. Containers and other structures will be dismantled in such a way as to prevent pollution risk to the surrounding environment.

Storage and treatment vessels and drainage systems will be drained and cleaned prior to dismantling, with all effluent and solid residues being contained and taken to an appropriate treatment or disposal facility.

Assessment will be undertaken of the site to assess its condition relative to the initial site report. If operations at the site have resulted in deterioration of the land, these areas will be re-examined and returned to their original state as defined by the initial site report.

19.0 Environmental Impact

19.1 Impact Assessments

A number of impact assessments have been undertaken in support of this application to demonstrate that the operation of the proposed facility at the site will not give rise to unacceptable impact on the environment.

The assessments carried out in line with current EA guidance are as follows:

- Amenity and Accident Risk Assessment (Section 5);
- Air Emissions Risk Assessment (Section 5 appendix ERA 2);
- Noise Assessment (Section 5 appendix ERA 4);
- Human Health Risk Assessment (Section 6); and
- Global Warming Potential Assessment (Appendix ERA 6).

The conclusions of the assessment are summarised below.

19.2 Amenity and Accidents Risk Assessment

The Accident and Amenity Risk Assessment considers odour, fugitive emissions, dust, releases to water, litter, mud, birds, vermin and insects, and potential for accidents and incidents. The assessment concludes that with the implementation of the risk management measures described, potential hazards from the proposed development are not likely to be significant.

The Accident and Amenity Risk Assessment is enclosed as Section 5 of this application.

19.3 Air Emissions Risk Assessment

An Air Emissions Risk Assessment which includes a detailed dispersion model has been carried out in accordance with EA guidance and is provided in Section 5 Appendix ERA 2 of the application. Please refer to the assessment for a detailed account of emission points, emission rates and abatement technologies provided. However, a short summary is given below.

The scope of the AERA incorporates:

- a review of relevant legislation and guidance;
- a review of baseline conditions at the site;
- quantification of pollutant emissions to air;
- prediction of the impact of emissions to air using atmospheric dispersion modelling techniques;
- consideration of model uncertainties and sensitivities; and
- assessment of the significance of these predicted impacts on air quality.

The objective of the assessment is to determine the potential effect of emissions from the proposed EfW on the air quality environment by comparison to relevant guidelines for the protection of human health and the environment (i.e. protected sensitive habitats).

For the purposes of the dispersion modelling assessment, to represent a precautionary (worst case) approach, it has been assumed that the plant will operate at maximum throughput, 24-hours per day for 365 days per year (i.e. 8,760 hours per year), with emission concentrations at the Permitted Emission Limit Values. In reality operational hours are likely to be less than this to allow for maintenance and the pollution control techniques will ensure that the facility meets the BAT-AELs which are below the Permitted ELVs. As such the following scenarios have been assessed:

- Normal 'daily average' emission limits;
- Half-hourly emission limits; and
- Plausible abnormal emissions

The conclusions of the detailed atmospheric dispersion modelling assessment of the EfW combustion emissions are as follows:

- there are no predicted exceedances of short-term or long-term standards at the point of maximum ground level impact or at relevant exposure locations for any of the scenarios assessed;
- the predicted impact on designated sensitive habitats are considered insignificant and will cause *'no significant pollution'* according to EA/Natural England guidance; and
- the model sensitivity assessment indicates none of the variations in the parameters investigated lead to exceedances of the standards or any material change to the overall conclusions of the assessment.

The Air Emissions Risk Assessment is enclosed as Section 5 appendix ERA 1 of this application.

19.4 Noise Assessment

A noise assessment has been undertaken in accordance with BS4142:2014, whereby the sound sources under investigation have been compared to the existing (background) sound levels.

The specific sound levels generated by the operation of the site have been predicted at the closest receptors using the proprietary software-based model CadnaA®. The model uses the calculation methodologies contained in ISO9613-2:1996 and assumes downwind propagation, i.e. a wind direction that assists the propagation of sound from the sources towards the receptors.

An assessment of noise generated by plant at the Facility has indicated that there is only a 'negligible' risk of adverse impact. For most receptors, the predicted specific noise level is very low and is unlikely to be noticeable against the residual noise environment. The assessment also demonstrates compliance with the conditions imposed within the planning consent.

Furthermore, with respect to noise from HGVs and staff cars travelling in and out of the site and onto surrounding roads, there is again only a 'negligible' risk of adverse impact.

Therefore, noise should not pose a material constraint to gaining the Environmental Permit for the proposed Facility.

The Noise Assessment is enclosed as Section 5 Appendix ERA4 of this application.

19.5 Site Condition Report

The Site Condition Report details the condition of soil and groundwater at the Site. It contains the information necessary to determine the current state of soil and groundwater conditions at the Site, so that a comparison can be undertaken upon the eventual cessation of activities.

A copy of the Site Condition Report is enclosed as Section 4 of this application.

19.6 Fire Prevention Plan (FPP)

A Fire Prevention Plan (FPP) has been prepared in accordance with EA guidance for FPPs[3]. The FPP details the required mitigation and management methods to prevent a fire of combustible materials stored on site.

The information contained within this FPP aims to meet the 3 main objectives of the EA FPP Guidance:

- minimise the likelihood of a fire happening;
- aim for a fire to be extinguished within 4 hours; and
- minimise the spread of fire within the site and to neighbouring sites.

The FPP is enclosed as Section 9 of this application.

19.7 Human Health Risk Assessment (HHRA)

The findings of the HHRA are that the predicted risks and hazards as a consequence of emissions from the proposed ERF plant are all within limits for the protection of human health as defined by the Environment Agency or United States-Environmental Protection Agency.

This conclusion is considered robust on the basis of the worst-case approach adopted in the characterisation of emissions, the safety factors incorporated into the US-EPA HHRA Protocol, and the hypothetical worst-case exposure scenario considered in the assessment.

The HHRA is enclosed as Section 6 of this application

19.8 Global Warming Potential Assessment (GWP)

The GWP assessment studies the relative emissions of greenhouse gases from different waste treatment technologies compared to overall efficiency of combustion as a waste treatment solution.

The GWP Assessment is enclosed as Appendix ERA 6 of Section 5 of the application.

19.9 NOx Abatement Review

The assessment has been undertaken to establish best available technique for the treatment of NOx and the impacts of various treatment options have been considered, along with associated implementation costs. The review focussed on the use of secondary measures including selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) and provides a simple summary ranking of performance and costs.

The NOx Abatement Options Appraisal is enclosed as Appendix BATOT 3.

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[3] Environment Agency - Fire Prevention Plans, May 2018 - https://www.gov.uk/government/publications/fire-prevention-plans-environmental-permits/fire-prevention-plans-environmental-permits.

19.10 Acid Gas Abatement Options Appraisal

The report considers best available techniques for the treatment of acid gases and considers the impacts of various treatment options, along with some of the associated implementation costs.

The Acid Gas Abatement Options Appraisal is enclosed as Appendix BATOT 2.

20.0 Information

20.1 Reporting and Notifications

All relevant notifications and submissions to the EA regarding the site will be made in writing and will quote the permit reference number and the name of the permit holder.

Records will be maintained for at least six years, however in the case of off-site environmental effects, and matters which affect the condition of land and groundwater the records will be kept until permit surrender.

20.1.1 Changes in Technically Competent Persons

The EA will be informed in writing of any changes in the technically competent management of the site and the name of any incoming person together with evidence that such person has the required technical competence.

20.1.2 Waste Types and Quantities

A report summarising the waste types and quantities accepted and removed from the site for each quarter will be submitted to the EA within one month of the end of each quarter.

20.1.3 Relevant Convictions

The EA will be notified of the following events:

- the operator being convicted of any relevant offence; and
- any appeal against a conviction for a relevant offence and the results of such an appeal.

20.1.4 Notification of Change of Operator's or Holder's Details

The EA will be notified of the following:

- any change in the operator's trading name, registered name or registered office address; and
- any steps taken with a view to the company going into administration, entering into a company voluntary arrangement or being wound up.

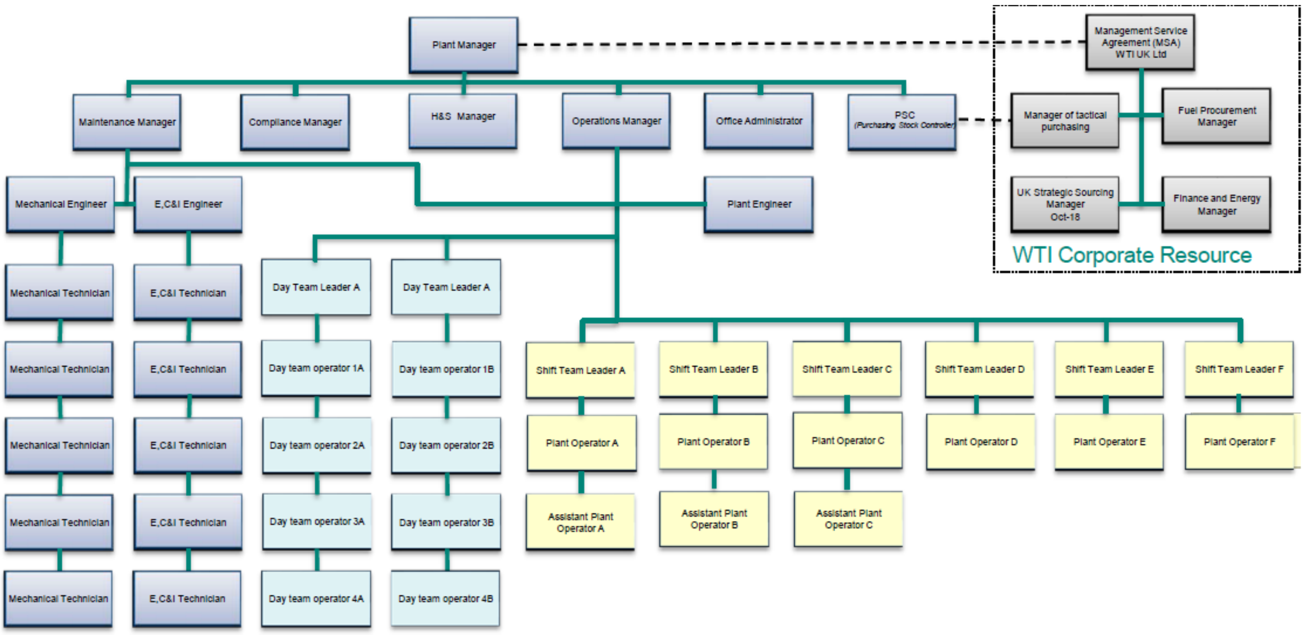
20.1.5 Adverse Effects

The EA will be notified without delay following the detection of the following:

- any malfunction, breakdown or failure of equipment or techniques;
- any accident;
- fugitive emissions which have caused, is causing or may cause significant pollution; and
- any significant adverse environmental and health effect.

APPENDIX BATOT 1

Indicative Management Structure


Plant Manager
Management Service Agreement (MSA) WTI UK Ltd
Maintenance Manager
Compliance Manager
H&S Manager
Operations Manager
Office Administrator
PSC (Purchasing Stock Controller)
Manager of tactical purchasing
Fuel Procurement Manager
UK Strategic Sourcing Manager Oct-18
Finance and Energy Manager
WTI Corporate Resource
Mechanical Engineer
E,C&I Engineer
Plant Engineer
Mechanical Technician
E,C&I Technician
Day Team Leader A
Day team operator 1A
Day team operator 2A
Day team operator 3A
Day team operator 4A
Day team operator 1B
Day team operator 2B
Day team operator 3B
Day team operator 4B
Shift Team Leader A
Shift Team Leader B
Shift Team Leader C
Shift Team Leader D
Shift Team Leader E
Shift Team Leader F
Plant Operator A
Plant Operator B
Plant Operator C
Plant Operator D
Plant Operator E
Plant Operator F
Assistant Plant Operator A
Assistant Plant Operator B
Assistant Plant Operator C

APPENDIX BATOT 2

Acid Gas Abatement Options Appraisal

APPENDIX BATOT 3

NO_x Abatement Options Appraisal

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