CORBY ENERGY FROM WASTE FACILITY PERMIT APPLICATION

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NON-TECHNICAL SUMMARY

Introduction

Encyclis Limited (Encyclis) is applying for a permit to operate an energy from waste (EfW) facility at Corby. This document and supporting Appendices form the application under the Environmental Permitting Regulations 2016 (as amended) for a permit.

A brief overview of the proposals subject to this application are provided in this Non-Technical Summary.

Site Location

The EfW facility will be located at the following address:

Shelton Road

Willowbrook East Industrial Estate,

Corby,

NN17 5XH.

The site for the EfW facility is located in a light industrial setting approximately 2.2 km north-east of Corby town centre.

Drawing 1 details a site location plan.

Process Description

The EfW facility will comprise the following activities

- Waste reception, handling and storage.
- A moving grate furnace.
- Electrical generation, with the potential for heat generation if a suitable heat offtake is found.
- Flue gas treatment, including selective non-catalytic reduction (SNCR), dry acid gas abatement, injection of activated carbon and a bag filter.
- Storage, handling and removal of residues from the site.
- Standby/auxiliary diesel generator.

Waste will be delivered to the EfW facility by road. Entry into the tipping hall building will be via an automatic roller shutter door which will remain shut other than for access. The waste to be accepted at the facility will comprise residual non-hazardous municipal solid waste and similar commercial and industrial wastes. Up to 357,408 tpa of these wastes will be accepted at the facility.

Waste will be combusted in a moving grate furnace with a nominal design feed rate of 33.2 tonnes per hour with waste having a calorific value of 10.9 MJ/kg. However, the plant is capable of operating at throughputs up to circa 45 tonnes per hour albeit the plant cannot be run at this throughput continuously. The furnace design will ensure that a minimum temperature of 850°C for at least 2 seconds will be achieved.

Fuel oil will be used to start and shutdown the plant but once operating temperatures are reached, waste will normally be burned without the need for any auxiliary fuel.

Heat from the hot flue gases leaving the furnace will be recovered as steam and used to produce electricity in a single steam turbine and generator. The parasitic load of the facility will be met using this electricity with the majority being distributed to the national grid.

The EfW facility will be designed to minimise internal energy demand thereby maximising the amount of heat and power available for export.

The EfW facility is capable of combined heat and power (CHP) operation should a heat user be secured in the future, although at the time of this application the facility is expected to generate electricity only.

Steam will be exhausted at low pressure from the turbine and condensed back into water and be pumped back into the boiler.

There are reserve burners fuelled by white diesel in place. The burners will be triggered automatically to ensure that the minimum temperature of 850°C is maintained.

Gases will be cleaned up using a flue gas treatment system prior to discharge. The abatement systems to be provided will include NOx abatement using ammonium hydroxide; acid gas abatement using hydrated lime; dioxins, furans and volatile heavy metals abatement using activated carbon; and a bag filter for abatement of particulates (including particulate phase heavy metals).

Following treatment, the cleaned flue gases will be discharged from a 75 m high stack. Emissions from the stack will be monitored in line with the BAT requirements.

There will be no process discharges to land, surface water, groundwater or sewer from the EfW facility under normal operation. Where possible, equipment certified to the Environment Agency monitoring standard will be used to carry out monitoring at the EfW facility.

All plant areas will be surfaced to an appropriate standard for the activities within that area. A limited amount of liquids are stored at the site (white diesel, ammonium hydroxide, boiler water treatment chemicals and maintenance oils). All liquid tanks and drums will be provided with adequate bunding in line with industry best practice standards (i.e. sized to contain 110% of the tank/container contents and include blind drains). Materials chosen for the surfacing of process areas and bunds will be resistant to the materials they may come into contact with.

The EfW is not expected to cause odour issues. Any possible odours generated from the storage of the waste materials will be extracted from above the storage bunker and used as combustion air within the furnace, thereby destroying any potentially odorous compounds. In the event of a full plant shutdown, waste volumes will be run down prior to the shutdown in order to minimise the quantity of waste within the bunker. During a shutdown air within the bunker area will be extracted via a carbon filtration unit to remove any potential odours. Where possible, the shutdown will be timed to coincide with periods where the waste deliveries can be minimised. |The tipping hall door will remain closed at all times other than for access, which will be made via fast acting roller shutters.

Freshwater consumption will be minimised through the design of the EfW facility. This is attained by maximising the re-use of process waters.

During the operational life of the EfW facility an inventory of raw materials will be implemented and maintained. Waste materials will be the primary raw material at the site. Furthermore, the following reagents will be used:

- ammonium hydroxide
- hydrated lime
- activated carbon
- white diesel
- water
- boiler water treatment chemicals.

Use of reagents will be optimised during commissioning and controlled during operation.

The primary solid residues generated by the EfW facility will be:

- bottom ash;
- air pollution control residues;

Bottom ash will be combined with boiler ash and will be sent offsite to a third-party ash processing plant for recovery. Air pollution control residues will be recirculated into the flue gas treatment process. Any surplus will be transferred to a hazardous landfill for disposal.

The quantity of wastes generated from the EfW facility will be monitored. Additional monitoring and reporting of bottom ash and air pollution control residues will be undertaken in accordance with the requirements of the environmental permit.

Automatic control of the EfW process to ensure that the EfW facility is controlled within the design parameters will be achieved using an advanced control system The plant control system will be configured according to the Project Technical specifications based on ensuring that the maximum practical amount of automation is provided.

The EfW facility will be designed for safe operation under normal, abnormal and emergency conditions. The design process will be subject to a hazard study process with the aim to remove hazards through the plant design, where possible. Before operation an accident management plan will be in place. This will be reviewed and maintained throughout the operational life of the EfW facility.

An environmental management system (EMS) will be established in accordance with the requirements of the ISO14001 standard. The EMS is to be combined with the quality and health and safety management system to form an integrated management system (IMS).

A site closure plan will be produced to show that, once the EfW facility has reached the end of its operational lifetime, it will be decommissioned to avoid any pollution risk and return the site of operation to its original condition at the time of the commencing operation, in accordance with the requirements of the Environmental Permitting regime. A range of appropriate measures will be implemented during the operational phase to ensure that the requirements for site restoration following decommissioning will be minimised.

It has been concluded during assessments of air quality effects and human health risk that as a result of operation of the EfW facility no significant effect will be generated. Effects at sensitive ecological sites were considered during the air quality assessment and it was concluded that no significant effects would occur.

A noise assessment was carried out for the EfW facility. The results of this assessment indicate that significant adverse noise or vibration effects would not be expected as a result of operating the facility.

A full description of the site conditions at the time of this application are provided in the Application Site Condition and Baseline Report.

In summary, the Corby EfW facility will be designed and operated to ensure that significant impacts will not arise as a result of its operation. The EfW facility will operate techniques that are proven and reliable and for the selected site are concluded to represent BAT.

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Appendices

1 INTRODUCTION

1.1 Application Overview

1.1.1 This document forms the supporting statement for an application to permit an energy recovery facility (EfW facility) at Corby under the Environmental Permitting Regulations 2016 (as amended)[1].

1.1.2 The single line EfW facility will be capable of processing 357,408 tonnes of waste per annum, generating circa 30.76 MW of electricity. Residual non-hazardous municipal solid waste (MSW) and similar commercial and industrial (C&I) wastes will be accepted at the facility.

1.1.3 The design throughput is 33.2 tph at a net calorific value (NCV) of 10.9 MJ/kg, although the plant is capable of operating at a throughput of up to 45 tonnes per hour (tph) of waste. The design envelope for the EfW facility is shown in the combustion diagram as Drawing 4.

1.1.4 The facility will be designed and operated to meet all requirements of the Industrial Emissions Directive 2010 (IED)[2], Waste Incineration Best Available Techniques (BAT) conclusions 2019[3] and EPR 5.01[4] and will use proven, reliable techniques for both the combustion of the waste materials and for the minimisation and control of releases to the environment.

1.2 Site Description

1.2.1 The EfW facility site is located at this address:

- Shelton Road,
- Willowbrook East Industrial Estate,
- Corby
- NN17 5XH.

1.2.2 The EfW facility site is located c 2.2 km north-east of Corby town centre in a light industrial setting. The closest residential property lies approximately 750 m from the site boundary.

1.2.3 The site is a largely rectangular plot measuring c.2.4 hectares. The site is bound to the north by the Northern Stream, green space and woodlands, to the east by Shelton Road, to the south by industrial units and to the west by car/vehicle storage.

1.2.4 The National Grid reference for the site is SP 90910 90860.

1.2.5 The site is a brownfield site, which comprises of Made Ground. The site has a heavy industrial history, which is associated with steelworks. In 2000 – 2001 the site was remediated and is currently used for car storage. Access to the site is granted from the southeast.

1.2.6 There are no sensitive land uses identified within 2 km of the site.

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[1] The Environmental Permitting (England and Wales) Regulations, 2016.

[2] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control). Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0075&from=EN

[3] Commission implementing decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D2010&from=EN

[4] The Incineration of Waste (EPR 5.01), March 2009, Environment Agency.

1.2.7 A location plan is provided in Drawing 1 and a layout plan is provided in Drawing 2, which also indicates the permit boundary.

1.3 The Applicant

1.3.1 The applicant and operator is Encyclis Limited (Encyclis).

1.4 Structure of the Permit Application

1.4.1 This section provides an overview of the proposals. This is supplemented by further details in Sections 2-5 as follows:

- Section 2 details the proposed management practices which will be in place at the facility with specific detail relating to:
  - Accident Management;
  - Energy Efficiency;
  - Efficient use of raw materials and water;
  - Avoidance, recovery and disposal of wastes.
- Section 3 addresses the operational measures which will be in place to prevent and/or control the environmental effects of the proposals;
- Section 4 identifies the nature of emissions from the facility and details the monitoring systems which will be in place.

2 MANAGEMENT OF ACTIVITIES

2.1 General

2.1.1 An environmental management system (EMS) will be produced. This EMS will be in accordance with the requirements of the ISO14001 standard. The EMS will be combined with both the quality and health and safety management system to form an Integrated Management System (IMS).

2.1.2 The elements required by ISO14001 and environmental permitting will be covered in the scope of the EMS element of the IMS. An environmental policy will underpin the EMS.

2.1.3 Consideration will be given to the EA guidance on adapting to climate change[5] when developing and/or reviewing the management system.

2.1.4 Systems will be developed and implemented for undertaking audits, setting and reporting of environmental performance, objectives, targets and programmes for future improvements.

2.1.5 The EMS will establish requirements for keeping of records, including, but not limited to:

- waste transfer/ duty of care documentation;
- records of incidents, accidents and emergencies including details of follow-up; and
- any other records required to be kept by the permit.

2.1.6 All key procedures will be in place as detailed below, prior to commencing commissioning on waste

Operations and Maintenance

2.1.7 Operations which have the potential to give rise to significant environmental effects will be carried out as designed and in accordance with procedures to ensure compliance with the permit. These procedures will cover normal operation as well as abnormal operation, including start-up and shutdown.

2.1.8 Specific requirements covering abnormal operating conditions are set out in Article 46 of the IED.

2.1.9 Procedures will be in place to record the duration of any period of abnormal operation to demonstrate that the 4 hour maximum permissible period is not exceeded. Similarly the procedures will also require that the cumulative duration of abnormal operations is monitored and recorded to ensure that no more than 60 hours of operation under abnormal conditions is carried out in any one year.

2.1.10 Routine planned maintenance will be established ensure plant remain in good working order. The manufacturers' recommendations inform maintenance schedules unless operational experience during the lifetime of the EfW facility would indicate the need for variance.

2.1.11 Of note the following procedures will be implemented:

- procedures for waste reception and handling, including waste acceptance;
- control of the combustion process and waste treatment activities, to ensure good combustion is achieved and compliance with IED and BAT conclusions requirements;
- operation of the flue gas cleaning systems; and
- storage, handling and removal of wastes from the site.

[5] https://www.gov.uk/guidance/develop-a-management-system-environmental-permits

2.1.12 The following section of this document provides further details on specific aspects of the management systems for the EfW facility.

Organisation, Competence and Training

2.1.13 Encyclis will ensure that sufficient appropriately trained personnel are available to ensure that the plant is operated safely. Roles and responsibilities will be clearly defined within the management system.

2.1.14 Operator training will be undertaken in advance of commissioning of the EfW facility. This training will not only address operation under normal operating conditions but will also address actions to be undertaken in the event of abnormal and emergency conditions.

2.1.15 Job specifications will be defined and will include details on relevant minimum qualifications and training (including where relevant on the job training) required for that role. Records of training will be stored and maintained.

2.1.16 Relevant staff (including contractors forming part of the commissioning team) will be made aware of the requirements of the permit. In particular those conditions in relation to emission limits and notification procedures. A copy of the permit will be available for reference within the Control Room.

2.1.17 The EMS will set out procedures for ensuring that contractors undertaking work at the EfW facility will be required to demonstrate that they are qualified for the task.

Waste Pre-acceptance and Waste Acceptance

2.1.18 Procedures will be in place as part of the EMS, documenting the waste pre-acceptance, waste acceptance and waste rejection requirements. Waste pre-acceptance checks will be carried out at the contract stage to ensure that waste contracts are only place with suppliers of permitted wastes

2.1.19 Waste acceptance procedures will apply at the point at which contracted waste arrives at the EfW through to offloading (or if deemed unacceptable through to rejection from the site). Further details on waste acceptance measures are detailed in section 3.

2.2 Accident Management

2.2.1 A draft accident management plan (AMP) is provided as Appendix I to this application. The AMP sets out the procedures to prevent accidents and management measures that will be in place should an accident occur. A fire prevention plan (FPP) has also been produced to support this application; a copy of the FPP is provided as Appendix D.

2.2.2 As part of the design process the proposals will be subject to detailed HAZID/HAZOP reviews that will seek to design out safety, health and environmental risks.

Site Security

2.2.3 A 2-metre-high mesh weld and galvanised palisade security fencing surrounds the site. CCTV cameras and intruder alarm provide additional security.

2.3 Start-Up and Shut-Down

2.3.1 The EfW facility will be designed to ensure that start-up and shutdown operations, including emergency shutdown scenarios are carried out safely and without significant environmental impact.

2.3.2 The site will document the procedures for start-up and shutdown, these procedures will be in place prior to commissioning of the EfW facility.

2.3.3 Shutdown procedures will include both routine shutdown and emergency shutdown procedures.

2.4 Energy Efficiency

General Energy Efficiency Issues

2.4.1 The EfW facility has been designed and will be operated and maintained to minimise internal energy demand. An energy flow diagram is presented in Drawing 5 which indicates the energy flows for the nominal design point.

2.4.2 The EfW facility has been designed to generate energy from waste. The process itself requires electrical energy to drive pumps, motors etc. A back-up generator which is sized to ensure a safe plant start up or shut down, will combust a small volume of white diesel. A summary of delivered and primary energy consumption at the EfW facility is provided in Table 2-1 below:

Table 2-1. Expected Breakdown of Delivered and Primary Energy Consumption

Energy Source	Energy Consumption[1]	
	Delivered MWh	Primary MWh
Electricity from EfW facility[2]	21,240	75,827

1. Based on 8,000 hours operation
2. The electrical consumption of the EfW facility is based on a parasitic demand of 2.655 MW over 8,000 hours of operation and is assumed to be provided by the EfW facility. A site-specific conversion factor of 3.57 is used to convert delivered to primary energy, this factor is based on the total thermal input of 100.5 MW and total net electrical output of 28.1 MW; 28.1 / 100.5 = 0.28 (28%) gross efficiency; 1 / 0.306 = 3.57.

2.4.3 Up to 28.1 MW of electricity for export after the parasitic demand of 2.655 MW will be generated by the EfW facility. The net electrical efficiency of EfW facility is 28%.

2.4.4 Specific energy efficiency measures which will be incorporated include the following:

- the EfW facility will be designed to produce electricity but with the ability to also provide heat;
- air pre-heat is minimised by extracting secondary air from the highest (which is also the warmest) point in the building, making use of natural warming of the air;
- the furnace section will be effectively insulated and lined to ensure heat is retained;
- design and construction of the EfW facility to avoid uncontrolled air ingress;
- optimisation of the EfW facility layout to avoid excessive transfer of materials, where possible; and
- effective plant maintenance regime to ensure energy efficiency is maintained over time and reduce down time or prolonged outages.

Operating, maintenance and housekeeping measures

2.4.5 Where relevant, operating procedures will include details of techniques to ensure that the EfW facility is operated efficiently. Maintenance and housekeeping measures will be developed as part of the preventative maintenance system. This will include details of the measures specifically aimed at maintaining the efficiency of the facility during its operational life. In particular, procedures will cover the following items:

- plant condition monitoring - operation of motors and drives – daily/shift checks on operations and conditions;
- compressed air systems – regular walk round checks for leaks, procedures for use of pneumatic tools;
- steam systems – walk round checks for leaks and insulation inspection; and

- lubrication systems – schedule for routine lubrication.

Physical Techniques

2.4.6 The plant will be insulated to avoid heat losses from relevant plant items such as the main furnace, steam systems etc. The main plant items will be housed within buildings and doors will be kept shut other than for access.

Building Services

2.4.7 Energy requirements for building services will be kept to a minimum. Energy efficient lighting will be employed where feasible and lights will be turned off in unoccupied buildings where they are not required for safety or security reasons.

2.4.8 Space heating will be limited to populated areas such as the control room and administration areas. Heating of other process buildings will not be required.

Energy Management Techniques

2.4.9 During the operational life of the EfW facility, energy use will be monitored and recorded. Periodically, usage will be reviewed to identify areas for improvement and ensure that any abnormal increase in energy use is investigated and appropriate action taken to resolve the issue.

2.4.10 Any areas where improvements are identified will be incorporated within the energy efficiency plan for the site. This plan will be incorporated within the EMS to ensure that it is regularly reviewed and maintained up to date in the light of technology developments.

Consideration of Energy Efficiency with other Environmental Effects

2.4.11 Whilst maximising energy efficiency is important it is noted that other environmental issues need to be considered alongside maximising energy efficiency. Sector guidance notes the following BAT considerations and requires justification of how the proposals represent BAT:

- The choice of fuel impacts upon emissions other than carbon e.g. sulphur in fuel.
- Where the potential minimisation of waste emissions by recovery of energy from waste conflicts with energy efficiency requirements.
- Where the nature of the waste is such that the primary concern of safe waste disposal may be jeopardised by additional energy recovery.

2.4.12 The selected fuel for the EfW facility comprises non-hazardous wastes and will replace energy currently generated from other sources including fossil fuels.

2.4.13 The EfW facility will be CHP-ready from the outset. A CHP ready (CHP-R) assessment has been undertaken and is provided in Appendix G.

Energy Efficiency – Sub-Sector specific Issues for Municipal Waste Incineration

2.4.14 As the EfW facility is burning MSW, among other waste types, the requirements for MSW facilities are appropriate to the EfW facility proposals. The key requirements relevant to the EfW facility are:

- Steam should be generated either for direct use or for electricity generation.
- Waste heat should be recovered unless to do so can be demonstrated not to represent BAT. All opportunities for CHP and district heating should be explored (see CHP-R assessment in Appendix G).

- The siting of plant near to potential or actual energy users will aid maximisation of recovery potential. Consideration of joint venture projects wherever possible.

2.5 Efficient Use of Raw Materials and Water

2.5.1 The principal raw materials used by the EfW facility will include the following:

- incoming waste materials
- ammonium hydroxide
- hydrated lime
- activated carbon
- white diesel
- water

2.5.2 In addition, smaller volumes of water treatment chemicals and maintenance oils and greases will also be required. Expected usage and storage volumes for the main raw materials are summarised in Table 2-3 below.

2.5.3 Given the primary driver for the EfW facility is the treatment of residual waste, consideration of fossil fuel alternatives is not within the scope of this project. It is not proposed to combust hazardous waste material – these will not be accepted to the site and in any event these materials would present increased environmental risks as fuel compared to the proposed waste inputs.

Incoming Waste

2.5.4 The European Waste codes applicable to the wastes to be accepted at the EfW facility are shown in Table 2-2 below.

Table 2-2 Incoming Waste Codes & Description

Waste Code		Description
02	**Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing and food preparation and processing**	
	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing	
	02 01 03	Plant-tissue waste
	02 01 04	Waste plastics (except packaging)
	02 01 10	Waste metal
	Wastes from the preparation and processing of meat – fish and other foods of animal origin	
	02 02 03	Materials unsuitable for consumption or processing
	Wastes from the baking and confectionary industry	
	02 06 01	Materials unsuitable for consumption or processing
03	**Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard**	
	Wastes from wood processing and the production of panels and furniture	
	03 01 01	Waste bark and cork
	03 01 05	Sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04
	Wastes from pulp, paper and cardboard production and processing	
	03 03 07	Mechanically separated rejects from pulping of wastepaper and cardboard
	03 03 08	Wastes from sorting of paper and cardboard destined for recycling

Waste Code	Description
04	**Wastes from the leather, fur and textile industries**
	Wastes from the textile industry
04 02 10	Organic matter from natural products (for example grease, wax)
04 02 21	Wastes from unprocessed textile fibres
04 02 22	Wastes from processed textile fibres
15	**Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified**
	Waste packaging (including separately collected municipal packaging waste)
15 01 01	Paper and cardboard packaging
15 01 03	Wooden packaging
15 01 04	Metallic packaging
15 01 05	Composite packaging
15 01 06	Mixed packaging
15 01 09	Textile packaging
17	**Construction and demolition waste (including excavated soil from contaminated sites).**
	Wood, glass and plastic
17 02 01	Wood
18	**Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)**
	Wastes from natal care, diagnosis, treatment or prevention of disease in humans
18 01 04	Wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers)
19	**Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use**
	Wastes from physico/chemical treatment of waste
19 02 03	Premixed wastes composed only of non-hazardous wastes
	Wastes from aerobic treatment of solid wastes
19 05 01	Non-composted fraction of municipal and similar wastes
19 05 02	Non-composted fraction of animal and vegetable waste
19 05 03	Off-specification compost
	Wastes from anaerobic treatment of waste
19 06 04	Digestate from the anaerobic treatment of municipal waste
19 06 06	Digestate from anaerobic treatment of animal and vegetable waste
	Wastes from the mechanical treatment of waste
19 12 01	Paper and cardboard (only if contaminated and unsuitable for recycling at the paper mill)
19 12 07	Wood not containing dangerous substances
19 12 08	Textiles
19 12 10	Combustible waste (refuse derived fuel)
19 12 12	Other wastes from mechanical treatment of wastes not containing dangerous substances
20	**Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions**
	Separately collected fractions (except 15 01)
20 01 01	Paper and cardboard
20 01 10	Clothes
20 01 11	Textiles
20 01 38	Wood other than that containing dangerous substances
20 01 39	Plastics
	Garden and park wastes (including cemetery waste)
20 02 01	Biodegradable waste

Waste Code		Description
	Other municipal wastes	
	20 03 01	Mixed municipal waste
	20 03 02	Waste from markets
	20 03 06	Waste from sewage cleaning
	20 03 07	Bulky waste

2.5.5 The EfW facility has been designed to combust the types of waste included in the list above and the design envelope (see combustion diagram in Drawing 4) will handle a wide variation in operating conditions.

Ammonium Hydroxide

2.5.6 NO_x control will utilise ammonium hydroxide as the reagent.

2.5.7 The use of ammonium hydroxide provides the benefit of reduced emissions of nitrous oxides with lower corresponding global warming potential (GWP) when compared to urea systems for NOx control. Nitrous oxide has a GWP of 310, compared to carbon dioxide with a GWP of 1 and is therefore a powerful greenhouse gas. However, ammonium hydroxide presents higher handling and storage risks. Consequently, the decision is a balance between the increased hazard risks and reagent consumption associated with ammonium hydroxide versus the increased GWP impacts associated with urea. Encyclis operates ammonium hydroxide based NOx control systems at its other EfWs and is both experienced in handling this material as well as having a good track record of safely managing this reagent. On this basis ammonium hydroxide has been selected.

2.5.8 Usage of the reagent will be monitored and controlled to minimise ammonia slippage whilst also effectively controlling NOx emissions. Dosing will be linked to flue gas NOx levels and will be alarmed to alert the Operator in the event of a problem with the dosing of the reagent.

Hydrated Lime

2.5.9 Hydrated lime has been selected as the reagent for controlling emissions of acid gas from the EfW facility.

2.5.10 Hydrated lime and lime are reported as achieving good removal efficiencies. These reagents also support reaction temperatures which are compatible with use in a flue gas cleaning system which combines bag filters, whilst efficient temperature ranges for sodium bicarbonate systems are towards the upper limit for use with bag filters. (Note bag filters are considered BAT for particulate control).

2.5.11 Sodium bicarbonate has easier handling properties compared to hydrated lime which is corrosive. Sodium bicarbonate has a stoichiometric ratio of 1.3 compared to 1.8 for hydrated lime, but they produce similar amounts of residue due to the difference in molecular weight. There can also be a small environmental benefit in using sodium bicarbonate, in that there is potential for recycling of the residue. However, there are a number of significant disadvantages:

- The residue has a higher leaching ability than lime-based residue, which will limit the disposal options;
- The reaction temperature doesn’t match as well with the optimum adsorption temperature for carbon, which is dosed at the same time;
- The sodium bicarbonate system has a slightly higher global warming potential due to the reaction chemistry; and
- It is a higher cost than lime reagent per kg.

2.5.12 Encyclis have experience in handling hydrated lime with a good environmental performance record at operational facilities. Therefore, hydrated lime is proposed for use in the acid gas abatement system. Effective management and maintenance of systems handling the material will minimise the increased inherent hazards of the material itself.

2.5.13 Dosage rates of hydrated lime will be controlled and monitored to ensure usage is optimised and to avoid overdosage resulting in increased quantities of unreacted material within the APC residues. Dosage will be controlled against raw gas concentrations of SO_2 and HCl. Flow of reagent will be monitored and alarmed to indicate a failure.

Powdered Activated Carbon

2.5.14 Powdered activated carbon (PAC) is the most commonly used reagent for dioxin, furan and mercury control at waste incinerators. The main alternative to the injection of PAC would be a catalytic system, however, whilst these systems destroy dioxins and furans they do not provide control of mercury and therefore activated carbon injection would still be required.

2.5.15 PAC is therefore considered BAT for this purpose.

2.5.16 The dosage rate of powdered activated carbon within the EfW facility will be set based on operational experience. The performance of the PAC dosage will be confirmed via monitoring of dioxins, furans and mercury during commissioning. In addition, mercury emissions will be continuously monitored and if necessary adjusted. Dosage of activated carbon will also be alarmed to indicate a failure.

Fuel oil / Diesel

2.5.17 White diesel will be used for auxiliary firing. The white diesel will contain less than 0.1% sulphur. Alternatives to the white diesel would be liquefied gas (LPG) or natural gas.

2.5.18 LPG is a flammable mixture of hydrocarbon gases. As LPG turns gaseous under ambient temperature and pressure, it is required to be stored in purpose-built pressure vessels. If there was a fire within the site, there would be a significant explosion risk from the combustion of flammable gases stored under pressure.

2.5.19 Natural gas can also be used for auxiliary firing and is safer to handle than LPG. Although occasional, when auxiliary fuel firing occurs, it requires a large volume of gas supplied from a high-pressure gas main. In addition certainty of supply would be needed via an uninterruptable supply which can be costly. A white diesel fuel oil tank can be easily installed at the facility. Whilst it is acknowledged that white diesel is a fossil fuel and is classed as flammable, its use is intermittent, and its storage does not pose the same risk profile as LPG. The combustion of white diesel will lead to emissions of sulphur dioxide, but these emissions will be minimised as far as reasonably practicable through the low sulphur content in the white diesel.

2.5.20 Natural gas does present environmental advantages in lower emissions. However, white diesel was selected for auxiliary firing as the onsite storage provides guaranteed availability. Taking the above into consideration, white diesel is considered to represent BAT for auxiliary firing at the EfW facility.

Water

2.5.21 The EfW facility has been designed to minimise use of fresh water. Water use is indicated in the water balance in Drawing 6. The key use of fresh water is within the boiler water treatment plant supplying top-up water to the boilers and supply to the process water tank.

2.5.22 The water system will be designed with the key objective of minimal consumption of potable water. The process water will be supplied by potable mains water. Freshwater input to the process water tank will be minimised through the collection of process waste waters for re-use. The feedwater used to generate steam in the boiler/turbine water/steam cycle will be recycled condensate. There will be no process water discharge from the site.

2.5.23 Make-up water for the boiler feedwater will also be supplied from the mains but will first be treated within the boiler water treatment system to provide a suitable feed quality to the boiler.

2.5.24 Other water consuming processes will be:

- the wet ash conveyor and the wet ash itself; and
- dust suppression.

2.5.25 Lost condensate will be replaced with demineralised treated water.

2.5.26 Process effluents will be collected in a settling basin for re-use within the EfW facility and will comprise process water from the following sources:

- process effluent collected in site drainage system (e.g. boiler blowdown);
- effluent generated through washing and maintenance procedures; and
- water run-off collected from the bottom ash quench.

2.5.27 Process waters collected in the settling basin will be re-used within the ash quench.

2.5.28 Washdown water consumption will be minimised by the use of trigger controls on wash hoses.

2.5.29 In the event of a fire, firewater would be supplied from a water storage tank. Wastewaters generated from firefighting will be retained within the EfW facility. Procedures will be in place for sampling and testing of the water and appropriate disposal arrangements will be in place. The procedure for handling, testing and disposal of fire waters will form part of the operational Fire Prevention Plan (FPP). Further details on fire prevention and management is provided in the draft FPP provided in Appendix D.

2.5.30 Expected usage and storage volumes for the main raw materials are summarised in Table 2-3 below.

Table 2-3: Main Raw Materials Usage

Raw Material	Nature	Expected Usage (approx.)	Storage including capacity	Fate	Environmental Effects	Alternatives
Incoming Waste	Non-hazardous waste	357,408 t/ year	5,100 t Concrete storage bunker	Combusted in the EfW facility. Approximately 70% to air as flue gases; 25% solid residues for reuse/recycling, 5% disposed to landfill	The fuel has the potential to contain List I and List II substances which are potentially toxic, although this is through leachate rather than the solid waste.	Other waste likely to have similar or increased environmental effects (e.g. hazardous waste).
Ammonium Hydroxide	<25%	225 kg/ hour	120 m^3 bunded storage tank within (110% capacity bund)*	Reacted and reduced to nitrogen and water and released to air.	Not potentially bioaccumulative. Environmental toxicity in water: 24 hour LC50 rainbow trout 0.008 mg/l, 96 hour LC50 fathead minnow 8.2 mg/l, 48 hour LC50 bluegill 0.024-0.093 mg/l, 48 hour EC50 water flea Daphnia 0.66 mg/l at 22 °C.	Urea has lower hazards in storage and handling but higher GWP
Hydrated lime	$Ca(OH)_2$, solid	1,223 kg/ hour	2 x silos, 330 m^3	Reacted with acid gases to form salts and collected with APC residues.	Low toxicity to mammals, severe irritant, corrosive.	Alternatives have similar effects
Activated Carbon	Powdered	5-40 kg/ hour	50 m^3 storage tank	Collected with APC residues.	Low toxicity to mammals, low bioaccumulation potential, highly insoluble and immobile.	Alternatives have similar effects
White diesel	Ultra-low sulphur diesel	Variable dependant on number of start-ups/shut downs and auxiliary usage	250 m^3 double skinned, fully integrated storage tank	Combusted and released as combustion gases.	Not readily biodegradable. Persists under anaerobic conditions. Has the potential to bioaccumulate. Harmful, 10 < LC/EC50 < 100 mg/l, to aquatic organisms (estimated). (LC/EC50 expressed as the nominal amount of product required to prepare aqueous test extract). Low acute toxicity to mammals. May cause physical fouling of aquatic organisms.	Natural gas (see discussion in paragraph 2.5.19 above)
Water	Town mains water		Raw water tank volume to be determined at detailed design stage. Fire water storage tank at least 900 m^3.	Re-used or evaporated	-	Recycled water – see discussion above

*Tank volume to be confirmed during detailed design but expected to be in the region of the volume stated.

2.5.31 In addition to the main raw materials, smaller quantities of boiler water treatment chemicals and maintenance oils and greases will be used within the facility.

2.5.32 All liquid reagent storage tanks will be bunded to 110% of the capacity of the storage tank. Bunds will be constructed to appropriate standards and lined with materials that are impervious to the material which they hold.

2.6 Avoidance, Recovery and Disposal of Wastes

2.6.1 The EfW facility will generate three main process wastes/residues, namely bottom ash, boiler ash and air pollution control (APC) residues. Expected amounts of each of these wastes is summarised in Table 2-4 below:

Table 2-4. Waste Generation, Storage and Disposal/Recovery

Waste	Expected Amount tpa	Storage	Disposal/Recovery Route
Bottom Ash (including boiler ash)	80,420	1,400m^3 bunker	Expected to be recycled[1]
Air Pollution Control Residues	14,300	2 x c460 m^3 storage silos	Disposal to landfill, following treatment, or neutralisation and alternative disposal if feasible.

1. Flexibility to landfill initially until waste characterised and a recycle route secured.

2.6.2 At the time of this application only the APC residues are expected to be sent to landfill, should a feasible recovery option (e.g. carbonation and subsequent recycling) not be available. This will be regularly reviewed and, should an alternative re-use option be identified as feasible, then preferentially this option will be used.

2.6.3 In addition to the above main wastes, smaller quantities of waste oils and used drums and containers will be generated. Where possible empty drums and containers will be returned to the manufacturers. Waste oils will be sent for recovery.

Bottom Ash (including boiler ash)

2.6.4 Bottom ash (IBA) is the cooled burnt-out residue generated from the furnace grate. The bottom ash is combined with the boiler ash prior to disposal. Expected amounts of IBA (including boiler ash) generated per annum are shown in Table 2-4.

2.6.5 IBA is discharged at the end of the grate into the water filled bottom ash extractor located beneath the grate, where this material is quenched. From here the ash is moved via a conveyor, which permits water to drain from the ash back into the quench bath for reuse. The IBA produced from the combustion process will be sent offsite to a third-party ash processing plant for recovery.

2.6.6 Boiler Ash is generated from deposits of particulates from the flue gases as they pass through the boilers and are removed through online cleaning. This comprises lighter ash particulates carried over from the furnace. The boiler ash will be combined with the bottom ash and sent offsite to a third-party ash processing plant for recovery. The boiler and bottom ash mixture will be subject to testing during commissioning and early operation to confirm the residue is non-hazardous.

Air Pollution Control (APC) Residues

2.6.7 APC residues are handled within a fully enclosed system. The residues will be stored in silos and discharged via sealed connections into fully contained disposal vehicles. These measures will avoid the release of dust from handling and transfer of this material.

2.6.8 There is currently no mechanism by which APC residues can be eliminated completely, however, the monitoring and control of reagent injection rates will be designed to minimise quantity of the residue formed.

2.6.9 Subject to testing to quantify the nature of the APC residues once operational, opportunities for reuse will be explored. Initially, the flexibility to landfill this material is required until such a time as a feasible alternative solution is secured.

3 OPERATIONS

3.1 Incoming Waste and Raw Material Management

3.1.1 Waste will be delivered to the EfW facility within an enclosed vehicle.

3.1.2 All loads will be weighed upon entry to the site at the weighbridge located at the site entrance. Here waste transfer paperwork will be checked to ensure that loads conform to those which the EfW facility is permitted to accept. The vehicles will be re-weighed on exit to establish the weight of material delivered.

3.1.3 It will not be practical to visually inspect all waste deliveries before it is tipped into the bunker. Therefore, the incoming waste will be observed during reception as it is tipped and/or during mixing.

3.1.4 In the event that a delivery is suspected to contain non-conforming wastes a visual spot check of the wastes will be made within the tipping hall. If confirmed as unacceptable the load will be rejected and returned to its place of origin. If it is deemed acceptable, the vehicle will be directed for unloading.

3.1.5 Any wastes that are identified as 'non-conforming' will be placed in quarantine. After inspection in quarantine, all 'non-conforming' or 'unsuitable' wastes will be loaded into an appropriate vehicle and removed from site to a suitable alternative licensed waste management facility.

3.1.6 Procedures will be in place as part of the EMS, documenting the waste pre-acceptance, waste acceptance and waste rejection requirements.

Waste Reception and Storage

3.1.7 Waste deliveries accepted at the weighbridge will be directed to the tipping hall. Access to and from the tipping hall will be via and entrances fitted with a fast acting rolling shutter door which will remain closed except for access and egress. The floor area within the hall will be regularly cleaned to ensure a high standard of housekeeping in this area is maintained.

3.1.8 Waste will be offloaded into the waste bunker. The waste bunker itself is contained within the main tipping hall. The bunker arrangement takes the form of a rectangular pit set into the floor of the tipping hall. The capacity is sufficient for approximately 5,100 tonnes of waste material. This equates to approximately 5 days' storage. Storing 5 days' worth of feedstock allows the plant to remain operational during times of the year when fewer deliveries are received.

Waste Bunker Management

3.1.9 An overhead crane will be provided for transferring fuel from the bunker and carrying out mixing of waste within the bunker to promote a more homogenous mixture of wastes. The crane will operate in either manual or semi-manual operating mode. Mixing and transfer activities will be manually controlled; waste feed operations will be semi-automatic.

3.1.10 The crane operator island will be strategically located overlooking the bunker area and the tipping area, with CCTV feedback from both the bunker and the charging hoppers. The crane operator will visually inspect the material within the bunker and will use the overhead crane to remove any unacceptable material to the end of the bunker. Unacceptable material will be removed from the bunker and returned to the producer.

3.1.11 Waste from the bunker that is transferred by the crane is deposited into charging hoppers which in turn feed the two moving grate furnaces located within the boiler hall. A closed-circuit camera will be set over the charging hoppers to view the hopper conditions and the grab when it is unloading.

3.1.12 There are to be 2 overhead cranes installed, one on duty and 1 on standby.

3.1.13 A bunker management scheme will be operated to ensure that waste is systematically removed, and that prolonged storage of materials as far as practicable does not occur. This scheme will also ensure that areas of the bunker are emptied to permit visual inspection of the bunker wall integrity at least annually.

3.1.14 Odour control within the bunker area is achieved by maintaining a negative pressure with air being drawn through the furnace and combusted. In the event of a full plant shutdown, waste volumes will be run down prior to the shutdown to minimise the amounts of material remaining in the bunker. Where possible, the shutdown will be timed to coincide with periods where the waste deliveries can be minimised. During a shut down, doors to the waste reception hall will remain closed at all times other than for access.

Fuels and Treatment Chemicals/Reagents

3.1.15 Auxiliary fuel for the EfW facility will be white diesel and will be stored in 2 x 45m^3 double skinned storage tank.

3.1.16 Other reagents will be delivered by road and discharged into dedicated bulk storage tanks. The duty member of staff will be responsible for checking that the material to be delivered is discharged into the appropriate storage vessel and for ensuring that there is sufficient capacity within the storage vessel prior to commencing unloading operations.

3.1.17 Activated carbon and hydrated lime will be used within the flue gas treatment plant. These reagents are potentially dusty. Deliveries will minimise the potential for dust releases through the use of sealed connections. Air displaced during deliveries will vent via a filter unit installed on the storage vessel. The filter unit will be visually inspected during unloading operations to ensure that it is operating effectively. In the event of a dust emission the filter will be replaced.

3.1.18 Deliveries of ammonia will be undertaken via a sealed connection into the storage vessel. The storage vessel will be fitted with a scrubber or vent system to allow pressure to be maintained at the required level for storage and delivery. Level detection will be provided for the storage tank which will be linked via a switch to prevent overfilling.

3.1.19 In the event of a spillage, any spilt material will be cleaned up immediately and disposed of appropriately.

3.2 Waste Charging

3.2.1 To ensure continuous steady state operation of the combustion stage and boiler sections, it is important to ensure that the waste materials are adequately mixed. The waste charging system will be designed such that the plant can be sufficiently supplied by the crane operating for only a fraction of each hour. The remaining time the crane will then be dedicated to bunker management and receipt of incoming waste as described above.

3.2.2 From the feed hopper the waste material will be deposited onto the feed grate via a feed chute. The waste in the feed chute will act as a gas tight seal between the combustion chamber and the bunker. The feed chute opening will widen in a downwards direction thus avoiding blockages as the waste material travels through the chute. The connection between the hopper and the feed chute will be designed to be as airtight as possible to prevent the potential escape of fumes or excess air flows into the boiler. A shut-off damper extending across the entire width of the feed chute will be installed beneath the feed hopper. This damper will provide an air-tight seal during start-up and shutdown of the combustion system when there is no waste in the chute.

3.2.3 A hydraulic ram system will push waste material off the feed table and onto the grate. Each grate will have its own hydraulically driven feed ram. The number of strokes, stroke length and stroke speed can be set individually. The feeding cycle will be integrated in the combustion control system; manual control is possible locally, if necessary.

3.2.4 Level detection is provided in the feed chute. A low-level alarm will alert the crane operator that more waste material needs to be transferred from the bunker.

3.2.5 The feed grate is located at the bottom of the feeding chute and is designed to be the same width as the grate thereby providing equal feeding of the waste materials across the entire width of the combustion grate. The grate has been designed as a single line sliding grate/feed stoker and longitudinally consists of five separate grate zones providing the following functions:

- drying;
- ignition;
- combustion; and
- burnout.

3.2.6 The movement of the grate transports the waste along its length. The proposed design permits operational control specific to the needs of each zone, i.e. both grate movement and combustion air supply (see detail in Section 3.4) can be separately controlled within each zone of the grate.

3.2.7 The feed chute is water cooled to provide temperature control. A fire sprinkler system is designed to be triggered in the event of a fire. In addition, water/foam guns are installed covering the entire area of the bunker and feed hoppers. Further detail on fire prevention and management is provided in the FPP (see Appendix D).

3.3 Furnace Types

3.3.1 The selected moving grate technology is a well proven, reliable and highly effective technique for combustion of waste materials comprising or derived from MSW or similar C&I wastes. Demonstrable and well understood performance is a key objective in the selection of the chosen techniques for the EfW facility. However, it is recognised that there are a number of alternative furnace types available for combustion of waste materials. Consideration of these techniques is summarised in the BAT Assessment in Appendix H.

3.4 Furnace Requirements

3.4.1 The furnace will be designed to achieve good combustion control with the aim of minimising emissions and maximising burnout of the waste material. In particular the furnace will be designed, validated and operated to meet the requirements within the Industrial Emissions Directive 2010 (IED) and Waste Incineration BAT Conclusions (BAT-C). The furnaces will be equipped with auxiliary low NOx burners fuelled by white diesel. The burners will be installed above the secondary air injection and will operate automatically to help fulfil the IED requirements:

- a minimum temperature of 850°C for at least 2 seconds after the last injection of combustion air whenever waste material is being burnt;
- validation that temperature and residence time, and selected oxygen content are achieved, under the most unfavourable conditions;
- minimisation of the amount and harmfulness of residues;
- achievement of less than 5% loss on ignition (dry weight) in bottom ash or 3% total organic carbon (TOC); and
- to ensure that emissions to air do not give rise to significant ground level air pollution.

3.4.2 In the event that the temperature falls below the minimum temperature (850 °C) an audible alarm will be activated to alert operational staff. An automatic interlock will prevent waste feed to the furnace should the temperature fall below the minimum required. This interlock will also be activated at start-up, until the minimum temperature is achieved and whenever the continuous emission monitors show breaches of the emission limit values (over the appropriate averaging period).

3.4.3 The combustion control system to be installed at the EfW facility is designed to control the process to ensure operations meet IED and BAT-AEL requirements, minimise emissions that can be influenced by operating conditions on the grate (CO, NOx and VOC), achieve a constant level of steam production and maintain operation within the range of the firing diagram in Drawing 4. Central to achieving this aim is controlling the combustion process to ensure an even and sufficiently high combustion temperature profile along and across the grate.

3.4.4 The control system includes interrelated control loops which adjust different operating parameters to maintain good combustion. Key variables include:

- ram feeder speed
- primary air flow
- grate bar frequency (adjustable for each zone)
- grate bar travel distance (adjustable for each zone)
- secondary air flow

3.4.5 An infra-red camera system will provide a continuous indication of the temperature profile and will provide fast feedback to the control system of changes in temperature on the combustion bed zone and thus permitting a quick reaction to adjust grate movement and primary air to maintain optimal combustion. Temperature measurements will be continuously recorded from the primary combustion zone (using the infra-red camera) and at the exit from the secondary combustion zone (using infra-red pyrometers at the inlet to the second pass).

3.4.6 The furnace design will be sized to ensure that the IED requirements for 2 seconds residence time after the last injection of combustion air can be met (see section 3.5 below).

3.4.7 The furnace will be equipped with auxiliary low NO_x burners fuelled by white diesel. The burners will be installed above the secondary air injection and will operate automatically to fulfil the following functions:

- to heat up the furnace during start-up in order to reach a temperature of at least 850ºC before waste derived material is introduced onto the grate;
- to ensure gas combustion for at least 2 seconds at 850ºC is maintained at any point where waste derived material is being burnt. An alarm will signal when there is a risk of not meeting that requirement and the burners will start automatically; and
- to ensure complete combustion of flue gases during shutdown.

3.4.8 The furnace design and operational control aims to maximise burn out of the waste, minimising residue quantity. As a maximum the furnace will achieve a total organic carbon level of 3% (dry weight) in bottom ash.

3.4.9 The furnace will typically operate with an excess oxygen level of 6 – 8%. The excess oxygen level is controlled automatically by the combustion control system to ensure that effective burn out of the waste fuel is achieved whilst avoiding adverse effects on energy efficiency by operating at too high excess.

3.4.10 In the event that levels fall below the set range the carbon monoxide (CO) control system will be manually adjusted to bring operations back within the desired range. Air control to the grate air flow with further control provided via the secondary air flow allows for a quick response to increases in CO emissions.

3.4.11 A staged combustion air system will be employed. The injection system for the combustion air has been designed to provide effective distribution of combustion air to avoid hot zones and minimise the amount of inorganic material volatised. This is supported by operational experience at a number of similar facilities which has demonstrated that hot zones and volatilisation of inorganic material has never been a problem.

3.4.12 Primary air, extracted from above the waste fuel bunker will be injected beneath the combustion grate. Primary and secondary air will be preheated using steam to improve plant efficiency. The primary air injection is controlled to minimise NO_x production and avoid excessive entrainment of particles.

3.4.13 Turbulence within the combustion chamber is achieved via the injection of the secondary air which utilises a battery of nozzles on each side of the boiler to provide an even distribution of combustion air. The injection points for the secondary air have been selected to ensure that the flue gas mixture and secondary air injection achieve good distribution of the oxygen.

3.4.14 The furnace is designed to ensure the combustion chamber is as airtight as practicable. In addition, the furnace is maintained under negative pressure to prevent the release of gases during charging.

3.4.15 Temperature measurements will be continuously recorded from the following locations:

- primary combustion zone (using an infrared (IR) camera)
- exit from the secondary combustion zone (using IR pyrometers at the inlet of the second pass).

3.4.16 In the event that the temperature falls below the minimum temperature (850 °C) an audible alarm will be activated to alert operational staff. An automatic interlock will prevent waste feed to the furnace should the temperature fall below the minimum required. This interlock will also be activated at start-up, until the minimum temperature is achieved and whenever the continuous emission monitors show breaches of the emission limit values (over the appropriate averaging period).

3.5 Validation of Combustion Conditions

3.5.1 The IED Annex VI Part 6 requires that combustion temperature and residence time (incinerators and co-incinerators) are subjected to appropriate validation at least once when the EfW facility is brought into service and under the most unfavourable operating conditions.

3.5.2 The combustion process of the EfW facility will be subject to computational fluid dynamic (CFD) modelling at the final design stage to demonstrate that the selected design will meet the IED requirements for residence time and minimum temperature for the chosen design envelope. The output of this study will be reported and will identify:

- input data for the modelling assessment;
- any assumptions made; and
- confirm the selected model and how this is representative of the EfW facility.

3.5.3 A detailed commissioning plan will be drawn up in advance of the commissioning trials and will describe the methodology which will be applied to ensure that the requirements of IED Annex VI Part 6 will be met. Measurements will be performed during commissioning in accordance with Guidance Note EPR5.01. If, in demonstrating the minimum temperature of 850 °C, it is not possible to locate the temperature probes at the precise point of the 2 second residence time, then a correction factor will be applied to the measured temperature.

3.5.4 The commissioning tests will assess the EfW facility performance over a range of operating conditions. Whilst there are some variables which can readily be tested during commissioning (e.g. waste material throughput), the treated waste material being burnt (and its NCV) will be determined by that delivered to the site and therefore will introduce some practical limitations on the extent of commissioning trials.

3.6 Combined Incineration of Different Waste Types

3.6.1 The material to be burned within the proposed EfW facility will comprise treated non-hazardous wastes of a similar nature and therefore the requirements under this section are not applicable.

3.7 Flue Gas Recirculation

3.7.1 Flue Gas Recirculation (FGR) is reported as providing a two-fold benefit:

- reduced NO_x levels.
- increased energy efficiency.

3.7.2 FGR is often selected where the oxygen content in the flue gases is to be reduced and/or improved mixing of the flue gas in the first boiler pass is required. The recirculated flue gases have a lower oxygen content and when mixed with fresh secondary air the combined larger volume promotes mixing. In practice, good mixing is achieved through appropriate design of the secondary air injection process.

3.7.3 However, despite the reported benefits most energy from waste facilities operate without FGR, and in a number of cases have been reported to retrospectively remove the FGR.

3.7.4 Although FGR can reduce NO_x levels, it would still require additional abatement to be installed to achieve the emissions level required by the IED. If the take-off point for the FGR system is installed after the APC plant the ducting will need to be installed with electrical trace heating and would outweigh any energy efficiency benefits in terms of secondary air savings. The requirement for electrical trace heating is primarily to prevent condensation of flue gas constituents in the duct.

3.7.5 The alternative of installing the FGR off-take direct from the boiler is reported as introducing corrosion problems as a result of dew point corrosion due to SO_x in the recirculation ducting, and abrasion problems due to the fly ash particles in the gas. In practice this leads to operational problems typically requiring replacement of ducting and blower blades after a relatively short time.

3.7.6 Given that the design minimises NO_x levels and any energy efficiency benefits reported using FGR are not borne out in practice, the resulting impact on the overall reliability of the EfW facility from FGR is not considered justified and the proposed combination of measures to control NOx, without FGR is considered to represent BAT.

3.8 Dump Stacks and Bypasses

3.8.1 There will be no dump stack or bypass included within the design. Under all operating conditions the flue gases will pass through the flue gas treatment plant prior to discharge from the stack.

3.9 Cooling Systems

3.9.1 There are three main types of cooling systems commonly employed at facilities generating energy from wastes. These are:

- once through sea or river water;
- evaporative cooling tower; and
- air cooled condenser.

3.9.2 The EfW facility will use air cooled condensers. There are advantages and disadvantages in using each of these types of cooling system. However, for the proposed EfW facility an air-cooled system has been selected for the following reasons:

- the site is not located in close proximity to an adequate supply of water;
- air cooled systems do not require the use of chemical treatment or biocides which evaporative systems do;
- there is no visible plume from air cooled systems; and
- there is no requirement for water input.

3.9.3 Air cooled condensers have larger energy requirements compared to alternatives and can give rise to noise impacts (as can cooling towers). An acoustic package will be provided to control noise emissions. The noise assessment in Appendix J has considered noise from the air-cooled condensers and with the proposed acoustic attenuation significant noise impacts are not predicted.

3.10 Boiler Design

3.10.1 The boiler is of a proven design and there are many examples in operation at similar plants. The boilers and furnace will be integrated to maximise energy recovery. The sides and walls of the furnaces will be integrated into the membrane walls of the first empty pass. The membrane walls will therefore directly extract heat from the furnace. The side walls will extend to the level of the grate.

3.10.2 The boiler design incorporates three vertical radiation passes, a horizontal pass with the superheater and evaporator bundles and a vertical economizer.

3.10.3 The boiler passes are designed to ensure a homogeneous and steady flue gas flow pattern in all areas. The selected boiler will be subject to a CFD study. The CFD study will be used to determine the exact geometric shape of the boiler sections and ensure that the selected design avoids the formation of pockets of stagnant or low velocity gas.

3.10.4 To maintain the flue gas temperature at the optimal temperature required for the flue gas treatment plant (140-145ºC), the final economiser bypass control system is implemented to control the minimum temperature at flue gas treatment inlet. The boiler economiser is designed to enhance energy recovery, with a maximum design temperature at the boiler exit of 160ºC.

3.10.5 Whilst measures to minimise dust carryover are included within the design, some dust will still be present which over time can accumulate as fouling within the boilers. To prevent excessive build-up of deposits in the boiler the following cleaning systems will be provided:

- a shower-cleaning-system within the 1st, 2nd and 3rd boiler passes;
- a rapping system for all heat exchanger bundles in the horizontal 4th pass;
- ball shot cleaning or sootblowers within the economiser.

3.10.6 In order to control the solids content of the boiler feed water, a blowdown of the steam flow will be extracted. Blowdown water is flashed inside a pressurised flash tank and the flashed steam is recovered in the low-pressure steam system. The residual condensate is sent to an atmospheric flash tank prior to reuse.

Primary measures for minimisation of Dioxins within the Boilers

3.10.7 Whilst the furnaces will be designed to operate at high temperature to achieve effective destruction of any dioxins within the waste gases, as the gases cool within the boiler section there is the potential for reformation of dioxins whilst in the 'de-novo' synthesis range of approximately 200 – 450ºC. This section identifies the measures in place to minimise dioxin formation in the boilers and thereby reducing the reliance on downstream abatement plant to remove these pollutants.

3.10.8 The boiler convective sections will be designed in such a way that the retention time in the temperature range whereby dioxin reformation can take place (200-450ºC) is reduced to a minimum value due to sufficiently high velocities of the flue gases.

3.10.9 The steam/metal surface temperature will be kept to a minimum where the flue gas temperature is within the de novo synthesis range.

3.10.10 The boiler passes will be successively narrowed, increasing the flue gas velocity to minimise the time flue gas temperature lies within the de-novo synthesis range.

3.10.11 Dust can promote the formation of dioxins by acting as a carrier for the catalysts for these reactions. The measures included within the EfW facility identified in paragraph 3.10.5 to minimise build-up of deposits and the boiler design to minimise dust carryover will therefore also contribute to minimising the reformation of dioxins.

3.10.12 The above measures are considered to represent BAT for avoiding dioxin formation within the boiler section.

Energy Recovery and Distribution

3.10.13 Energy is recovered from the hot flue gases within the steam boiler. The resulting high-pressure steam is directed to the steam turbine, generating electricity which is exported to the grid.

3.10.14 A single steam turbine will generate electricity which will be exported to the Grid and used onsite to power the internal electrical systems.

3.10.15 The EfW facility will initially operate in electricity-only mode but will be designed to operate in combined heat and power (CHP) mode in the event that a suitable heat load is identified in the future. Appendix G further considers opportunities for CHP operation.

3.10.16 Under normal operating conditions the steam turbine will control the pressure within the boilers. Deviations in actual steam flow arising from changes in input waste material quality, for example, will be levelled out by the inlet pressure control of the turbine. The steam exhaust at the back end of the steam turbine will be fed into the air-cooled condenser. The vacuum in the condensing section of the turbine will be kept as low as possible in order to recover as much energy as possible.

Water Treatment Plant

3.10.17 The water treatment plant will be designed to treat mains water to meet water quality specification for the boilers and turbine. Fresh water from mains supply will be treated in a demineralisation plant to meet the water quality specification requirements for the boilers and turbine. The demineralisation process will comprise a reverse osmosis unit, electro-deionisation and buffer storage for demineralised water prior to use.

3.11 Flue Gas Treatment

3.11.1 Whilst the EfW facility is designed to minimise the formation of pollutants, abatement plant has been included for those which are generated to ensure flue gases are cleaned before they are released to the atmosphere. The flue gas treatment system will be designed to be compliant with the Industrial Emissions Directive (IED) and Waste Incineration BAT-C and will comprise the following stages:

- selective non-catalytic reduction (SNCR) using ammonium hydroxide;
- dry or semi dry sorbent injection of hydrated lime;
- dry sorbent injection of activated carbon injection; and
- fabric bag filter.

3.11.2 The flue gas treatment plant is discussed further in section 4.1 and within the BAT assessment in Appendix H.

3.12 Back-Up Generator

3.12.1 A diesel back-up generator will supply power to critical systems in the event of loss of power. The generator's role will be to keep essential equipment operational such as cooling water system and emergency escape lighting and allow the plant to shut down safely. It will be tested for less than 50 hours per annum and therefore routine emissions are not considered significant. The size of the back-up generator will be sufficient to safely shutdown the plant. The back-up generator will be used as a second back up as mains electricity would be normally used first.

3.12.2 In the event of a power failure at start-up a plug-in connection will be included to allow power to be supplied by a larger emergency diesel generator. This larger diesel generator would be temporarily brought to the site and operated for start-up purposes only following which it would be removed from the site.

4 EMISSIONS AND MONITORING

4.1 Point Source Emissions to Air

4.1.1 The EfW facility will give rise to emissions to air, primarily water vapour and carbon dioxide (CO_2) as a result of the combustion process. However, given the nature of the incoming waste material for the EfW facility there will also be low concentration releases of the following:

- nitrogen oxides (NOx);
- acid gases e.g. sulphur oxides (SOx), hydrogen chloride (HCl), hydrogen fluoride (HF);
- particulate matter;
- heavy metals; and
- volatile organic compounds (VOCs), carbon monoxide (CO), dioxins and furans.

4.1.2 The EfW facility will have a dedicated abatement system for controlling emissions prior to release to atmosphere. The EfW facility design and operation will ensure compliance with relevant emission limits as set out within the IED, Waste Incineration BAT-C and values established by the EA as BAT, see emission limit values set out in Table 4-1. The proposed methods for control of emissions to air are detailed below whilst justification for the selected techniques is provided in the BAT Assessment in Appendix H.

4.1.3 Flue gases will discharge via a 75 m high stack (emission point A1 as shown in Appendix B).

4.1.4 Emissions to air following treatment and dispersion from the 75 m stack have been considered both in terms of the human health and ecological impacts in Appendices E and F. Appendix E includes a stack height assessment to support the selected 75 m.

4.1.5 Emissions from the back-up generator will be limited due to it ordinarily only being periodically operated for testing (up to 50 hours per annum) and will be controlled by the choice of fuel (white diesel) and combustion control.

4.1.6 In addition to the main stack there are two further emission points to air, emission point A2 is associated with the odour abatement unit used to control emissions to air during plant shutdowns and emission point A3 associated with the back up generator. The expected location of these release points in shown on Drawing 2 in Appendix B

Abatement of Particulate Matter

4.1.7 A fabric bag filter system will be provided for particulate control. The bag filter unit will contain compartments which will each contain a set of filter bags. The compartments can be isolated for maintenance or cleaning. The raw gas duct distributes flue gases evenly to the bag house filter chambers.

4.1.8 Over time there will be a build-up of particulates on the surface of the filter media, which improves the particulate removal efficiency and also provides additional reduction of acid gases with unspent reagent in the dust cake. Automatic cleaning will be provided using a reverse jet compressed air cleaning system to periodically remove the dust cake. The dust cake will discharge via the bottom of the filter compartment and will be collected. Recirculation of, or a portion of, the residues will take place.

4.1.9 Cleaning will be activated via pressure drop monitoring across the filter media, when the set point is exceeded the unit will commence cleaning. Cleaning operations cease when the pressure differential returns to normal.

4.1.10 The monitoring of pressure drop across the filter bags will provide a reliable system for detecting bag filter failures and allows investigation to identify and isolate the failed compartment.

Oxides of Nitrogen

Primary NOx measures

4.1.11 There are three recognised mechanisms for the formation of NOx:

- fuel NOx;
- thermal NOx; and
- prompt NOx.

4.1.12 Fuel NOx relates to the conversion of fuel bound nitrogen into nitrogen oxides and therefore is partly a function of the incoming waste material. Fuel NOx is affected by the level of oxygen in the vicinity of the flame and therefore reducing oxygen levels can influence NOx emissions. However, there is a balance between minimising NOx emissions and ensuring effective combustion and compliance with IED requirements for providing good burn out of waste material and minimising carbon in ash levels to<3% TOC. The proposed air supply regime has been selected to ensure that effective combustion and burnout is achieved whilst controlling oxygen levels to a minimum to limit oxidation of the fuel bound nitrogen to NOx.

4.1.13 Thermal NOx requires high temperatures and there is a direct relationship between increasing temperature and unabated NOx levels in the flue gases.

4.1.14 Prompt NOx is formed by the relatively fast reaction (hence, the name prompt NOx) between nitrogen, oxygen, and hydrocarbon radicals. This very complicated process consists of hundreds of reactions and dozens of species. Prompt NOx is an important mechanism in lower-temperature combustion processes but is generally much less important compared to thermal NOx formation at the higher temperatures found in combustion processes of the type proposed for the EfW facility.

4.1.15 The primary NOx controls will comprise the following:

- optimisation of the primary and secondary air feeds, providing turbulence within the combustion chamber;
- design of the EfW facility to ensure it is as airtight as possible;
- control of the combustion stage to ensure that optimum combustion conditions are maintained; and
- use of low NOx burners for auxiliary fuel firing.

4.1.16 The proposed design will ensure effective mixing and aims to provide a uniform velocity and temperature profile, therefore avoiding the potential for hotspots within the furnace which can promote thermal NOx formation. CFD modelling of the final design will be used to confirm that this will be achieved.

4.1.17 The EfW facility has been designed to be as airtight as practicable. The furnace is kept under negative pressure. A water seal is provided on the ash extraction preventing ingress of air into the furnace from this outlet.

Secondary NOx measures

4.1.18 In addition to the primary NOx measures identified above, the EfW facility will also include secondary NOx abatement. A selective non-catalytic reduction (SNCR) system will be installed using ammonium hydroxide as the reducing reagent. This system will inject the ammonium hydroxide into the main combustion chamber via a number of nozzles located at three levels within the combustion chamber. To ensure effective NOx control the proposed design will:

- match the injection sites to the localised changing temperature;
- ensure a wide-ranging fine and even additive distribution;

- promote good mixing of the reagent with the flue gases (see detail above on combustion air); and
- control the rate of injection of reagent to the process conditions (e.g. load and flue gas NOx and NH_3 monitoring). The NOx load is calculated as a function of either the load or the flue gas temperature. For each level of load or temperature, the maximum flow of reagent is pre-set in the control system. In addition, the NOx and NH_3 stack measurements are used as feedback signals to the reagent flow controller to adjust the dosage rate to ensure flue gas emissions are within the set values and that overdosing leading to excessive ammonia slippage does not occur.

4.1.19 The ammonium hydroxide reagent will reduce NOx in the flue gases producing nitrogen and water vapour as per the equations below:

$$4NO + 4NH_4OH + O_2 \rightarrow 4N_2 + 10H_2O$$

$$2NO_2 + 4NH_4OH + O_2 \rightarrow 3N_2 + 10H_2O$$

4.1.20 The rate of injection of ammonium hydroxide will be optimised during commissioning and controlled during operation to avoid overdosing of reagent thereby avoiding excessive ammonia slippage. It will also be linked to the continuous NOx monitoring, see section 4.7 for further details.

Acid gases and halogens

Primary acid gas measures

4.1.21 The potential for acid creation is dictated by the content of the incoming waste material (sulphur, chlorine and fluorine content). Given the nature of the proposed waste materials, the content of these elements cannot readily be controlled. Mixing of the waste material in the bunker will ensure that as homogenous a composition as possible is produced and therefore assist with emissions control.

4.1.22 Whilst emission of acid gases from combustion plant can be reduced using in-furnace injection of sorbents, this technique is considered better suited to fluidised bed systems and is therefore not proposed for the EfW facility. Acid gas levels in the releases from the stacks will therefore be controlled using proven secondary abatement.

Secondary acid gas measures

4.1.23 The acid gas abatement system will comprise a dry or semi dry sorption reactor using injection of hydrated lime upstream of the bag filter. Recirculation of a portion of the flue gas treatment residues will reduce the consumption of hydrated lime.

Other Releases

Carbon Dioxide

4.1.24 Emissions of carbon dioxide from the EfW facility will primarily arise as a consequence of the oxidation of carbon within the incoming waste material. For the combustion stage of the EfW facility the main aim is to achieve complete combustion, thus maximising the conversion of carbon to carbon dioxide, to liberate the energy in the waste material. Therefore, for any given waste material, the carbon dioxide emissions will be limited by its carbon content. Furthermore, the achievement of good combustion (which means maximising conversion of carbon in the waste material to carbon dioxide) is BAT.

4.1.25 The EPR Sector Guidance Note (EPR 5.01)[4] notes that all measures to reduce energy use also reduce the CO_2 emissions (see Emissions and Monitoring section, paragraph 50 of EPR 5.01). The selection where possible of raw materials with low organic matter content and fuels with low ratio of carbon content to calorific value reduces CO_2 emissions. For the EfW facility, this is only relevant to the support fuels used and the selection of white diesel will meet this requirement. Further, the use of support fuel will be minimised through good operational management.

4.1.26 As it is the purpose of the combustion phase to convert the waste material into primarily water and CO_2, EPR 5.01[4] indicates the areas upon which attention should focus to improve the overall impact in this area (see Emissions and Monitoring section, paragraphs 51 and 52 of EPR 5.01). To minimise the overall impact of the EfW facility in terms of carbon dioxide releases, measures that minimise internal energy consumption and maximise energy recovery from combustion of the waste material will be incorporated. Details of the measures to be in place at the EfW facility are provided in Section 2.4, of this document.

4.1.27 Further, although not relevant to CO_2 emissions, releases of nitrous oxides associated with the use of SCR contribute to the overall GWP associated with the EfW facility, however this is typically very small compared to the CO_2 from burning of the waste. The EfW facility meets BAT for control of the contribution to the overall GWP from nitrous oxides through controlling process conditions.

Carbon Monoxide and VOCs

4.1.28 High levels of CO and VOCs are indicative of poor combustion. As detailed earlier (see section 3.3 and 3.4), the furnace will be designed and operated to ensure that effective combustion is achieved, these measures will ensure that CO and VOC levels are controlled below required limits without the need for further abatement.

Dioxins and Furans

4.1.29 Dioxins and furans are minimised through the following:

- destruction within the combustion stage due to the high temperatures and combustion control as set out in Section 3.4;
- minimisation of reformation within the boiler (see section 3.4 above for detail); and
- abatement to remove reformed dioxins in the flue gases.

4.1.30 Powdered activated carbon (PAC) will be injected before the dry sorption reactor. PAC removes dioxins and furans through adsorption. In its powdered form, activated carbon provides a high surface area for adsorption to take place providing effective control of dioxins and furans.

4.1.31 The activated carbon will be stored in a 50 m^3 silo. The storage silo system will include level probes, mechanical discharge devices to prevent arching, rat holing and flooding, and a dust extraction unit. In addition, a load cell system will also be fitted in order to give an accurate assessment of the quantity of material within the silo. The dosing rate will be based on the flue gas flow and will be set during commissioning.

4.1.32 A human health risk assessment which considers the effect of dioxins and furans is provided in Appendix F.

Metals

4.1.33 Most heavy metals will be present as particulates and will be effectively controlled by the bag filter unit, as described above. Mercury is a notable exception, as this metal will be present as a vapour. Mercury removal is effectively controlled by adsorption onto activated carbon; see detail above for dioxins and furans.

Iodine and Bromine

4.1.34 Where wet scrubber systems are used for acid gas control, plume colouration from iodine or bromine can be a problem. The EfW facility will not employ a wet scrubber system.

4.2 Point Source Emissions to Surface Water and Sewer

4.2.1 A preliminary drainage plan is provided in Figure 3.

4.2.2 Surface drains from roads and paved areas around buildings pass via an oil interceptor, the water will collect in either of the two attenuation tanks and the attenuation pond prior to final release into the storm water sewer. Clean roof water is discharged directly into the attenuation pond.

4.2.3 Process water will be recycled to the water treatment plant where solids are settled out prior to waters being re-used (see water balance (Drawing 6). The plant is expected to be a net water consumer and therefore emissions of process water under normal operation is not expected. In the event of boiler maintenance requiring the boilers to be drained water removed will either be temporarily drained into mobile tankers and then re-used or removed off site.

4.2.4 Waste waters from amenities will discharge to the foul sewer and do not fall under the scope of the environmental permit.

4.3 Point Source Emissions to Land

4.3.1 There will be no direct or indirect process releases to land or groundwater from the EfW facility.

4.4 Fugitive Emissions

4.4.1 Fugitive releases have been identified and assessed as part of the Environmental Risk Assessment (see Appendix C). The assessment indicates that the proposed measures for control of fugitive releases will ensure that no significant risks from fugitive releases are expected from the EfW facility.

4.4.2 Good housekeeping practices will be in operation to ensure that any spillages of potentially dusty materials are cleared up at the earliest opportunity. Spill kits will be available for clean-up of all chemicals (i.e. boiler water treatment chemicals) and oils (i.e. white diesel and maintenance oils) stored and used within the EfW facility and will be located in proximity to the relevant storage area(s) and/or delivery points. Site procedures will detail those actions which should be followed in the event of a spillage.

4.4.3 Potential fugitive releases to surface water, sewer and groundwater are likely to occur only as a result of an incident or accident.

4.4.4 Table 2-3 identifies the storage tanks and containment for the main raw materials. Further storage and process tanks etc. will be provided for various waters used/recycled within the process, as follows:

- boiler blowdown tank;
- settling basin;
- demin water tanks (2 x 100m^3);
- condensate collection tank;
- fire water tank (at least 900m^3);
- service water tank; and
- condensate tank.

4.4.5 These tanks will be designed to be watertight.

4.4.6 The incoming waste material storage bunkers will be constructed of concrete and will be impervious.

4.4.7 All process areas will be located on hard standing.

4.4.8 All bunds provided for chemical and oil storage tanks will be manually inspected to ensure they remain empty.

4.4.9 As stated in 2.5.32, bunds will all be designed to contain at least 110% of the contents of the largest storage tank or 25% of the total tankage, whichever is the greater, will be resistant to the material which they are designed to contain and will be designed in accordance with appropriate standards. Procedures will be in place for visual inspection of all bunds to ensure they remain free from accumulation of rainwater. Any discharge of rainwater will be tested for pH and visible solids and oil. Should the tests indicate that there was no contamination; the water would be discharged to the surface water drainage system. In the event that the water is found to be contaminated the waters would either be treated on site or tankered for off-site disposal.

4.4.10 Underground structures will be limited to:

- the lower part of the bunker;
- site drains;
- drainage sumps;
- oily water separator
- underground attenuation tanks;
- attenuation pond; and
- incoming clean water systems.

4.4.11 At the time of application final detail of the precise routing for underground drains has not been established, this will form part of the detailed design stage. A preliminary drainage plan is provided as Figure 3 in Appendix B and identifies the likely drainage proposals for rainwater and surface waters. The drainage system includes oil separation for run-off from roads and car parking areas up stream of the attenuation tanks. Oil separation will be provided using a class 1 oil separator for rub-off from trafficable areas.

4.4.12 During commissioning the underground surface drains and foul drains will be subject to integrity testing and will be certified as sound prior to the EfW facility operations commencing. These drains will subsequently be tested after 6 years of operation. The condition at that time will be confirmed by CCTV inspections and will subsequently determine the inspection frequency for further inspections.

4.5 Odour

4.5.1 The primary source of odour from the proposed facility will be from the incoming treated waste materials. Under normal operation effective odour control will be achieved through the extraction of air from above the waste bunker and the use of this air as combustion air within the furnace, thereby destroying any potential odours.

4.5.2 In the event of a full plant shutdown, waste volumes will be run down prior to the shutdown to minimise the amounts of material remaining in the bunker. Where possible, the shutdown will be timed to coincide with periods where the EfW facility waste deliveries can be minimised. Doors to the waste reception hall will remain closed at all times other than for access, which will be made via a fast acting roller shutter.

4.6 Noise and Vibration

4.6.1 Noise and vibration effects from the EfW facility are considered within the Environmental Risk Assessment (ERA) included in Appendix C. The ERA has followed the format of EA guidance[6][7] and concluded that no significant noise risks are expected from the Corby EfW facility.

4.6.2 An assessment of the expected impact of noise from operation of the proposed facility (including commissioning) is provided in Appendix J. This Appendix identifies the main noise sources and nearest noise sensitive receptors (NSRs), characterises the noise sources, assesses its potential impact and considers those impacts in the context of relevant BAT criteria. Details of noise monitoring for the purpose of establishing the baseline levels are also provided.

4.6.3 The results of the assessment indicate that significant adverse noise or vibration effects would not be expected as a result of operating the Corby EfW facility.

4.7 Monitoring and Reporting of Emissions (Water, Sewer and Air)

Monitoring and Reporting of Emissions to Air

4.7.1 Emissions monitoring for releases to air will be undertaken in accordance with Table 4-1:

[6] Commission implementing decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants.
[7] Risk assessments for your environmental permit, 1st February 2016 updated 25th March 2021, Environment Agency.

Table 4-1: Summary of Monitoring of Emissions to Air.

Pollutant	Emission Point	Emission Limit Value	Emission Limit Value (IED)	Monitoring Method	Monitoring Frequency	MCERTS certified?
NO_x	A1	100 mg/Nm³ daily average	200 mg/Nm³ daily average 400 mg/Nm³ half-hourly average (100% A)	BS EN 15267-3	Continuous	Yes
SO_2	A1	30 mg/Nm³ daily average	50 mg/Nm³ daily average 200 mg/Nm³ half-hourly average (100% A)	BS EN 15267-3	Continuous	Yes
CO	A1	50 mg/Nm³ daily average	50 mg/Nm³ daily average 100 mg/Nm³ half-hourly average	BS EN 15267-3	Continuous	Yes
Particulate Matter	A1	5 mg/Nm³ daily average	10 mg/Nm³ daily average 30 mg/Nm³ half-hourly average (100% A)	BS EN 15267-3 and BS EN 13284-2	Continuous	Yes
VOC (expressed as TOC)	A1	10 mg/Nm³ daily average	10 mg/Nm³ daily average 20 mg/Nm³ half-hourly average (100% A)	BS EN 15267-3	Continuous	Yes
HCl	A1	6 mg/Nm³ daily average	10 mg/Nm³ daily average 60 mg/Nm³ half-hourly average (100% A)	BS EN 15267-3	Continuous	Yes
HF	A1	1 mg/Nm³ average over the sampling period	1 mg/Nm³ daily average, 4 mg/Nm³ half-hourly average (100% A)	BS ISO 15713	Quarterly for the first 12 months and six monthly thereafter	Yes
NH_3	A1	10 mg/Nm³ daily average	n/a	BS EN 15267-3	Continuous	Yes
Hg	A1	0.02 mg/Nm³ average over the sampling period	0.05 mg/Nm³ average over a sampling period of a minimum of 30 minutes and a maximum of 8 hours	BS EN 15267-3 and BS EN 14884	Subject to the outcome of an accelerated programme of monitoring*	Yes
Heavy metals (except mercury)	A1	Cd + Tl = 0.02 mg/Nm³ average over the sampling period	Cd + Tl = 0.05 mg/Nm³ Others = 0.5 mg/Nm³	BS EN 14385 (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Tl, V)	Quarterly for the first 12 months and	Yes

		Others : 0.3 mg/Nm^3 average over the sampling period	Average over a sampling period of a minimum of 30 minutes and a maximum of 8 hours		six monthly thereafter	
Dioxins and Furans	A1	0.04 ng I-TEQ/Nm^3 average over the sampling period	0.1 ng/Nm^3 average over a sampling period of a minimum of 6 hours and a maximum of 8 hours	BS EN 1948 Part 1-3	Quarterly for the first 12 months and six monthly thereafter	Yes
Dioxin-like PCBs	A1	0.06 ng WHO-TEQ/Nm^3 average over the sampling period (PCDD/F + dioxin-like PCBs)	n/a	BS EN 1948 Parts 1, 2 and 4	Quarterly for the first 12 months and six monthly thereafter	Yes
Polycyclic Aromatic Hydrocarbons (PAHs)*	A1	n/a	n/a	BS ISO 11338-1 and BS ISO 11338-2	Quarterly for the first 12 months and six monthly thereafter	Yes
N_2O	A1	n/a	n/a	BS EN 21258	Annual	Yes

* PAHs - Comprise; Anthanthrene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[b]naph(2,1-d)thiophene, Benzo[c]phenanthrene, Benzo[ghi]perylene, Benzo[a]pyrene, Cholanthrene, Chrysene, Cyclopenta[c,d]pyrene, Dibenzo[ah]anthracene, Dibenzo[a,i]pyrene Fluoranthene, Indo[1,2,3-cd]pyrene, Naphthalene.

** In the event that the accelerated programme demonstrates stable emissions below 10µg/Nm^{3}periodic monitoring will be carried out otherwise monitoring will be continuous.

4.7.2 As permitted under Annex VI Part 6, continuous measurement of HF will not be undertaken on the basis that the acid gas abatement system will operate to guarantee that the emission limit for HCl will not be exceeded. Monitoring of HF as detailed in Table 4.1 above will be undertaken

4.7.3 Monitoring results will be corrected to standard reference conditions and reported to the EA, as required by the permit.

4.7.4 An annual periodic stack test will also be undertaken by an MCERTS certified body to confirm the performance of the continuous emissions monitoring. Further, the CEMS monitoring system will be calibrated by means of parallel measurements with the reference methods at least every three years.

4.7.5 The precise location of the sampling and measurement points will be determined at the detailed design stage and details will be submitted to the EA for approval. This submission will also include an assessment of the sampling points in accordance with the M1 guidance. Plant performance guarantees require the monitoring ports to comply with EA monitoring requirements as set out in M1 guidance.

4.7.6 Emission limits to air will be regarded as having been complied with where monitoring data confirms that emission values are below the limits specified in the IED, over the corresponding monitoring period.

4.7.7 At the daily emission limit value level, the value of the 95% confidence intervals of a single measured result shall not exceed the following percentages of the emission limit value.

- carbon monoxide 10%
- sulphur dioxide 20%
- nitrogen dioxide 20%
- total dust 30%
- total organic carbon 30%
- hydrogen chloride 40%
- hydrogen fluoride 40%

4.7.8 A valid daily average monitoring value will have no more than 5 half hourly average values in any day discarded due to malfunction or maintenance of the CEMS. No more than 10 daily average values per year shall be discarded due to malfunction or maintenance of the CEMS.

Monitoring and Reporting of Emissions to Water and Sewer

4.7.9 Under normal operation there will be no process discharges to water. Only surface water run-off will discharge to the Northern stream after passing through an oil interceptor and attenuation pond.

4.7.10 Discharges to sewer will be limited to domestic effluents from the onsite amenities. There will be no process discharges to sewer.

Monitoring and Reporting of Waste Emissions

4.7.11 All waste will be characterised prior to disposal to demonstrate suitability for the selected disposal or recycling route.

4.7.12 Bottom ash would be re-analysed following any major plant modification which could impact on the nature of the residue and also prior to disposal via a different route. Similar tests will be carried out on the APC residues.

4.7.13 The test protocol to establish the pollution potential of the ash will cover:

- Total Organic Carbon (for bottom ash)

- Heavy metals concentration (to include Cd, Tl, Hg, As, Cu, Co, Cr, Mn, Pb, Zn, Ni, V)
- Dioxin, furan and dioxin-like PCB content
- pH and alkali reserve
- Leachable metal ions

4.7.14 Additionally, any test that is required by the company who will be seeking to accept the processed bottom ash or the waste disposal site accepting the APC residues will be undertaken as required.

4.7.15 During operation the following routine monitoring will be undertaken:

Table 4-2: Monitoring of Waste Emissions.

Residue	Parameter	Frequency
Bottom Ash (including boiler ash)	Total Organic Carbon	Quarterly
	Heavy Metals	Quarterly
	Dioxin and Furans	Quarterly
	Dioxin-like PCBs	Quarterly
APC Residues	Heavy Metals	Quarterly
	Dioxin and Furans	Quarterly
	Dioxin-like PCBs	Quarterly
All wastes	Mass/Volume	Every load removed from the EfW facility for disposal or recovery/recycling

4.7.16 An ash sampling protocol for the sampling of APC residues and bottom ash will be established and submitted for agreement with the Environment Agency, prior to commencing operations at the Site.

Monitoring During Commissioning

4.7.17 During commissioning, monitoring to at least the frequencies stated during normal operation will be carried out. All continuous monitors will be in place and operational.

4.7.18 Monitoring will also be undertaken for those parameters that are not continuously monitored. At least one set of monitoring results for start-up, shut-down and continuous running will be undertaken to establish satisfactory operation is being achieved at all times. This will form part of the EfW facility acceptance test. Monitoring of all releases (to air, water, waste etc.) will be carried out.

4.7.19 Following completion of satisfactory commissioning, periodic sampling will be carried out at the frequencies specified within the permit.

4.7.20 Table 4-1 above confirms the proposed frequency of undertaking periodic monitoring for those species that are not monitored by the CEMS, this meets the requirements for monitoring as specified within the IED and within EPR Guidance. The proposed monitoring is considered consistent with monitoring undertaken at similar installations.

Environmental Monitoring (Beyond the Installation)

4.7.21 A programme of environmental monitoring beyond the installation will be carried out in accordance with the requirements of the permit when issued.

Monitoring of Process Variables

4.7.22 The following monitoring of process variables will be undertaken:

Table 4-3: Summary of Process Monitoring

Line (s)	Process Variable	Description
L1	Combustion temperature	Continuous monitoring to demonstrate compliance with minimum temperature requirement of 850 °C as required by IED Article 50(3) and Annex VI Part 6
L1	Oxygen content in the combustion chamber	Continuous monitoring to ensure good combustion is achieved and to minimise CO and NOx formation.
L1	Exhaust gas temperature	Continuous monitoring as required by IED Annex VI Part 6
L1	Exhaust gas pressure	Continuous monitoring as required by IED Annex VI Part 6
L1	Exhaust gas water vapour content (unless monitored dry)	Continuous monitoring as required by IED Annex VI Part 6
L1	Exhaust gas oxygen content	Continuous monitoring as required by IED Annex VI Part 6
L1	Exhaust gas flowrate	Continuous monitoring to enable evaluation of mass emissions.
L1	Reagent flowrate	Continuous monitoring to ensure optimal addition of reagents (hydrated lime, activated carbon and ammonium hydroxide).
L1	Waste material delivered (tonnage)	Recording of input tonnage to demonstrate compliance with design capacity.
L1	Steam exported (when applicable)	Continuous monitoring to track plant efficiency.
L1	Electricity exported	Continuous monitoring to track plant efficiency.
L1	Internal energy usage	Continuous monitoring to track plant efficiency.

L1 – Line 1

Monitoring Standards (Standard Reference Methods)

4.7.23 The information provided within the sections above details the proposed monitoring and identifies the relevant methods proposed for monitoring.

4.7.24 In addition, quality assurance monitoring will be undertaken in relation to the CEMS system in accordance with the requirements of BS EN 14181.

Appendix A
APPLICATION FORMS

Appendix B
DRAWINGS

Appendix C
ENVIRONMENTAL RISK ASSESSMENT

Appendix D
FIRE PREVENTION PLAN

Appendix E

AIR QUALITY ASSESSMENT

Appendix F
HUMAN HEALTH RISK ASSESSMENT

Appendix G
CHP-READY ASSESSMENT

Appendix H
BAT ASSESSMENT

Appendix I
ACCIDENT MANAGEMENT PLAN

Appendix J
NOISE ASSESSMENT

Appendix K
IED BASELINE AND APPLICATION SITE CONDITION REPORT

Appendix L
ODOUR MANAGEMENT PLAN

Appendix M
ENVIRONMENTAL STATEMENT

CORBY ENERGY FROM WASTE FACILITY PERMIT APPLICATION

EPR/FP3502BB/A001

Supporting Information

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2023-02-14

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