South Humber Bank Energy Centre

South Marsh Road, Stallingborough, DN41 8BZ

Environmental Permit Application – Supporting Statement

Environmental Permit (England and Wales) Regulations 2016 (as amended)

Applicant: EP SHB Limited
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GLOSSARY OF ABBREVIATIONS AND DEFINITIONS

Abbreviation	Description
AC	Ambient Concentration
ACC	Air Cooled Condenser
AEP	Annual Exceedance Probability
AFL	Above Floor Level
AMP	Accident Management Plan
AOD	above Ordnance Datum
AQS	Air Quality Standard
ARM	Alternative Raw Material
AW	Ancient Woodland
BAT	Best Available Technique
BAT-AEL	Best Available Techniques – Associated Emissions Level
BAT-AEEL	Best Available Techniques – Associated Energy Efficiency Level
BATc	BAT Conclusions (from the Waste Incineration Best Available Techniques Reference document, draft, 2017)
BC	Baseline Concentration
bgl	Below Ground Level
BGS	British Geological Society
BS	British Standard
CCGT	Combined Cycle Gas Turbine
CEMS	Continuous Emissions Monitoring Systems
CEWEP	Confederation of European Waste-to-Energy Plants
CFD	Computational Fluid Dynamics
C&I	Commercial and Industrial
CHP	Combined Heat and Power
CHP-R	CHP-Ready
CIRIA	Construction Industry Research and Information Association
CL	Critical Level
CO	Carbon monoxide
CO_2	Carbon dioxide
COMAH	Control of Major Accident Hazards Regulations 2015
COSHH	Control of Substances Hazardous to Health
CSM	Conceptual Site Model
DCS	Distributed Control System
DH	District Heating
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations 2002

Abbreviation	Description
Regulations	
EA	Environment Agency
EAL	Environmental Assessment Levels
EfW	Energy from Waste
ELV	Emission Limit Value
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016 (as amended)
EP -SHB	EP South Humber Bank Limited
EPUKI	EP UK Investments Limited
ERA	Environmental Risk Assessment
ES	Environmental Statement
EU-ETS	European Union Emissions Trading Scheme
FCG	Ford Consulting Group
FGT	Flue Gas Treatment
FGTH	Flue Gas Treatment Hall
FPP	Fire Prevention Plan
FR	Fire Rating
H_2O	Water
HCl	Hydrogen chloride
HF	Hydrogen fluoride
HGV	Heavy Goods Vehicle
HSE	Health and Safety Executive
IBA	Incinerator Bottom Ash
IBC	Intermediate Bulk Container
IED	Industrial Emissions Directive
IET	Institution of Engineering Technology
ISO	International Standards Organisation
kKg	Kilogram
kW	Kilowatt
kWh	Kilowatt-hour
LCV	Lower Calorific Value
LWS	Local Wildlife Sites
MJ	Megajoules
MRF	Materials Recovery Facility
MSDS	Material Safety Data Sheets
MW	Megawatt
MWh	Megawatt-hour
MW_{th}	Megawatt-thermal
NAQS	National Air Quality Strategy
NCV	Net Calorific Value
NFPA	National Fire Protection Association
NG	National Grid
NH_3	Ammonia
NOx	Nitrogen oxides
NSR	Noise Sensitive Receptor
O_2	Oxygen
OMP	Odour Management Plan
OTNOC	Other Than Normal Operating Conditions
PAC	Powdered Activated Carbon

Abbreviation	Description
PAH	Polyaromatic hydrocarbons
PC	Process Contribution
PCB	Polycyclic Biphenyls
PCDD/F	Polychlorobenzodioxins (PCDDs) and Polychlorodibenzofurans (PCDFs)
PEC	Predicted Environmental Concentration
PPG	Pollution Prevention Guidance
PPM	Planned Preventative Maintenance
PTW	Permit to Work
RDF	Refuse Derived Fuel
SAC	Special Area of Conservation
SCR	Selective Catalytic Reduction
SGN	Sector Guidance Note
SHBEC	South Humber Bank Energy Centre
SHBPS	South Humber Bank Power Station
SNCI	Site of Nature Conservation Importance
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulphur dioxide
SPA	Special Protection Area
SPMP	Site Protection and Monitoring Plan
SSSI	Site of Special Scientific Interest
STP	Standard Temperature and Pressure
SuDS	Sustainable drainage systems
t/h	Tonnes per hour
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
tpa	tonnes per annum
UCV	Upper Calorific Value
UKAS	United Kingdom Accreditation Service
UPS system	Uninterruptable Power Supply system
VOC	Volatile Organic Compounds
WFD	Water Framework Directive
WI BRef	Waste Incineration Best Available Techniques Reference document (draft, 2017)
WID	Waste Incineration Directive

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TABLES

1.0 NON TECHNICAL SUMMARY

1.1 Introduction

1.1.1 This document supports the application submitted by EP SHB Limited ("EP SHB") under the Environmental Permitting (England and Wales) Regulations 2016 ("the EPR Regulations") (as amended) to vary the environmental permit for the South Humber Bank Power Station ("SHBPS") (permit reference: EPR/MP3235LY), to include the installation of an energy from waste (EfW) power plant – South Humber Bank Energy Centre ("SHBEC"); located at South Marsh Road, Stallingborough, North East Lincolnshire, DN41 8BZ (the 'Site'). The SHBPS installation currently comprises a Combined Cycle Gas Turbine (CCGT) power station, which will continue to operate as per the existing permit conditions.

1.1.2 Following the variation proposed by this environmental permit variation application, the South Humber Bank Power Station (SHBPS) installation would include:

- the existing CCGT Power Station , which consists of two combined cycle gas turbine phases fired by natural gas with a gross electrical capacity of 1,375MW; and
- a new, two-stream, EfW facility fired by refuse derived fuel (RDF) with a combined thermal input of 240MW_{th}, a gross electrical output of 49.9MW_e and a nominal thermal export of 84.1MW_{th}; with the capability to export all steam generated (approximately 211MWth) to the CCGT power plant when not producing electricity for direct export.

1.1.3 The proposed EfW facility will generate up to 49.9MW of electricity through the combustion of Refuse Derived Fuel (RDF), of which approximately 43.4MW will be available for export to the transmission or distribution networks, and circa 84MW of steam for export to the CCGT power station, allowing it to utilise more of its existing capacity and potentially reduce the required natural gas consumption in the CCGT units while still achieving the same electrical output.

1.1.4 The EfW facility will comprise two combustion lines, each having a maximum thermal input of 120MW_{th}. The EfW facility is designed to use waste as a fuel source (RDF and similar fuels). This is consistent with the UK strategy to divert waste from landfill and move waste up the waste hierarchy. This recognises the use as waste for energy recovery.

1.1.5 The EfW facility will operate using fuel with a range of Net Calorific Values (NCV) between 9MJ/kg and 14MJ/kg, with a design average NCV of 11MJ/kg. Based on a nominal lifetime availability to combust fuel of 89.6% the facility will have an annual capacity to treat between 484,400 tonnes per annum (tpa) of fuel (at a NCV of 14MJ/kg) and 753,500tpa of fuel (at a NCV of 9MJ/kg); or 616,500tpa of fuel at the design average NCV of 11MJ/kg. The availability could be higher in the early years and also years with no outage requirements. Based on this increased availability, the maximum annual throughput of fuel at a NCV of 9MJ/kg is expected to be 781,000tpa.

1.1.6 This environmental permit application and all associated impact assessments have been prepared on the basis of the lifetime average plant availability of 89.6% (7,850 hours per annum) and a maximum throughput of 753,500tpa of fuel having a NCV of 9MJ/kg.

1.1.7 The proposed EfW facility covers an area of 7.3 hectares lying largely within the existing permit boundary of the SHBPS, on land crossed by the cooling water pipelines supplying abstracted water from the River Humber for use at the CCGT power station.

The variation of the permit will also include an extension of the permit boundary of the SHBPS to include additional land between the existing permit boundary and South Marsh Road. This allows the full extent of the proposed facility to be included within the permit. Figure 1 (Appendix 1) shows the Site location. The extent of the existing installation boundary and the proposed installation boundary are shown in Figure 2. Figure 3 and Figure 4 show proposed installation boundary and the layout of the EfW facility (including indicative location of emission points) within the installation boundary. A schematic of the facility operations is shown in Figure 5.

1.2 Baseline Conditions

1.2.1 A Site Condition Report outlining the existing baseline of the Site, using available existing ground investigation details for the CCGT power station, has been prepared and is presented in Appendix 2. The Site Condition Report demonstrates the baseline condition of the Site, proposed operations and associated raw materials and wastes along with the control measures that will be in place. It is considered that there is little opportunity for incidents to occur that may lead to the accidental spillage of liquid materials that could migrate to groundwater, as adequate bunding, storage systems and impermeable surfacing have been incorporated into the design of the EfW facility. Further ground investigation for the additional land area proposed to be added to the installation boundary for the installation of the EfW facility and the area within the existing boundary down hydraulic gradient of the EfW facility is proposed to be undertaken prior to commencement of operations, to ensure appropriate baseline conditions are known prior to commencement of operation of the EfW facility.

1.3 Technical Description

1.3.1 Section 4.0 outlines the technical details of the EfW facility. The EfW facility will be designed with a dedicated fuel reception and storage facilities comprising up to four new weighbridges and a fully enclosed fuel tipping hall containing a fuel storage bunker. Section 4.0 provides details of the fuel (RDF and similar fuels) specification and fuel bunker. The facility will have appropriate waste acceptance procedures in place and will only accept permitted fuel types. The operator will develop a waste acceptance procedure following development of detailed design for the facility; to be implemented when the operations commence.

1.3.2 The key raw material used at the facility will comprise RDF which will be used as fuel; with the facility designed to store up to four days' worth of this material. An indicative list of waste types, representative of similar facilities, and which would be accepted at the facility is provided in Appendix 3.

1.3.3 Only processed RDF and similar fuels are intended to be accepted at the facility; however, to allow flexibility for future operations, a shredder will be provided within the fuel reception hall to facilitate acceptance of baled materials and to shred any oversized materials.

1.3.4 The facility will operate with two combustion lines comprising reciprocating grate-based systems which are fed with fuel from the fuel bunker via a feed chute fed by cranes.

1.3.5 The combustion process within the combustion chamber will be continuously monitored to maintain optimised combustion, compliance with the requirements of the Industrial Emissions Directive (IED) and the revised Waste Incineration Best Available Techniques Reference document (WI BRef). The process controls will be designed to implement the BAT for the operation of an EfW. All required measures to comply with the waste incineration articles of the IED have been incorporated within the design of the plant.

1.3.6 The EfW facility will utilise auxiliary burners to ensure the minimum combustion temperature of 850°C required by the IED is achieved prior to RDF being introduced as the fuel source. Once this temperature is achieved, waste can be loaded onto the grate and the process becomes self-sustaining. At this point the auxiliary burners are no longer required. Once RDF combustion is established, if the temperature drops below 850°C, RDF feed to the chamber will be stopped automatically. Auxiliary burners will be used to maintain temperatures above the required minimum level.

1.3.7 During such periods when auxiliary burners are in use a small amount of auxiliary fuel will be used. The choice of fuel will not be confirmed until detailed design but will comprise either natural gas or a low sulphur distillate. It is most likely that the facility will use a low sulphur distillate such as diesel as the auxiliary fuel as opposed natural gas or firing on both natural gas and diesel. This is considered BAT for the process due to the intermittent and infrequent requirement for auxiliary fuel use. In addition, there is a further requirement to have diesel storage at the facility for the auxiliary diesel generator used to safely shut-down the facility in the event of an emergency, and potentially for refuelling any facility vehicles.

1.3.8 The EfW facility will be controlled from a new Control Room located within the footprint of the new facility and separate from the existing CCGT power station operation. An automated Distributed Control System (DCS) will be used to control and supervise operations over several levels, allowing safe and efficient operation by optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over. The combustion system will be automatically controlled to optimise the process, with controls applied for a number of parameters, including but not limited to primary air, secondary air and fuel feed rate. A number of in-process sensors and alarms will also be installed within the process to control their operation within defined parameters. These would alert the operator when pre-set alarm levels within the process itself or on the abatement system are exceeded.

1.3.9 Hot gases from the combustion process will be passed through a boiler to raise steam, which will then be passed to a steam turbine to generate electricity. During normal operation the EfW facility is also expected to supply the CCGT power station with high pressure steam utilise currently unused capacity within the CCGT's steam turbines and potentially to offset the use of natural gas within the CCGT units. The volume of steam supplied from the EfW facility will depend on the instantaneous waste throughput of facility. The EfW facility will therefore operate as a cogeneration plant. In addition, other suitable offtake routes for steam have been investigated in the accompanying CHP report.

1.3.10 The EfW facility will require a condensing system to condense the turbine exhaust steam. It is proposed to use an air-cooled condensing (ACC) system at the EfW facility. An ACC is considered to represent BAT for the EfW facility as it is a proven technology for projects of this type and size, it will not produce a water vapour plume from the cooling cells and does not require a substantial water supply. This is beneficial for the EfW facility as there is little, if any, spare capacity within the existing SHBPS abstraction licence; either significant modifications would be required to the existing cooling water pumping station or a new pumping station would need to be installed in the Humber estuary. Section 4.11 provides details of all the cooling options considered for the facility.

1.3.11 The combustion gases will be treated in a flue gas treatment (FGT) plant prior to being discharged via two stacks, one for each combustion line; each flue stack will be up to 100m tall to allow appropriate dispersion of the treated flue gas. Stack details are provided within Section 4.13 of this document.

1.3.12 The main emissions from the combustion process will consist of combustion gases emitted to air. Due to the nature of the fuel used, such emissions to air will include nitrogen oxides (NOx), sulphur dioxide and other acid gases, dioxins and heavy metals including mercury, and particulate matter as dust. The FGT system will be designed to control and minimise the emissions of these pollutants. Section 4.12 outlines the FGT methodology likely to be used at the facility but this will be confirmed at the detailed design stage. The FGT system will most likely include installation of a Selective Non-Catalytic Reduction (SNCR) system consisting of ammonium hydroxide (or urea) injection for control of oxides of nitrogen; the injection of activated carbon to control dioxin, mercury and heavy metal emissions; the injection of hydrated lime (or sodium bicarbonate) to control acid gas emissions; and a fabric filter system to remove dust.

1.3.13 Dust will be controlled at the facility through the enclosure of all potentially dusty operations within buildings, with specifically enclosed conveyor systems and sealed silos for controlling emissions of fly ash. Primary air for the boiler will be extracted from the tipping hall and fuel bunker, resulting in these areas being kept under a slight negative pressure which will further minimise the potential for the escape of dust and odours.

1.3.14 There will be no process discharges to ground and groundwater from the EfW facility.

1.3.15 During normal plant operation, all process water, including waste water from the flushing of the water treatment plant, plant maintenance and drainage from the ash quenching process will be recycled at the facility in the ash quenching process.

1.3.16 It is proposed that surface water runoff from the EfW facility roofs will be collected in a new surface water attenuation pond to be located within the eastern boundary of the installation, prior to being discharged to the drains located within the Site at green field discharge rate.

1.3.17 Appropriate procedures will be implemented to minimise the risk of contamination to surface water from the roadways, including installation of oil/water interceptors in drains in any areas where vehicles will be present. All drains from the process areas (i.e. within the facility and in reagent delivery areas) are likely to be routed to the bottom ash water tank for re-use in the ash quench bath, and will not be discharged from the facility. Contingencies such as spill kits would be put in place should there be the risk of contamination due to spillages.

1.4 Emissions Monitoring

1.4.1 Monitoring of point source emissions will be undertaken through the use of an a suitably certified continuous emissions monitoring systems (CEMS), in accordance with the waste incineration articles of the Industrial Emissions Directive (2010/75/EU). Periodic stack monitoring will also be undertaken on specific determinands, through a sampling location designed to meet the requirements of the Environment Agency's M1 Monitoring Guidance Note. Section 6.2 describes the procedures in place for monitoring emissions to air from the EfW facility.

1.5 Assessment of Best Available Techniques

1.5.1 An assessment to demonstrate implementation of BAT with respect to the proposed techniques being used at the EfW facility has been undertaken and is shown in **Error! Reference source not found.** of this document. The BAT assessment includes an assessment of the proposed technologies for the FGT system, for cooling options and compliance with the WI BRef.

1.6 Assessment of Environmental Impact

1.6.1 All emissions to air from the EfW facility will be compliant with the Best Available Techniques – Associated Emissions Levels (BAT-AELs) provided in the revised WI-BRef. An air quality assessment reviewing the potential emissions from the facility against the BAT-AELs has been undertaken (Chapter 7 of the Environmental Statement (ES) Volume I, presented in Appendix 6 of this document).

1.6.2 The assessment reviewed the impacts of the concentration of oxides of nitrogen (NOx) in the atmosphere, and nitrogen (N) deposited on adjacent habitats either directly (known as dry deposition, including directly onto the plants themselves) or washed out in rainfall (known as wet deposition).

1.6.3 The air quality impact assessment has concluded that the annual nitrogen deposition rate (as kg N/Ha/year) process contribution at the nearest saltmarsh habitat would be 2.1% of the critical load at receptors E1 - E3. As this is above the 1% screening threshold, it is therefore necessary to examine the output from the modelling in greater detail to establish whether this elevation in N deposition would result in any significant effects on the saltmarsh habitat.

1.6.4 The total annual N deposition predicted at these three receptors is 0.4 kg N/ha/yr, resulting from NOx and ammonia (NH_3), compared to the background deposition of 15.7 kg N/ha/yr. There would therefore be no exceedance of the critical load for this habitat type from the EfW facility, which is 20 – 30 kg N/ha/yr. It is therefore assessed that nitrogen deposition resulting from the EfW facility will result in a neutral effect on the Humber Estuary SPA/ SAC/ Ramsar/ SSSI that is not significant.

1.6.5 The assessment concluded application of suitable mitigation measures will ensure that the impact of the residual emissions on human health and on the nearby ecological receptors, mainly the Humber Estuary which is a designated Site of Special Scientific Interest (SSSI), Special Conservation Area (SAC) and Special Protection Area (SPA), will be minimal.

1.6.6 In addition, the air quality assessment evaluated the impact on global warming. It is predicted that there will be a net reduction of at least 19,000 tonnes of CO_2 equivalent per annum, taking into account direct and indirect emissions from the EfW facility and offsets from the electricity generated, when compared against the UK average release of CO_2 per MWh of electricity produced. Further carbon savings are realised when considering the diversion of waste from landfill for use as a fuel.

1.6.7 A noise and vibration assessment undertaken as part of this application reviewed the potential impacts on the nearest residential and ecological noise sensitive receptors (NSRs) (Chapter 8 of the Environmental Statement (ES) Volume I, presented in Appendix 6 of this document).

1.6.8 The nearest NSRs are also a considerable distance from any vibration source, therefore further assessment of operational vibration impacts on the identified NSRs was not considered to be required. Necessary noise controls will be built in to the detailed design.

1.6.9 At ecological receptors located along the Humber Estuary to the east, noise levels are predicted to fall below ambient noise levels during the operation of the EfW facility and no significant effects are predicted.

1.6.10 The assessment identified that there is the potential for noise disturbance to some ecological receptors (waterbirds) from the operation of the EfW facility. The ecological impact assessment concludes that, as the majority of waterbirds will be located in the central and eastern parts of the fields to the south and central and northern parts of the fields to the north, the effects on waterbirds will not be significant.

1.6.11 Therefore, no additional mitigation is considered to be required. It is proposed that as best practice during the detailed design of the facility, appropriate building design measures will be considered to reduce any noise impact upon the closest NSRs. During the detailed design phase, noise data/ information will be reviewed and where there are likely to be significant changes to what has been assumed certain aspects of the noise assessment may need to be revisited.

1.7 Energy Efficiency

1.7.1 The gross efficiency of the facility has been determined using a method proposed in the Annex to the BREF on BAT-AEELs (as proposed by the Confederation of European Waste-to-Energy Plants (CEWEP)). This method uses data for the steam flow to the steam turbine (electrical generation) and the exported steam flow (heat export) to create a ratio that is applied to the thermal input and allows gross efficiency to be calculated for each element. Based on this methodology, the gross electrical efficiency for the EfW facility is estimated to be 30%, assuming a thermal input of 240MW, gross electrical output of 49.9MW and steam output of circa 84MW. The proposed EfW facility will therefore be compliant with the BAT-AEEL specified in the draft revised BRef.

1.7.2 In addition to the efficiency calculation, the EA require that a Combined Heat and Power (CHP) Readiness assessment is completed for a new EfW facility where there are no immediate opportunities for the supply of waste heat from the outset. It is recognised that BAT is to build the plant to be CHP-Ready (CHP-R) to a degree which is dictated by the likely future opportunities which are technically viable and which may, in time, also become economically viable. The CHP Readiness Assessment for the proposed facility is presented in Appendix 8. The assessment reviews potential outlets for exporting heat from the EfW facility, and the economic viability of the export options. The assessment concludes that due to the largely industrial nature of the area, the most appropriate outlets would be other industrial operations; however, several suitable options identified were found to already have CHP plants installed to meet that site's specific heat needs. The assessment also showed that the considerable distance of the other identified potential outlets and the cost of installing the required infrastructure to facilitate export to such outlets render the use of the EfW facility as a CHP at present unviable. The EfW facility will, however, be designed as a CHP Ready plant, with a dedicated space available to allow installation of suitable infrastructure to export heat to off-site consumers, in the event that viable heat outlets are identified in future.

1.8 Raw Materials, Water Use and Waste

1.8.1 The facility will use other raw materials in addition to the fuel, including: flue gas treatment reagents such as hydrated lime (or sodium bicarbonate), ammonium hydroxide, activated carbon; diesel fuel; and boiler water treatment chemicals. The operator will maintain a register of materials containing full material safety data sheets (MSDS) for all raw materials. Raw material usage will be reviewed regularly for operational efficiency and health, safety and environmental improvements. Containment measures for all raw materials will be assessed and monitored as part of the facility maintenance management system.

1.8.2 A demineralised water production and storage system will be required to fill the boiler and replenish blow down. The demineralised water system will be fed by the Towns Mains and will be used to feed the boiler and replace any water that is blown down. Boiler blow down water will typically be fed into the process water system, which would supply water for on-site processes such as within the flue gas treatment (FGT) system. If the demand for process water exceeds supply, then the difference will be made up with Towns Mains water. Conversely, if supply to the process water tank exceeds demand, then it will typically be allowed to overflow to the bottom ash water pit, which would supply the bottom ash quench bath. The bottom ash water pit will also be fed by other process drains, rain water harvesting and reject flow from the demineralisation plant. In the unlikely event, that there is no spare capacity in the bottom ash water pit and the process water tank, the excess effluent will be discharged from facility to the Anglian Water foul sewer for off-site treatment and disposal, following appropriate analysis, and in compliance with a Trade Effluent Discharge Consent

1.8.3 The main by-products generated from the process will be in the form of ash, comprising both incinerator bottom ash (IBA) and FGT residue. It is expected that the EfW facility will produce up to 179,000tpa of IBA and 20,600tpa of FGT residue. The IBA will be discharged to an enclosed bunker via a conveyor system from the boiler for storage. The IBA bunker will be designed as a liquid containing structure in accordance with BS EN 1992-3, with any drainage being routed to the bottom ash water pit for re-use. Ash which drops out in the boiler passes will typically be collected in hoppers and conveyed back to bottom ash ejector to be mixed with the IBA. IBA will either be recycled as an aggregate or landfilled if suitable outlets for use are not identified.

1.8.4 All FGT residues will be handled in enclosed conveyors and silos to minimise the potential for dust release. FGT residues are currently expected to be disposed of to landfill due to their hazardous nature, although options for future recycling will be kept under review.

1.8.5 The facility will also generate small quantities of wastes from maintenance activities and general wastes from the offices. The EfW facility will have dedicated waste storage areas, where waste will be segregated according to the nature of the hazard it represents. Waste storage facilities will be located away from drains and watercourses and will be of suitable construction for the materials they hold. Opportunities for waste minimisation will be pursued as part of the continuing development and definition of the processes at the facility. The most environmentally appropriate disposal option for each waste will be sought, and recovery/disposal options will be reviewed on a regular basis, to demonstrate compliance with the waste hierarchy.

1.9 Management Arrangements

1.9.1 The facility will be operated by qualified and trained operators to ensure the process is optimised, and appropriately managed. The existing environmental management system (EMS) certified to ISO14001, will be revised to reflect the operation of the EfW facility.

1.9.2 The potential for fugitive emissions will be regularly reviewed as part of the EMS environmental aspect identification procedure, with the use of planned preventative maintenance and regular inspections to minimise risk.

1.9.3 A qualitative environmental risk assessment has been completed to support this application in order to identify and review potential environmental risks associated with accidents and abnormal operations (Appendix 7). The accident management plan (AMP) which is in place for the existing CCGT power station installation, will be amended to add any additional risks from the EfW facility. Additionally, as this facility handles combustible waste, an outline Fire Prevention Plan (FPP) in accordance with the latest EA requirements and guidance has been developed for the facility to provide outline design fire prevention and mitigation measures for the facility, and is presented in Appendix 5.

1.10 Site Closure Management

1.10.1 The facility is expected to operate for around 30 years, the existing procedure for the CCGT power station installation which details the anticipated steps required to close the facility and surrender the permit will be adapted to include consideration of the EfW facility prior to commissioning of the EfW facility.

2.0 INTRODUCTION

2.1.1 This document supports the application submitted by EP SHB Limited ("EP SHB") under the Environmental Permitting (England and Wales) Regulations 2016 ("the EPR Regulations") (as amended) to vary the Environmental Permit for the South Humber Bank Power Station ("SHBPS") (permit reference: EPR/MP3235LY), to include the installation of an energy from waste (EfW) power plant – South Humber Bank Energy Centre ("SHBEC"); located at South Marsh Road, Stallingborough, North East Lincolnshire, DN41 8BZ (the 'Site'). Figure 1 (Appendix 1) shows the Site location, and Figure 3 shows the proposed installation boundary and the extents of the CCGT Power Station operation and the EfW facility. The SHBPS installation currently comprises a Combined Cycle Gas Turbine (CCGT) power station, which will continue to operate as per existing permit conditions, following the installation of the EfW facility.

2.1.2 Following the variation proposed by this environmental permit variation application, the South Humber Bank Power Station (SHBPS) installation would include:

- the existing CCGT Power Station , which consists of two combined cycle gas turbine phases fired by natural gas with a gross electrical capacity of 1,375MW; and
- a new, two-stream, EfW facility fired by refuse derived fuel (RDF) with a combined thermal input of 240MW_{th}, a gross electrical output of 49.9MW_e and a nominal thermal export of 84.1MW_{th}; with the capability to export all steam generated (approximately 211MWth) to the CCGT power plant when not producing electricity for direct export.

2.1.3 The SHBEC EfW facility will comprise approximately 7.3 hectares (ha) of land located on SHBPS land at approximate National Grid Reference (NGR) TA 23064 13443. The variation to the environmental permit for the installation proposed by this application will require the addition of land lying between the north-eastern boundary of the SHBPS installation and South Marsh Road to the defined installation boundary. The land is under EP SHB ownership.

2.1.4 The EfW facility will generate up to 49.9MW_e gross electrical output, operating continuously. On average it is expected that the facility will operate for an expected 7,850 hours per annum based on a nominal plant availability of 89.6%, which is an average over the life of the plant and may be higher in the early years and also years with no outage requirements. The EfW facility will also have the capability to recover heat in the form of steam, and approximately 84MW of steam is expected to be exported to the existing CCGT power station. The EfW facility will be designed to enable export of all steam generated at the facility to the CCGT power station (approximately 211MW_{th}); however the facility will only operate in this mode in the event that it is not generating any electricity for direct export.

2.1.1 The EfW facility will operate using fuel with a range of Net Calorific Values (NCV) between 9MJ/kg and 14MJ/kg, with a design average NCV of 11MJ/kg. The range of NCVs for the fuel will provide sufficient flexibility in operations and is representative of commercial and industrial (C&I) waste in the region. Based on a nominal lifetime availability to combust fuel of 89.6% the facility will have an annual capacity to treat between 484,400 tonnes per annum (tpa) of fuel (at a NCV of 14MJ/kg) and 753,500tpa of fuel (at a NCV of 9MJ/kg); or 616,500tpa of fuel at the design average NCV of 11MJ/kg. The availability could be higher in the early years and also years with no outage requirements. Based on this increased availability, the maximum annual throughput of fuel at a NCV of 9MJ/kg is expected to be 781,000tpa. It should be noted that the thermal input to the facility will remain 240MWth at all operational availabilities

2.1.2 This environmental permit application and all associated impact assessments have been prepared on the basis of the lifetime average plant availability of 89.6% (7,850 hours per annum) and a maximum throughput of 753,500tpa of fuel having a NCV of 9MJ/kg.

2.1.3 The layout of the proposed EfW facility along with indicative locations of emission points is shown in Figure 4 (Appendix 1).

2.2 Background

2.2.1 The CCGT Power Station consists of two phases of combined cycle gas turbines fired on natural gas, with a combined gross electrical capacity of 1,375 MW, located near Stallingborough in North East Lincolnshire. The CCGT power station has been operational since 1997, and is operated by EP SHB Ltd under the environmental permit - EPR/MP3235LY.

2.2.2 The existing SHBPS installation boundary extends to include the operation of the CCGT power station, and the cooling water pipelines transporting abstracted water from the Humber estuary to the CCGT power station for use in the cooling system (see Figure 2).

2.3 Proposed Operations

2.3.1 It is now proposed to install the EfW facility largely within the existing SHBPS permit boundary. However, some parts of the proposed facility are to be located on land adjacent to the north eastern boundary of the existing installation boundary (between the existing permit boundary and South Marsh Road); therefore an extension of the existing permit boundary of SHBPS is required (see Figure 2). There will be minimal technical interaction between the two facilities, with the primary link comprising export of steam from the EfW facility to the CCGT power station. The proposed installation boundary is shown in Figure 3 whilst the layout of the EfW facility is shown in Figure 4.

2.3.2 The activities undertaken at the EfW facility will require an environmental permit under Schedule 1, Part 2, Section 5.1 A(1)(b) of the Environmental Permitting (England and Wales) Regulations 2016 (as amended), for the *“the incineration of waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour”.*

2.3.3 The EfW facility will comprise two combustion lines, each with a thermal input of approximately 120MW_{th}, with associated flue gas treatment (FGT) facilities. On each line, fuel will be fed into a furnace kept at a steady operating temperature. The heat from combustion of the fuel will be used to generate steam, which will then be transferred to a steam turbine generator to generate electricity before entering an air-cooled condenser (ACC) to recover the water.

2.3.4 The Planning Application for the EfW facility has allowed sufficient flexibility to allow for both streams to be built out in parallel, for a phased approach whereby the first combustion stream is operational in 2022 and the second in a future year, or for only a single stream development to be built. This application is being made on the basis of the entire facility being built out and operated i.e. both combustion lines operating as this is considered to represent the worst case operational scenario; the impact assessments have also been undertaken on this basis.

2.3.5 In summary, the EfW facility will comprise operations including:

- incoming and outgoing weighbridges capable of fully automatic recording of deliveries;
- fuel reception hall and storage area;

- a shredder;
- fully automated overhead cranes for the feeding of fuel;
- a grate-based combustion system comprising two combustion lines, with both primary and secondary combustion air;
- a water tube boiler of vertical or horizontal arrangement for each combustion line;
- auxiliary burners for start-up and ensuring the minimum combustion temperature (850°C), as required by the Waste Incineration Best Available Techniques Reference document (WI-BRef), is maintained during normal operation;
- a flue gas treatment (FGT) system including:
  - acid gas abatement using the addition of a lime or sodium-based reagent;
  - abatement of oxides of nitrogen using a Selective Non-Catalytic Reduction (SNCR) system with the addition of ammonium hydroxide or urea;
  - activated carbon addition for the absorption and removal of dioxins, mercury, and heavy metals from the flue gas; and
  - bag filters for the removal of ash and FGT residue.
- two stacks, containing one flue per boiler;
- an ash conveying and storage system, including an over-band magnet and ferrous metal storage;
- a water treatment system;
- a steam turbine and generator;
- an air-cooled condenser (ACC); and
- associated electrical distribution and connection equipment.

2.3.6 In addition to the above, the facility will have stores and workshops to store the required maintenance equipment and chemicals (expected to be small quantities of cleaning chemicals). There would also be storage tanks for raw materials including water, diesel, and FGT reagents.

2.4 Environmental Setting

2.4.1 The Site for the EfW facility is located off South Marsh Road, Stallingborough on the South Humber Bank between the towns of Immingham and Grimsby; both over 3 km from the Site.

2.4.2 The surrounding area is characterised by a mix of industrial and agricultural land use with the main settlements being the villages of Stallingborough, Healing and Great Coates. The nearest settlement is the village of Stallingborough over 2 km away. Figure 1 (Appendix 1) provides further details of the Site location.

2.4.3 The area surrounding the Site is in agricultural use immediately to the south, west and north-west. There is a concentration of industrial land uses on the South Humber Bank along the bank of the Humber Estuary. A large polymer manufacturing site (Synthomer (UK) Limited) and the NEWLINCS waste management facility are both located to the north of the Site beyond South Marsh Road. The Humber Estuary lies adjacent to the east of the installation permit boundary.

2.4.4 Access to the South Humber Bank is via the A180 Trunk Road and the A1173. The Barton Line (railway) runs north-west to south-east between Barton-on-Humber and Cleethorpes circa 2.5 km to the south-west of the SHBPS and a freight railway line runs north-west to south-east circa 300 m (at the closest point) to the Site.

2.4.5 In addition to the drainage channels around the majority of the perimeter of the Site, the Oldfleet Drain is located approximately 300m south of the Site boundary. A large pond lies off-Site approximately 400m south of the Site to the south of the Oldfleet Drain.

3.0 SITE CONDITION

3.1 Site Location

3.1.1 The EfW facility is proposed to be installed on land largely within the existing permitted boundary of the SHBPS installation, located off South Marsh Road, Stallingborough, North East Lincolnshire.

3.1.2 The surrounding area is characterised by a mix of industrial and agricultural land use with the main settlements being the villages of Stallingborough, Healing and Great Coates. There is a concentration of industrial land uses on the South Humber Bank along the bank of the Humber Estuary.

3.1.3 The addition of the proposed EfW facility to the environmental permit held for SHBPS installation requires an increase in the permitted installation boundary, to include the land located to the north east of the current SHBPS installation (see Figure 2). A detailed Site condition assessment to demonstrate the baseline condition of the proposed Site has been undertaken and is presented in Appendix 2.

3.2 Site History

3.2.1 Prior to its development as a power station in the late mid-1990s, the Site was primarily occupied by agricultural land. Historical mapping shows chemical works in the vicinity of the Site from around the 1960s.

3.2.2 The area surrounding the Site is currently in agricultural use immediately to the south, west and north-west with a large polymer manufacturing site (Synthomer (UK) Limited) and the NEWLINCS waste management facility, both located to the north of South Marsh Road. The Humber Estuary lies around 25m to the east of the Site.

Environmental Sensitivity

3.2.3 The environmental sensitivity of the Site is considered to be as follows:

- groundwater – Low/Moderate sensitivity – Underlying unproductive strata within superficial deposits and Principal Aquifer within the bedrock deposit;
- surface water – Moderate/ High sensitivity – nearby River Humber and the Humber Estuary;
- land use – Low sensitivity – the Site is surrounded by a mix of industrial and agricultural land. Made ground is classified as Soils of High Leaching Potential (H1), defined as Soils which readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.

3.3 Baseline Condition

3.3.1 It is proposed to use the baseline condition of the land within the existing permit boundary, with additional baseline monitoring to be undertaken within the additional land being proposed to be added to the permit boundary.

3.3.2 It is noted that the existing boreholes within the existing boundary of the permit lie up the hydraulic gradient of the proposed EfW facility, with no boreholes within the land proposed to be added to the permit boundary. Therefore it is proposed to install additional boreholes down the hydraulic gradient of the EfW facility in addition to boreholes within the additional land being added to the permit prior to commencement of operations of the EfW facility to provide a comprehensive baseline for the Site. It is proposed to install these boreholes prior to operation of the facility.

4.0 OPERATING TECHNIQUES

4.1 Technical Standards

4.1.1 The EfW facility will operate in accordance with the applicable EA Sector Guidance, namely:

- How to comply with your environmental permit Additional guidance for: The Incineration of Waste (EPR 5.01)[1]
- Best Available Techniques (BAT) Reference Document for Waste Incineration[2] (WI BRef); and
- Environmental Permitting Guidance: Waste Incineration[3].

4.1.2 It should be noted that the existing WI BRef is currently under review, with a first draft of the revised document published in May 2017. Although this draft has not yet been adopted, it is considered likely that by the time the EfW facility becomes operational, the revised WI BRef may be in place. Therefore, this application has been produced on the basis of achieving compliance with the revised draft WI BRef.

4.1.3 The EfW facility will be designed to be compliant with the Industrial Emissions Directive (IED), the revised draft WI BRef and associated BAT Conclusions (BATc), where applicable. A summary of compliance against the BATc is shown in Appendix 4, with further discussion presented in this document.

4.1.4 In addition, the EfW facility will operate in accordance with the EA guidance – 'Develop a management system: Environmental Permits'[4] as a good practice measure. As the operation of the EfW facility is proposed to be added to the permit for the CCGT power station, it is expected that EA guidance will be used to revise the existing systems and procedures at the Site, to include the proposed operations.

4.1.5 The facility will have the capability to combust up to 96 tonnes per hour. The proposed activity is therefore covered under Section 5.1 Part A(1) (b) of the Environmental Permit (England and Wales) Regulations 2016 (as amended) ("EPR") as an activity for 'the incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour'

4.1.6 Figure 2 and Figure 3 (Appendix 1) show the revised installation boundary, including the extents of the EfW facility.

4.2 Process Description

Fuel

Fuel Composition

4.2.1 The EfW facility will be restricted to specified wastes, identified by specific European Waste Catalogue (EWCs) codes. An indicative list of the wastes expected to be treated/recovered at the EfW facility is shown in Appendix 3 of this document. It should

[1] How to comply with your environmental permit Additional guidance for: The Incineration of Waste (EPR 5.01), EA, March 2009
[2] Best Available Techniques (BAT) Reference Document for Waste Incineration, European IPPC Bureau, August 2006
[3] Environmental Permitting Guidance: Waste Incineration, Department for Environment Food & Rural Affairs, 22nd December 2015
[4] Develop a management system: Environmental Permits, EA, issued: 01 February 2016, last revised: 03 April 2018, accessed at https://www.gov.uk/guidance/develop-a-management-system-environmental-permits on 03 October 2018

be noted that this list may need to be revised once the fuel supply chain has been finalised for the EfW facility.

4.2.2 The proposed facility is being designed to combust fuel comprising RDF and similar fuels from commercial and industrial (C&I) sources, with a NCV range of 9 – 14 MJ/kg, and average design NCV of 11MJ/Kg. Therefore, the annual fuel throughput could be up to 753,500tpa having NCV of 9MJ/kg and an expected plant availability of 89.6% (which is an average over the life of the plant and may be higher in the early years and also years with no outage requirements). The combustion system will be designed with consideration given to the expected composition of fuel (including potential variations) and maximum throughputs.

4.2.3 The facility will therefore be designed to be able to operate with fuel within the fuel range presented in Table 4.1 below. These ranges allow for a reasonable variation around the design composition, as moisture and ash contents may vary. Such variation in the composition of waste, even if from a homogenous source, is generally accepted in the industry.

Table 4.1: Expected Composition of Design Fuel, Including Proposed Design Fuel Range

Parameter	Unit	Design Fuel Composition	Proposed Design Fuel Range	
			Minimum	Maximum
Carbon	%	26.50	n/a	n/a
Hydrogen	%	5.00	n/a	n/a
Nitrogen (N)	%	0.50	n/a	1.50
Sulphur (S)	%	0.10	n/a	0.40
Oxygen	%	20.00	n/a	n/a
Chlorine	%	0.50	n/a	1.00
Ash	%	15.00	5.00	20.00
Water (H2O)	%	32.40	10.00	40.00
NCV (calculated using Boie equation)	MJ/kg	11.00	9.00	14.00

4.2.4 Further discussion with boiler suppliers will be undertaken during the development of the detailed design of the plant, to ensure the final chosen boiler design is capable of dealing with the fuel ranges stated above.

4.2.5 It is expected that all fuel accepted will be processed, which may include screening and removal of recyclables such as plastic packaging, metals, glass etc. prior to delivery to the facility. Therefore, no on-site processing of the fuel to recover recyclables is proposed to be undertaken.

4.2.6 The EfW facility will not be designed to combust hazardous substances; and specification of acceptable fuel, defining the relevant acceptance criteria, will be agreed with each supplier prior to commencement of operations. As a proportion of the overall waste mass, however, this is likely to constitute a negligible fraction, and will be described within the fuel specification for each fuel supplier.

RDF Reception and Tipping Hall

4.2.7 The facility will operate continuously, 24 hours a day and 7 days a week. Fuel will only be delivered to the facility at specified times, with deliveries expected to be between the hours of 6 am and 6 pm every day. The facility will be equipped with four weighbridges - two incoming; and two outgoing, to enable efficient handling of the number of delivery vehicles anticipated.

4.2.8 Incoming vehicles will proceed to the incoming weighbridges where the quantity of incoming fuel is checked and recorded. Following weighing, the vehicles will proceed to the tipping hall, where they will be directed to a vacant tipping bay to discharge into the bunker.

4.2.9 To provide flexibility in operations the concept design layout has allowed for 11 tipping bays, which would allow sufficient capacity for the peak fuel deliveries with the minimum NCV.

4.2.10 On completion of the tipping operation, the vehicles will leave the tipping hall via the exit doors. The weight of the outgoing vehicles will be recorded on the outgoing weighbridges as they leave the facility. Doors to the tipping hall will be fast acting and kept shut at all times including when delivery of fuel is not taking place (e.g. at night), except when vehicles are entering and exiting the building. Any fuel spilt during delivery will be contained within the enclosed tipping hall.

4.2.11 A one-way system will be operated around the facility to reduce the risk of congestion and collisions.

4.2.12 The general aspects of waste acceptance at the facility are detailed below.

- Pre-Acceptance Procedure: It is proposed that appropriate analysis will be undertaken on initial acceptance of waste from a new waste supplier and then on a periodic basis to ensure ongoing compliance with agreed fuel specifications.
- Acceptance Procedures:
    - Loads will be accepted at the facility in accordance with an outline delivery schedule to ensure there is sufficient storage capacity to receive waste.
    - Waste records will be maintained detailing the volume and type of waste accepted along with any verification checks that are completed.
    - Incoming vehicle loads will be inspected randomly at the weighbridge to confirm the nature of incoming fuel and only authorised fuel will proceed to the fuel reception area. In accordance with BAT 12, radioactivity detection will be installed to monitor incoming fuel.
- Quarantine Areas: There will be designated quarantine area for storage of quarantined waste, expected to be located at the HGV holding area. Any ad-hoc waste or waste that contains potential contaminants will be isolated in defined quarantine areas in compliance with relevant legislation, until it is further analysed, if needed, and sent to authorised specialised facilities. The quarantine area will need to be accessible by a road vehicle, and its location of will be confirmed during the detailed design stage.

4.2.13 The operator will develop a procedure for handling non-conforming waste received at the EfW facility. Non-conforming waste will be deemed to be waste which:

- is not permitted under the Environmental Permit;
- if processed could potentially damage the plant – this material will be generally non-hazardous;
- is deemed to be hazardous (as defined under the Hazardous Waste (England and Wales) Regulations 2005) and cannot be processed; or

- is dangerous to handle (e.g. explosives or hot loads).

4.2.14 At the weighbridge, if any vehicle is suspected of containing any non-conforming wastes, or suspected of posing risk to operations, the vehicle will be instructed to wait. Further investigations will be undertaken by the operational staff, including discussions with the driver, to ascertain whether the load is safe or acceptable to tip.

4.2.15 In the event that hazardous or non-compliant material is identified in an incoming load, this will result in the load being transferred to the relevant quarantine area and held until arrangements can be made to transfer to a suitable off-site treatment/disposal facility.

4.2.16 The fuel may require mixing prior to treatment to improve homogeneity, and may require shredding to ensure any large items do not cause a blockage. A shredder will be installed within the fuel reception area. The shredder will be fed by fuel cranes and discharge directly into the fuel store.

4.3 Fuel Storage

4.3.1 At its design point, it is expected that the EfW facility will receive circa 1,900t of fuel per day and the storage capacity will be designed to provide flexibility around periods when there are no fuel deliveries.

4.3.2 The fuel bunker will be designed so as to provide approximately 4 days storage of the design fuel dependent on fuel density and the extent of fuel stacking.

4.3.3 The depth of the bunker may be dependent on the ground conditions at the Site. It is understood from available information from the British Geological Society (BGS)[5] and existing ground investigation information that the bedrock geology of the area comprises chalk located approximately 22m below the current ground level and is classified as a Principal Aquifer. To avoid any likelihood of affecting the groundwater quality in the area, the depth of the fuel bunker will be above the bedrock level. The base of the bunker will be approximately 10 m below the tipping hall floor.

4.3.4 The fuel storage bunker will be designed as a liquid containing structure in accordance with BS EN 1992-3. This will prevent the ingress of ground water or the seepage of leachate from the fuel to ground.

4.3.5 At this stage of facility design, considering daily fuel deliveries, buffer storage capacity, installation of fuel hopper, and associated cranes within the fuel bunker, it is expected that the width and length of the bunker are likely to be at 25m and 55m respectively. Cranes will span the bunker. The final dimensions and layout of the fuel bunker will be confirmed during the detailed design stage.

4.3.6 The location and layout of RDF reception is shown in the proposed layout (see Figure 4 in Appendix 1)

4.3.7 Considering the nature of the proposed operations, fire control measures including firewater systems will be employed at the facility. The facility will be designed for compliance with NFPA 850 in regards to fire protection standards and other regulations/standards (including building control) that place requirements on fire detection and segregation. It is proposed that 2-hour fire walls will be installed between the fuel store, boiler hall, and administration buildings. All fuel will be stored within the fuel bunker where fire suppression will be available. This is likely to include directional

[5] Geology of Britain, British Geological Society, accessed at http://mapapps.bgs.ac.uk/geologyofbritain/home.html on 10th September 2018

water cannons with fully automatic and manual operational modes and high-level sprinkler systems to extinguish the fire and protect the structural steelwork. Fire control measures are detailed in the Outline Fire Prevention Plan (FPP) which is presented in Appendix 5. Final fire control measures will be confirmed following development of detailed design for the facility and an updated FPP supplied to the EA.

4.3.8 Potential fugitive releases of dust and odour will be managed by extraction of the primary air for the boiler from above the fuel bunker, thereby maintaining a negative pressure within the tipping hall, coupled with fast-acting doors. Odour suppressant sprays and fans may be used to also help control emissions.

4.4 Fuel Handling Protocols

4.4.1 Fuel monitoring and delivery protocols for control of fuels that are accepted and stored in the bunker will be implemented at the EfW facility, including:

- delivery and reception of fuel will be controlled by a management system that will identify all risks associated with the reception of fuel and shall comply with all legislative requirements, including statutory documentation;
- incoming fuel will be delivered in covered vehicles or ISO containers and unloaded directly into the enclosed reception bunker;
- incoming vehicle loads will be inspected randomly at the weighbridge to confirm the nature of incoming fuel and only authorised fuel will proceed to the fuel reception area. In accordance with BATc, radioactivity detection will be installed to monitor incoming fuel;
- the fuel will meet the defined waste acceptance criteria. Fuel quality will be analysed at source and certified. Any loads not meeting the specification could be rejected and a quarantine area will be provided at the facility for out of specification fuel;
- fuel will be monitored for compliance with the specification. The fuel specification for each supplier will state the maximum moisture content, and excessively wet loads will be rejected. Liquid waste with the potential to generate leachate will not be accepted by the facility;
- should a non-compliant delivery arrive at the facility (and non-compliance is visually identified by the operations staff), the delivery from the specific supplier will be quarantined and not be mixed with the other stored fuel prior to a decision being made on the management of the non-compliant delivery; and
- vehicles will be unloaded in designated areas provided with impermeable hard standing. These areas will have appropriate falls to prevent drainage into the clean surface water system.

4.4.2 In addition:

- design of equipment, buildings and handling procedures will minimise the potential for litter, dust or odour;
- a high standard of housekeeping will be maintained in all areas and suitable equipment to clean up spilled materials will be provided and maintained;
- fuel crane operating procedures will ensure the fuel is well mixed in the bunker to maximise the homogeneity of fuel fed to the incinerator;
- inspection procedures will be employed to ensure that fuels which would prevent the EfW facility from operating in compliance with its permit are identified, segregated

and placed in a designated quarantine storage area pending removal to an appropriate disposal location; and

- further inspection will take place by the crane operator during vehicle tipping and fuel mixing.

4.4.3 Procedures to minimise odour and dust releases include:

- employing bunker management procedures and good mixing to avoid the development of anaerobic conditions;
- diverting fuel away from the facility during shut downs if odour management is not effective; and
- implementing odour suppressant sprays and fans to also help control emissions.

4.5 Combustion System

4.5.1 The technology proposed for use in the EfW facility is a reciprocating grate-based system. This is a proven technology for the proposed fuel, and widely implemented in the industry. An assessment of the potential combustion technologies has been undertaken, which concludes that this technology represents the best available technique for the EfW facility (see Appendix 4).

4.5.2 The plant will have two combustion lines, therefore providing operational flexibility. The fuel will be transferred from the bunker onto each grate using an overhead grab crane. The facility will incorporate automated combustion control via regulation of fuel feed rate, addition of primary combustion air, secondary air flow, and control of the grate. Control of various aspects of combustion is expected to achieve good combustion of the fuel, and consequently better control the emission of pollutants.

4.5.3 Automatic control of air/ fuel ratio will be used to maintain optimum combustion conditions in each section of the furnace. Oxygen probes within the furnace will monitor the residual oxygen in the exhaust gases and feed this data into the control system.

4.5.4 Primary air for combustion will be fed to the underside of the grate by fans. The feed rate of primary combustion air is controlled to provide sub-stoichiometric combustion at the base of the furnace. Secondary air will be injected in the combustion chamber above the grate to create optimum mixing of flue gases and ensure complete combustion with minimum levels of oxides of nitrogen (NOx). Flue gas recirculation is expected to be incorporated to the design so as to meet the requirements of BAT; this will be confirmed in the detailed design stage.

4.5.5 Preheating of both primary and secondary air will use heat from the water-steam cycle to improve the overall efficiency of the facility. Since the volumetric flow rates of primary air are generally significantly larger than secondary air, the preheating of primary air is likely to have a larger impact on efficiency whilst also being useful in maintaining stable combustion within emission limits.

4.5.6 Further discussion of the energy efficiency of the EfW facility is provided in Section 4.21.

4.5.7 A schematic of the proposed EfW facility is shown in Figure 5 (Appendix 1).

4.5.8 The combustion process will be optimised through continuous monitoring of oxygen and carbon monoxide levels, and temperatures within the combustion chamber, to ensure that a minimum combustion temperature of 850°C for a minimum of two seconds is attained in compliance with Industrial Emissions Directive (IED) requirements; using auxiliary burners, if necessary.

4.5.9 If problems are encountered in the combustion system, and temperature cannot be managed above the IED thresholds via the automated process controls, then fuel feeding will cease automatically. The process control system is fully automated with safety interlocks and alarms. If any combustion parameter such as temperature, pressure or oxygen level reaches a set level, an alarm will be triggered; the operation will then be stopped automatically if the problem worsens.

4.5.10 As the material burns, the ash that forms and the coarse inert content of the fuel remains and moves slowly along the grate. Once the fuel has been combusted, the residual ash will fall off the end of the grate into a removal system, where it will be cooled and transported to the ash handling system.

4.5.11 The hot combustion gases produced during the combustion process will pass through the boiler to raise steam, before being passed to the Flue Gas Treatment System.

4.5.12 RDF can be quite corrosive due to relatively large amounts of organic chlorine. This is liberated as Hydrogen Chloride (HCl) in the flue gas and can lead to significant high temperature corrosion. For this reason, it is typical to limit the final steam temperature in an RDF fired facility to approximately 430°C.

4.5.13 As it is common for RDF to have a high ash content compared to other solid fuels, larger volumes of ash are carried through the boiler and subsequently deposited on the boiler tubes. This process is called fouling. Fouling acts to resist heat transfer and therefore reduces the rate at which heat is transferred from the flue gas to the water-steam cycle. For this reason, cleaning systems will be installed within the boilers that are able to operate with the facility in operation. It is expected that the online cleaning systems will include the following elements:

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

4.5.14 The performance parameters for the system are shown in Table 4.2.

Table 4.2: Plant Performance Parameters

Parameter	Units	Total
Maximum generation capacity of the EfW facility	MW_e	49.9
Gross electrical efficiency[(a)]	%	30
Maximum expected fuel NCV	MJ/kg	14
Design fuel NCV	MJ/kg	11
Minimum expected fuel NCV	MJ/kg	9
Nominal annual availability	%	89.6[(b)]
Fuel throughput based on NCV of 14 MJ/kg and expected annual availability	t/h	61.7
Fuel throughput based on NCV of 11 MJ/kg and expected annual availability	t/h	78.5
Fuel throughput based on minimum NCV of 9 MJ/kg and expected annual availability	t/h	96.0
Fuel throughput based on NCV of 14 MJ/kg and expected annual availability	tpa	484,393

Parameter	Units	Total
Fuel throughput based on NCV of 11 MJ/kg and expected annual availability	tpa	616,500
Fuel throughput based on minimum NCV of 9 MJ/kg and expected nominal annual availability	tpa	753,500

Notes:

(a) This is the instantaneous efficiency of the facility estimated by proportioning the thermal input based on steam mass flow utilised within the EfW to generate electricity and steam mass flow exported the CCGT power station.

(b) It is anticipated that the facility will be operational at full thermal input for 7,850 hours, which is equivalent to an RDF processing availability of 89.6% (which is the average over the life of the plant which may be higher in the early years and during years with no outage requirements). However, it is considered that over the design life of the project the RDF processing availability is expected to be 89.0%.

(c) As the facility will be designed to operate with maximum fuel throughput of 753,500tpa based on the minimum design fuel NCV of 9MJ/kg at nominal plant availability, the information for this is also provided here.

4.6 Combustion Process Optimisation

4.6.1 The process schematic (shown in Figure 5 in Appendix 1) depicts the thermal capacity of the grate which in turn determines the capacity of the steam turbine generator and the flue gas treatment system. The combustion diagram is based on the following parameters:

- each line capable of treating 48 tonnes per hour at a fuel NCV of 9 MJ/kg;
- design lower calorific value (LCV) of fuel 9 MJ/kg, and upper calorific value (UCV) of fuel 14 MJ/kg; and
- number of combustion lines - 2.

4.6.2 The gross thermal input of both lines combined is approximately 240 MW_{th}.

4.6.3 The firing diagram for the EfW facility is illustrated in Figure 6 (Appendix 1).

4.6.4 In normal operation, steam flow is measured and serves as the controlled variable for the fully automatic combustion control. Keeping the steam flow constant stabilises the combustion process, independent of short and long-term changes in the fuel characteristics. The usual control peaks will be allowed for and the design of the plant components cater for short-term peaks of at least +10%, which is required in everyday plant operation.

4.6.5 The EfW facility is being designed as a recovery operation, and therefore requires demonstration of R1 status in line with EA guidance[6]. An indicative R1 calculation has been prepared by the project technical consultants based on an expected annual operating regime; this is included in Appendix 10.

[6] Waste incinerator plant: apply for R1 status, EA, First published - 4 October 2016, Last updated 15 May 2017, accessed at https://www.gov.uk/guidance/waste-incinerator-plant-apply-for-ri-status on 12/12/2018

4.6.6 It should be noted that the R1 calculation is based on design fuel NCV as a conservative basis.

4.6.7 Details of anticipated overall annual performance of the facility (as calculated in the R1 calculation) are shown below in Table 4.3. The data confirms that the facility is R1 compliant.

Table 4.3: Annual Facility Performance

Parameter	Units	Design
Fuel NCV	MJ/kg	11.0
Thermal input	MW_{th}	240.0
Electrical output (gross)	MW_e	49.9
Electrical output (net)	MW_e	43.4
Heat exported (gross)(1)	MW_{th}	84.1
Heat exported (net)(1)	MW_{th}	81.2
Auxiliary load (13% of gross power)	MW_e	6.5
Waste Framework Directive (R1) Ratio	-	0.88
Minimum required Waste Framework Directive (R1) ratio	-	0.65
Waste Framework Directive (R1) ratio compliance	Pass/ Fail	Pass

4.7 Auxiliary Firing

4.7.1 The furnaces will also be fitted with auxiliary burners which will assist in maintaining the combustion chamber temperature above 850°C, as required under the IED.

4.7.2 The auxiliary burners will most likely be fired using low sulphur distillate (diesel). This is acceptable as it is one of the fuels permitted under IED Article 50, paragraph 3 which states that *"the auxiliary burner shall not be feed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels, liquefied gas or natural gas".*

4.7.3 The choice of fuel will be confirmed at detailed design but in terms of facility specific considerations for using low sulphur distillate as the choice of fuel instead of the alternative natural gas, it was determined that:

- diesel will already be available at the facility as a fuel for auxiliary generators and for refuelling site vehicles and as the diesel is only needed in low quantities by the burners, it was decided to utilise the available diesel fuel rather than introduce a second fuel source such as natural gas;
- whilst natural gas is available at the Site, the import capacity and associated infrastructure is sized to accommodate the supply to the CCGT power station. If diesel is used, it can be stored at the facility and the supply to the auxiliary burners is directly within the control of the operator; and

- the additional connection costs associated with the provision of natural gas to the facility are disproportionate based on the expected gas usage in the auxiliary burners and generators.

4.7.4 It is therefore considered that use of diesel for fuelling the auxiliary burners represents BAT in this scenario. There will therefore be diesel storage at the facility for the auxiliary burners, auxiliary diesel generator and potentially for fuelling any site vehicles.

4.8 Fuel Charging

4.8.1 The EfW facility will meet the indicative BAT requirements outlined in the Incinerator Sector Guidance Note (SGN 5.01) for waste charging, and the specific requirements of the waste incineration articles of the IED. In particular the combustion control and feeding system will be fully in line with the requirements of the waste incineration articles of the IED.

4.8.2 The conditions within the combustion chamber will be continually monitored to ensure that optimal combustion conditions are maintained, and that the mandatory emission limits are achieved. Auxiliary burners will be installed and will be used to maintain the temperature in the combustion chamber.

4.8.3 The fuel charging and feeding systems will be interlocked to prevent fuel charging when the combustion chamber temperature falls below 850°C".

4.8.4 Fuel will be transported from the bunker onto the grate using an overhead grab crane, feed hopper and ram feeder. Primary air supply to the combustion chamber will be controlled through the grate surface to allow optimal combustion conditions. Combustion chamber, casings, ducts, and ancillary equipment will be maintained under a negative pressure to prevent the release of gases. Secondary air will be injected from nozzles in the wall of the furnace to optimise combustion and thermal NOx formation.

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

4.9 Boiler

4.9.1 The facility will include two water tube boilers (one for each combustion line) of vertical or horizontal arrangement; the arrangement of the boilers will be confirmed during detailed design. It is expected that each boiler will be designed to be suitable for use in an EfW plant processing fuel (RDF and similar fuels) with an NCV range of 9 to 14MJ/kg. This range of NCVs may be reduced following detailed design.

4.9.2 The two combustion lines and associated boilers will be located in the Boiler Hall, the location of which is shown in Figure 4.

4.10 Steam Turbine

4.10.1 A single steam turbine will be installed to serve the two combustion lines, as this is more thermally efficient at full load than independent smaller turbines operating with the same steam flow. This is due to a combined higher isentropic and mechanical efficiency of the larger unit. Another advantage of a single turbine is the lower capital cost, when compared to the costs for smaller independent turbines. This arrangement is therefore considered to represent the best available technique for the facility.

4.10.2 The steam turbine will be located in the Turbine Hall. A turbine bypass will be included to allow 100% of the steam generated to go to the condensers so that the boilers can be operated (to continue to process waste) in the event that the steam turbine/generator is unavailable; this would be an abnormal operating scenario for the facility. The turbine bypass will be sized for 110% of the live steam mass flow and as the facility is sized close to the limit of the gross electrical output consideration will be given during detailed design to the installation of a trim bypass to achieve greater control and reduce wear of the main bypass valve. The final turbine design and controls will be confirmed during detailed design stage.

4.10.3 At this stage, it is expected that the facility will be capable of achieving net power export of approximately 43.4MW as electricity, as well as exporting approximately 84MW (gross) of heat as steam. The annually exported amount of electricity (MWh) is based on the nominal plant operational availability whilst generating electricity. In the event of the facility not generating electricity for export, the EfW facility will be designed to enable export of all steam generated at the facility to the CCGT power station (approximately 211MW_{th}. It is envisaged that boiler outages would be staggered with operation of the steam turbine at part load; in order to maximise the annual export of electricity.

4.11 Cooling System

4.11.1 The facility will utilise an air-cooled condenser (ACC) as the cooling system to condense the turbine exhaust steam. A detailed assessment of the choice of system against BAT was completed and is attached in Appendix 4.

4.11.2 Based on the design efficiency of the facility, an ACC was chosen for the facility and is felt to be representative of BAT because:

- Established technology for the sector:

  ACC are typically seen on projects of this type and size due to the fact that there is no requirement for a water supply and no plume is produced.

- Limitations on the existing abstraction licence:

  EP SHB Ltd holds an abstraction licence (reference: 4/29/09/*T/0135), which allows abstraction of up to 870million m^3 of water from the River Humber. However, the entirety of the current abstraction capacity is required for the operation of the existing CCGT power station, with no spare capacity to supply water for cooling to the new EfW facility if wet or hybrid cooling options are installed. A new abstraction licence would therefore need to be obtained if an alternative wet or hybrid cooling system was installed and this cannot be guaranteed given the sensitivity of the Humber estuary.

- Reduced capital costs:

  No additional infrastructure will need to be installed to enable supplementary abstraction from the River Humber for the EfW facility and as such ACC will have lower capital costs.

- No impact on overall electrical efficiency of the EfW facility:

  Engineering data provided by the plant designers for the EfW facility show that there would be no improvement in gross electrical efficiency of the EfW facility if hybrid cooling towers or once through cooling systems are implemented at the facility instead of ACC, due to steam conditions required to allow steam export to the CCGT power station, along with the cap on gross power production being 49.9MW.

4.12 Flue Gas Treatment System

4.12.1 Each combustion line will be fitted with a Flue Gas Treatment (FGT) system consisting of:

- Selective Non-Catalytic Reduction (SNCR) for the abatement of emissions of nitrogen oxides (NOx) or if detailed design identifies the need, this would be substituted with Selective Catalytic Reduction (SCR);
- acid scrubbing using hydrated lime or sodium-based injection for the abatement of acid gases such as sulphur dioxide;
- activated carbon injection for the abatement of dioxins, furans and heavy metals; and
- fabric bag filters for the abatement of particulate emissions, including residues from the other FGT systems such as injected lime and activated carbon.

4.12.2 The FGT system is designed to achieve the emission limit values (ELVs) specified in the IED.

4.12.3 The facility will also need to be compliant with the BAT-Associated Emissions Levels (BAT-AELs) provided in the WI BRef. The emissions from the proposed EfW facility have been assessed against the revised BAT-AELs, in line with a conservative approach. The FGT system will be designed to ensure that the facility operates within the BAT-AELs.

4.12.4 Assessment of the proposed FGT systems against BAT requirements has been undertaken and is shown in Appendix 4.

NOx Abatement System

4.12.5 Nitrogen oxide (NOx) emissions will be controlled through a combination of primary and secondary means. Primary means, such as control of the combustion air, will be used to limit the formation of NOx in the combustion system. In addition to primary controls, additional NOx control will be achieved by Selective Non-Catalytic Reduction (SNCR) secondary abatement.

4.12.6 Installation of SNCR will involve injecting a reagent (i.e. ammonia solution or urea) into the boiler to reduce the NOx and produce nitrogen and water. Should an ammonia solution be used, it is expected that a diluted (25%) ammonium hydroxide solution will be used as a reagent; its storage on Site therefore does not fall within the scope of COMAH and it has fewer safety risks than storing any higher concentration of ammonia solution.

4.12.7 The rate of reagent injection will be automatically controlled on the basis of continuous analysis of the NOx concentrations in the flue gas.

4.12.8 SNCR has been considered against other techniques for NOx control (see assessment in Appendix 4) and is considered to represent BAT for NO_x abatement at the EfW facility due to:

- being a recognised BAT technique for control of NOx and is established within the energy from waste sector;
- IED and BAT-AELs for NOx can be achieved with SNCR;
- SNCR has a lower risk of nitrogen deposition on sensitive ecological receptors than the alternative Selective Catalytic Reduction (SCR) which is important given the proximity to the Humber Estuary which is a designated Site. Assessment of the impact of resultant releases has been shown to be acceptable through air dispersion assessment (see Chapter 7 of the Environmental Statement (ES) Volume I in Appendix 6);

- SNCR having significantly lower capital and operating costs compared with SCR; and
- SNCR having a low impact on energy efficiency compared with SCR which requires flue gas reheating and additional pressure losses which require a larger exhaust fan to compensate.

4.12.9 If detailed design identifies the need to use an alternative NOx control technique then this would be SCR which is another recognised BAT technique and has been considered in the BAT assessment.

Acid Gas Scrubbing System

4.12.10 Following treatment for NOx abatement, the flue gas will transfer to an acid scrubbing system, using hydrated lime or sodium bicarbonate as a reagent, which will remove sulphur dioxide and acid gases produced during combustion.

4.12.11 To achieve optimum control, the raw gas will be analysed by a CEMS before the conditioning tower and the content of H_2O, HCl, SO_2 and O_2 will be monitored and the data used to regulate the dosing of the lime. The spent reagent will be recovered in the fabric bag filters, although a proportion of the residual reagent from the scrubber may be re-circulated to improve the gas clean-up and reduce the amount of fresh reagent used.

4.12.12 The specific choice of acid gas scrubbing system will be confirmed at detailed design but the various options for acid gas control were evaluated in the BAT assessment, and dry/semi-dry scrubbing was determined to be BAT for the EfW facility because:

- it is a Recognised BAT technique for control of acid gases and is established within the energy from waste sector;
- unlike wet scrubbing, these systems typically produce a relatively lower volume of hazardous liquid effluent, leading to no impact on the power generating efficiency of the plant;
- semi-wet and dry systems provide high removal efficiencies (for soluble acid gases), therefore allowing achievement of the required BAT-AELs. Emission levels can be decreased by adjusting the reagent dosing rate and design; and
- reagents, other than alkaline reagents, can also be added to adsorb other flue-gas components (e.g. activated carbon for mercury and PCDD/F).

Abatement of Metals and Organic Pollutants

4.12.13 Activated carbon will also be injected in to the flue gas duct as part of the acid gas scrubbing process to minimise emissions to air of Persistent Organic Pollutants, mercury and other heavy metals. The rate of injection of activated carbon, as with the other reagents, will be controlled automatically.

Particulate Abatement System

4.12.14 Downstream of the acid gas scrubber, the flue gas will be drawn through a fabric bag filter to remove particulates, including residual reagent (hydrated lime and activated carbon particles) from the prior treatment systems. Each fabric filter will be divided into compartments. The treated flue gas will pass through an induced draught fan into the stack for release.

4.12.15 Regular bag filter cleaning will be performed on-line by pulsing compressed air through the filter bags. The residues will be collected in fully enclosed hoppers beneath the filters. Bag failure, albeit an infrequent occurrence would be identified by a sudden increase in particulate concentration at particulate meters installed immediately downstream of the bag filter or by a change in the pressure differential across the bag filter. These monitors will be connected to the automated process control system for the facility to allow quick detection and amelioration.

4.13 Stacks

4.13.1 Flue gases will be emitted to atmosphere via two separate stacks, one for each boiler. This will enable phased installation of the combustion lines, if required, therefore providing flexibility in operation. The location of the stacks is shown in Figure 4.

4.13.2 The flue gas exit temperature is approximately 120°C. Flue gas will be emitted with an efflux velocity in excess of 15 m/s. Combined with the thermal buoyancy of the warm gas, the flue gas will rise before becoming dispersed. The top of the flues will be stainless steel lined to avoid corrosion.

4.13.3 Dispersion modelling has been used to determine the appropriate height of the stack; the proposed height of the stack is estimated to be 100 metres above ground level. The stack height has been designed to ensure adequate dispersion of emissions.

4.13.4 The continuous emission monitoring sampling points and non-continuous sampling points will be located according to the requirements of the Industrial Emissions Directive and the EA Technical Guidance Notes M1 '"Sampling Requirements for stack emission monitoring" and M2 'Monitoring of stack emissions to air". The location of sample ports will be selected to provide appropriate access. If the sampling points are located in the stack, a suitable platform and access ladder will be provided together with hoist facilities for lifting equipment onto the sampling platforms.

4.14 Ash Handling System

4.14.1 The EfW facility will produce two types of solid waste from the combustion operation, comprising Incinerator Bottom Ash (IBA) plus boiler ash, and FGT residue.

<u>Incinerator Bottom Ash Handling System</u>

4.14.2 The burnt-out residue from the combustion process is referred to as IBA. IBA produced at the facility will be passed under a magnetic separator to remove ferrous materials, which will be discharged to a separate storage pit or skip, following which the remaining IBA will then discharged to a bottom ash bunker. The bunker will be designed as a liquid containing structure in accordance with BS EN 1992-3 with any drainage being routed to the bottom ash water pit for re-use on-site via the ash quench system. The quench system will maintain the seal in the boiler whilst quenching the hot ash so that it does not represent a fire risk or damage the conveying equipment. The current design layout assumes that the ash bunker will be situated inside the main facility (see Figure 4), sized for approximately 5 days of storage and provided with an overhead crane.

4.14.3 IBA is typically non-hazardous and is likely to be recycled for use as Alternative Raw Material (ARM) in cement kilns or in general low-grade aggregate use. Where recycling is not possible, a back-up landfill site will be used for disposal of bottom ash. Any ferrous material removed from the bottom ash will be sent off-site for recycling.

4.14.4 It is expected that based on the maximum fuel input, operational hours and the maximum allowable ash content of 20%, IBA generated will equate to approximately 143,000tpa. The IBA will include absorbed water from the quenching system, which is assumed to represent approximately 25% additional weight; therefore, it is considered that the facility will generate around 179,000tpa of wet IBA. It is anticipated that the wet

IBA will be taken off-site for appropriate treatment for recycling (assuming viable outlets are identified) and/or disposal.

Flue Gas Treatment Residues Handling System

4.14.5 FGT residues are expected to comprise fine particles of ash and residues from the flue gas treatment process which will be collected in the bag filters. The FGT residue will be stored in a sealed silo adjacent to the FGT plant. FGT residues are typically alkaline in nature, which results in their classification as hazardous waste, and will therefore need to be transported by road in a sealed tanker to an appropriate treatment facility prior to disposal. Although no viable options to recover FGT are currently known, this will be kept under review to ensure that opportunities to recover the material can be explored when they arise.

4.14.6 Assuming that the FGT residue comprises the 5% of ash that is not collected as IBA and includes the solid reagents added for emissions abatement (such as activated carbon and hydrated lime), then it is estimated that the facility will generate approximately 20,600tpa of FGT residue.

4.15 Process Control System

4.15.1 The facility will be controlled from a Control Room (see Figure 4 for the location), which will contain an automated control system to control facility operations, optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over. The main control and supervision system will consist of a Distributed Control System (DCS) organised on several levels. The facility will be fully automated and instrumented to allow safe and efficient operation.

4.15.2 The combustion system will be automatically controlled, using a number of parameters to optimise the process, including but not limited to:

- primary air;
- secondary air;
- fuel feed rate;
- SNCR reagent injection rate;
- flue gas oxygen concentration at the boiler exit;
- flue gas composition at the stack, including ammonia content;
- furnace temperature;
- boiler feed pumps and feedwater control;
- steam flow at the boiler outlet;
- steam outlet temperature;
- boiler water level control;
- power generation; and
- steam turbine exhaust pressure.

4.15.3 The response times for instrumentation and control devices will be designed to be fast enough to ensure efficient control. The control process is fully automated with safety interlocks. If any parameter such as temperature, pressure or oxygen level reaches a set level, an alarm will sound. If the problem worsens, the facility will be stopped automatically.

Validation of Combustion Conditions and Boiler Design

4.15.4 Computational Fluid Dynamics (CFD) modelling will be used during the detailed design process and commissioning process for the furnace and boiler to validate the configuration and dimensions of the furnace in order to optimise the combustion process, and the mixing and turbulence in the furnace to minimise emissions of pollutants and optimise burn out of the ash to achieve values below compliance with the required regulations.

4.15.5 CFD models typically take into account all physical phenomena taking place in the furnace including:

- turbulent flow (to obtain the most realistic flue gas flow solving vorticity and stream flow function differential equations);
- combustion (the heat released is calculated in each volume where the combustion occurs, based on the specific heat of the chemical reaction; and
- thermal transfer by radiation, convection and conduction (the radiation properties of the flue gas and particulate are taken into account using a decomposition of the gas in a sum of several grey gases. These models are able to predict the absorption, emission and diffusion of the radiation energy.)

4.15.6 The results from the modelling can then be used for:

- checking residence time, turbulence and temperature along flue gas paths in the furnace;
- calculating the basic parameters to be introduced in the DCS for continuous control of the flue gas residence time at temperatures above 850°C for more than two second after the last injection of air;
- optimising the location of nozzles for SNCR reagent injection; and
- determining the most appropriate location of temperature sensors in the furnace, in order to have the best control of combustion parameters and to ensure safe operating conditions in all cases.

4.15.7 In order to meet high operating availabilities, the boiler will be subject to continual review in terms of corrosion resistant materials and the location of the various heat exchange surfaces.

4.15.8 The average optimal temperature window for SNCR is between 850ºC and 1,100ºC.

4.15.9 The combustion calculation for the system will be developed to align with the proposed firing diagram (Figure 6 shown in Appendix 1). This will be verified based on the results of generic CFD modelling data during detailed design and validated at the time of plant commissioning.

4.15.10 The combustion calculation will determine the various air flows and the resulting flue gas flow that will be used as a basis for dimensioning the boiler and the air pollution control systems. From these parameters, the steam output of the boiler will be determined, and ultimately the power generated by the steam turbine.

4.16 Ancillary Equipment and Structures

Bulk Material Storage in Tanks and Silos

4.16.1 The facility will use various raw materials during operation, which will be delivered to the facility in bulk transportation vehicles. The minimum storage capacity shall be set to reflect the process requirements.

4.16.2 In order to minimise the risks of contamination to process and surface water, all liquid chemicals stored at the facility will be kept in bunded areas having a volume of 110% of stored capacity. Diesel will be held in a bunded storage tank and any spillages or leaks will be retained in this area and treated locally. All oil storage tanks will be constructed in accordance with the Environment Agency guidance[7]

4.16.3 All process activities that have the potential to result in pollution through spillage will be located in appropriately bunded areas (compliant with CIRIA C736 requirements) or on hardstanding (i.e. concrete) with a sealed drainage system. The facility will have a number of above ground bulk storage tanks as shown in Figure 4. Any areas where oil will be handled and used will be protected by an enclosed drainage system. This will allow the storage and collection of any spillages, so that they can be recycled or disposed of via a suitable third party licensed waste contractor, as required.

4.16.4 There will be no underground chemical storage tanks on-site and no former underground tanks are understood to have been present on the Site. Any facilities designed to below ground level (for example the fuel storage bunker) will be designed with consideration to the groundwater table level.

4.16.5 Delivery areas for the bulk liquids (for example, 25% ammonium hydroxide solution and diesel) will be designed with specific containment measures in the event of a spillage during delivery and transfer. Hydrated lime will be delivered by bulk tanker and offloaded pneumatically into the silos with displaced air vented through a reverse pulse jet filter. Activated carbon for the flue gas cleaning process will be delivered by bulk tanker and offloaded into one silo with displaced air vented through a reverse pulse jet filter.

4.16.6 FGT residues collected from the bag filters will be temporarily stored on-site in sealed silos. FGT residues will be removed from the facility via enclosed tankers by licensed contractors for treatment or disposal at a hazardous landfill, as appropriate.

4.16.7 The bunds/ bunded areas will have no gravity outlets or drains meaning that there are no pathways to the water environment. Regular inspections will be carried out to ensure that potential defects are identified and corrected.

4.16.8 Regular visual bund inspections will be carried out for the above tanks as part of the planned preventative maintenance (PPM) regime with records maintained at the facility. Bund contents will be emptied as and when required and would be tested prior to discharge to the facility drainage system or taken off-site by a licensed waste contractor for appropriate disposal as appropriate.

Table 4.4: Storage Tanks and Containment

Tank Description and Contents	Secondary Containment
FGT residue – two silos of approximately 110 m^3 each (total 220 m^3)	Concrete hardstanding area with no surface water drains within the Flue Gas Treatment building.

[7] Oil storage regulations for businesses, EA, published 6 May 2015, Last updated 3 January 2018, accessed at https://www.gov.uk/guidance/storing-oil-at-a-home-or-business on 16/11/2018

Tank Description and Contents	Secondary Containment
Hydrated lime or sodium bicarbonate – two silos of approximately 65 m^3 each (total 130 m^3)	Concrete bunded area
Ammonium hydroxide (25% solution) or urea (1 tank with approximately 60m^3 capacity)	Double skinned tank within a concrete bunded area
Powdered activated carbon (powder) (1 silo with approximately 50m^3 capacity)	Concrete bunded area
Auxiliary fuel (diesel) (one tank of approximately 140 m^3capacity)	Concrete bunded area
Notes: (a) It is expected that containment provisions will be sized to be complaint with the requirements of Ciria C736 and other best practice documents as part of the detailed design. (b) The facility layout shows the location of the ammonium hydroxide/urea tank alongside the diesel tank in the same bund, the bund capacity has therefore been estimated based on 110% of the largest tank in the bund i.e. the diesel tank.	

Auxiliary Generators

4.16.9 An auxiliary generator will also be available for safe shut down of the facility in the event of a loss of electrical connection and failure of the steam turbine to transfer to island mode operation. It is anticipated that one stand-alone auxiliary diesel generator will be installed, having a capacity of 2-5 MW. It is expected that the generator will not be used for any more than 50 hours a year (mainly for routine testing) unless an emergency shut-down scenario occurs.

Water Treatment Plant

4.16.10 A demineralised water production and storage system will be required to treat the water sourced from the Towns Main to fill the boiler and replenish blow down water. Details of the water treatment plant will be finalised during the detailed design stage.

Firewater and Fire Protection

4.16.11 The fire strategy for the CCGT power station is incorporated into an overall emergency planning procedure; this procedure will be revised to include the operation of the EfW facility. Appropriate standards will also be referenced to provide the necessary fire safety design for the EfW facility. The Outline FPP as required by the EA for facilities handling combustible waste is presented in Appendix 5 and this will be updated following final detailed design.

4.16.12 Fire pumps and a fire water storage tank will be installed on at the facility. The location of the fire water tank is shown in Figure 4. Detailed firewater requirement will be developed as part of the detailed Fire Prevention Plan (FPP) for the facility, as part of the detailed design stage of the facility.

4.16.13 In case of a fire alarm, the connection to the surface water drainage system will be automatically closed and surface run-off (fire-fighting and rain water) will be contained within the facility, most likely within the fuel bunker. Following a fire, water contained within the facility will be pumped out to tankers and transferred off-site to a licensed waste management facility, unless analysis demonstrates that it is uncontaminated and suitable for discharge via the surface water discharge route.

Grid Connection

4.16.14 Electricity will be exported either to the National Grid Electrical Transmission (NGET) 400 kV system at the SHBPS 400 kV substation (located within the Site), or to the Northern Powergrid 132 kV local distribution network (located off-site).

4.16.15 Connection to the National Grid Electrical Transmission (NGET) system at the 400 kV substation would require 400 kV underground electrical cables and control system cables from a new transformer compound.

4.16.16 Connection to the 132 kV local distribution network would require an on-site substation which is included in the layout for the development. This substation would be connected to the local distribution network at a 132 kV tower approximately 2 km to the west of the Site. It is anticipated that the route to the 132 kV tower would follow South Marsh Road.

4.17 Start-up, Shutdown and Abnormal Operations

Start-up and Shutdown Operations

4.17.1 The EfW facility will be started and stopped automatically, under the supervision of trained operators, using auxiliary fuel to reach safe combustion temperatures before any RDF is added. The flue gas treatment system and emissions monitoring will be in operation before any RDF is added.

4.17.2 Facility shutdown will be carried out in a controlled manner by reversing the start-up process. RDF feeding will be stopped, but the process will continue to operate to ensure that all material is burnt, and any flue gases are cleaned out of the system. Air flows will be left on to allow the boiler to cool down before the facility is fully shut off.

4.17.3 If any emergency condition is reached, or if a rapid facility shut down is required, the facility will stop automatically in a rapid manner. Fuel flows and air flows will be stopped instantly causing combustion to cease quickly. The boiler can be depressurised via safety valves if required. This system will be fully interlocked to prevent manual intervention unless it is safe to do so.

4.17.4 The facility will also be protected in case of a complete loss of power, a “black plant” trip. In this case, the process will stop as under an emergency stop. Control systems will be supplied from an Uninterruptable Power Supply (UPS system) to ensure the operators are aware of what is happening.

4.17.5 These systems are well proven and are utilised in other European and UK energy from waste facilities.

4.17.6 Times when the EfW facility operates outside the requirements of IED are likely to occur during start-up and shutdown processes and periods when specific aspects of the process (including continuous emissions monitoring system (CEMS) equipment) are not functioning correctly (known as abnormal operations).

4.17.7 During start-up and shutdown periods, the emission limits as defined in the waste incineration articles of the IED do not apply as the plant is not combusting fuel. Therefore, a signal would be sent from the main plant control system to the CEMS package to indicate when the plant is operational and burning fuel. The averages would only be calculated when this signal was sent, but raw monitoring data would be retained for inspection.

4.17.8 During start up and shutdown the boilers will be required to vent steam, releasing steam to atmosphere.

4.17.9 In the case of a boiler overpressure event the boiler safety valves will lift resulting in a significant amount of noise and steam being released to atmosphere.

4.17.10 Other abnormal operating conditions along with appropriate abatement and/or control measures will be identified during the commissioning period. Process controls to be in place at the EfW facility as a minimum during abnormal events is outlined in the section below.

<u>Process Control during Abnormal Events</u>

4.17.11 The DCS system will monitor a number of process parameters and in the event the system operation goes outside pre-set criteria, an alarm will sound. The types of alarms installed at the facility may include:

- Basic alarms – these will be generated by detecting deviations on single process measurements or on single items of equipment; and
- Aggregated alarms – these will be generated from a process section and indicate a plant operational issue (e.g. burner stopped, ash transport stopped, shot cleaning stopped).

4.17.12 All alarm events will be logged and time-stamped in the DCS. The alarms inform the operator of operational deviations outside the control criteria and will either:

- require operator intervention; or
- automatically shut down the plant if not acted upon by the operator.

4.17.13 Alarms will have separate parameters that define the conditions for the alarm being active or not, and these can be acted upon from the operator control console. Operators will be required to record in an operational log the reason for the alarm being set off, and any subsequent action taken; these records will be retained on Site as part of the EMS.

4.17.14 If any incident endangers or is likely to endanger personnel (e.g. an external steam leak), or there is a risk of serious damage to the plant (e.g. loss of water from the boiler drum following a burst tube), the emergency shut-down procedure will be followed.

4.17.15 The operator will develop specific operating procedures for the various possible scenarios according to the likelihood of incidents in the plant, taking into account the safety of personnel, then as far as possible, the safety of the plant.

4.17.16 In order to ensure that the plant operates safely and within the limits of the Environmental Permit and with high availability, various items of standby equipment and control system elements will be provided at the facility.

4.17.17 In addition, various monitoring procedures will be undertaken by the operator to ensure that the combustion parameters and emissions remain within the limits set by the Environmental Permit.

Typical Failure Modes

4.17.18 The list below identifies some typical failures and potential actions and control measures.

- **Failure of the export/ import electrical supply:** If the export/ import supply fails the plant will continue to operate in island mode, i.e. generating its own power. If the turbine trips, then the import electrical supply ensures the safe shutdown of the plant. If the turbine trips then the auxiliary diesel generator system ensures the facility can be shutdown safely. If the auxiliary diesel generator system fails, then the operator will initiate an Emergency Shutdown, using the Uninterruptable Power Supply (UPS) to supply the CEMS to monitor that combustion conditions and emissions comply with the Permit.
- **Failure of the FGT equipment:** There will be various standby equipment, and buffer storage capacities within the FGT system. If a total acid gas abatement system failure occurs, then the reagent recirculation system and unspent reagent on the filter bags should ensure that the plant will remain within the emission limit values in the permit, during the emergency shutdown.
- **Failure of ash handling equipment:** In the event of a failure of bottom ash and FGT residue conveyors, then diverter chutes and bypasses are utilised to avoid shutdowns. In the event of a failure of grate rams and combustion air or ID fans, the operator will initiate a controlled shutdown. The combustion conditions and emissions will continue to comply with the Permit; if this cannot be achieved then procedures for abnormal operations will be implemented.

4.18 Raw Materials

Raw Materials Inventory

4.18.1 The main raw material to be used at the EfW facility will be the solid fuel comprising RDF and similar fuels. It will be delivered to the area by bulk transfer vehicles.

4.18.2 Other raw materials required would include hydrated lime or sodium bicarbonate, ammonium hydroxide or urea, activated carbon and fuel for site vehicles and auxiliary burners.

4.18.3 Diesel will be required intermittently to provide auxiliary burning, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls below 850°C. It is proposed to store a small quantity of diesel at the facility for the auxiliary generator.

4.18.4 Ammonium hydroxide (as a 25% solution) or urea is likely to be used for SNCR. Ammonium hydroxide will be delivered to the facility in bulk by road tanker. Alternatively, urea could be used instead of ammonium hydroxide in the SNCR; if used, urea will be delivered in either solid form or as a solution.

4.18.5 The materials for use in the FGT have been selected for optimum performance characteristics in the abatement of emissions to air. No alternative materials have been identified of lower potential environmental hazard that would provide the same level of performance within the plant.

4.18.6 Other materials such as machinery lubricating oil and water treatment chemicals will be delivered and stored in small quantities (typically less than 1 tonne). There will be a dedicated chemical storage area in the workshop, where the chemicals will be kept under cover on impermeable hardstanding with sealed drainage.

4.18.7 Other materials required for the operation and maintenance of the facility, stored in small quantities within the workshop, could comprise:

- oils and greases including hydraulic or silicone based oils;
- antifreeze/Glycol;
- welding gases;
- carbon dioxide or other firefighting gases;
- reverse Osmosis membranes;
- electrical insulating gas for switchgear panels (SF6 gas);
- refrigerant gasses for air conditioning plant; and
- calibration gases.

4.18.8 An inventory of raw materials to be used within the EfW facility is provided in Table 4.5 below. Raw material storage locations are indicated in the Facility Layout drawing (Figure 4, see Appendix 1).

4.18.9 Material Safety Data Sheets (MSDS) for all materials used at the facility, together with tank inventories and inspection information will be held at the facility. The proposed raw materials have been selected according to performance characteristics and with regard to the requirement for minimisation of emissions of trace impurities and any associated impacts on the environment. No opportunities for substitution with potentially less harmful materials have therefore been identified.

Table 4.5 Indicative Annual Raw Material Requirements

Raw Material	Process	State (@STP)	Typical On-site Storage Quantity	Typical Usage (tpa)	Environmental Impact
RDF and similar fuels	Fuel / feedstock	Solid	26,400m^3	753,500[(1)]	Non-hazardous waste only will be accepted at the EfW facility. This will mainly be commercial and industrial waste after it has been processed.
Hydrated lime or sodium bicarbonate	Flue gas treatment – acid gas scrubbing	Solid	130m^3	10,500	Injected reagent is removed with the FGT residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility. Causes severe irritation and burns. Harmful if swallowed. No toxicity data available

Raw Material	Process	State (@STP)	Typical On-site Storage Quantity	Typical Usage (tpa)	Environmental Impact
Ammonium hydroxide (25% solution) or urea	Flue gas treatment – NOx reduction	Liquid	60m^3	2,185	Toxic – harmful in swallowed or inhaled. Corrosive to eyes, skin and respiratory tract. Reacts with nitrogen oxides to form nitrogen, oxygen and water vapour, any unreacted ammonia is released to atmosphere at low concentrations and is continuously monitored.
Powdered Activated carbon	Flue gas treatment – dioxins/ heavy metal	Solid	50m^3	350	Injected carbon is removed with the FGT residues at the bag filer and disposed of as hazardous waste at a suitable licenced facility. Not classed as environmentally hazardous.
Low sulphur fuel oil (diesel)(2)	System firing	Liquid	140m^3	1,000	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Hydraulic and silicone based oils	Maintenance	Liquid	<1t	<5	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Corrosion inhibitor,	Boiler treatment	Liquid	<1t	<5	Soluble in water and affects pH.

Raw Material	Process	State (@STP)	Typical On-site Storage Quantity	Typical Usage (tpa)	Environmental Impact
scale inhibitor, Biocide, ion exchange resins	chemicals				Potential for bioaccumulation is very low.
Acids for pH control	Boiler treatment chemicals	Liquid	$2m^3$	<5	Soluble in water and affects pH. Potential for bioaccumulation is very low.
Notes: (1) Based on nominal plant operational availability of 89.6%. (2) Based on 10 starts per year per boiler (assuming 2 boilers), each start using 43 tonnes of diesel. 10% has been added to the total figure to account for other uses e.g. maintaining the temperature above 850°C. Delivery size is expected to be nominal.					

Minimising the Use of Raw Materials

4.18.10 The plant has been designed such that the addition of auxiliary raw materials (e.g. for abatement purposes) will be carefully controlled and optimised according to on-line monitoring or sampling and analysis schedules, to minimise use and prevent emissions or waste. Details of proposed process control systems are presented in Section 4.15, and are considered to represent BAT for minimisation of raw material use for the EfW facility.

4.18.11 Efficient use of fuels is incorporated into the plant design both through the use of good combustion controls and through the efficient heat recovery within the boiler system.

Waste Minimisation

4.18.12 The facility will implement procedures outlining techniques compliant with the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration to minimise the production of residues. These procedures will be developed prior to commencement of operations.

Fuel Homogeneity

4.18.13 Improving fuel homogeneity can improve the operational stability of the plant, leading to reduced reagent use and reduced residue production. Homogeneity of fuel will be achieved by mixing the fuel in the storage bunker by cranes.

Furnace Conditions

4.18.14 Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal. Burnout in the furnace will reduce the total organic content (TOC) of the bottom ash to less than 3% by optimising fuel feed rate and combustion air flows. SNCR reagent dosing will be optimised to reduce ammonia slip.

Flue Gas Treatment Control

4.18.15 Close control of the FGT system will minimise the use of reagents, and therefore minimise the residues produced from it. Variable speed screw feeders will ensure the dosing rate can be rapidly and precisely varied to match the acid load.

4.18.16 Back-up feed systems will be provided to ensure no interruption in dosing. The bag filter is designed to build up a filter cake of unreacted reagent, which acts as a buffer during any minor interruptions in dosing.

Water Use

4.18.17 The primary requirement for water is to provide make-up for the steam cycle (to replace that which is blown down) and in the FGT plant. The quantity required in the FGT plant will be dependent on the particular FGT technology used and therefore the figures quoted below are indicative of FGT systems used.

4.18.18 Based on previous experience of the project engineers, it is expected that the average water consumption for the EfW facility will be around 14t per hour during normal operation; therefore, on the basis of 7,850 operating hours a year it is anticipated that approximately 118,000t of water will be required for the EfW facility operation annually.

4.18.19 Additionally, in accordance with NFPA 850, the facility will be capable of re-filling the fire water tank within 8 hours. Based on the current sizing of the fire water tank, this will require a peak flow rate of 250 tonnes per hour.

4.18.20 Towns water will be imported for the following uses:

- Feed into the demineralised water system;
- Topping up the process water tank; and
- The administration building for sanitary purposes and drinking water.

4.18.21 A demineralised water production and storage system will be required to fill the boiler and replenish blow down.

4.18.22 Boiler blow down will typically be fed into the process water system, which will supply water for processes such as radiation pass cleaning, or within the flue gas treatment system. If the demand for process water exceeds supply, then the difference will be made up with Towns Water. Conversely, if supply to the process water tank exceeds demand, then it will typically be allowed to overflow to the bottom ash water pit, which would supply the bottom ash quench bath. If there is insufficient capacity within the bottom ash pit to receive overflow from process water tank (unlikely during normal operations), the excess water will be discharged to the foul sewer under a Trade Effluent Discharge Consent, following appropriate analysis.

4.18.23 The bottom ash water pit will also be fed by other process drains, rain water harvesting and reject flow from the demineralisation plant.

4.18.24 An indicative water balance for the facility has been produced and is shown in Figure 7 in Appendix 1.

4.18.25 The following key points should be noted:

- The water system has been designed with the key objective of minimal consumption of potable water.

  The water balance only shows the water into and off site. It does not show any flows on-site that are effectively within a closed loop, such as the live steam mass flow. The steam export to the CCGT power station is a closed loop since it is assumed that all condensate is returned; therefore it does not affect the overall water consumption and is not shown in this balance. Similarly, it should be noted that the steam/ water cycle losses demonstrated in the water balance represent 50% of the top-up water that is fed to the boiler (i.e. 50% of the losses from the steam cycle are attributable to cycle losses and 50% to boiler blowdown) and not 50% of the feed water or steam mass flow rate. This is in line with other similar operations.

- Some of the steam produced will be exported to the CCGT power station; thereby improving the overall efficiency of the combustion process. Should soot-blowing be used, it will result in a minimum amount of steam being lost, and some boiler water will be lost as blowdown to prevent build-up of sludge and chemicals, and through continuously flowing sample points.
- The water balance shows that nearly 60% of the water used at the facility is within the FGT system. This mass flow rate is based on a conditioned dry FGT system, where water is injected along with lime (or sodium bicarbonate) and activated carbon to control emissions. The purpose of the water is to control the flue gas temperature to the optimum for the reaction processes and to help increase the efficiency of the recirculated residue (the water helps to break down the external layer of reacted material on the recycled FGT residue). The figure has been reviewed against existing technology for similar operations and is considered to be appropriate. If a dry FGT system is used rather than a conditioned or semi-dry system then this water usage would reduce significantly.
- The facility will have completely separate foul sewer systems and storm water systems (surface drainage).

4.19 Waste

4.19.1 All waste produced at the facility will be managed in accordance with applicable regulatory requirements. All waste materials will be stored appropriately and will be managed to optimise recycling and re-use opportunities and prevent escape of waste materials.

4.19.2 Individual sources of waste are discussed below.

<u>Incinerator Bottom Ash (IBA)</u>

4.19.3 Boiler ash will be collected in hoppers and conveyed back to bottom ash ejector to be mixed with the IBA. IBA will either be recycled for use in the production of aggregate or landfilled.

4.19.4 It is expected that following quenching, up to 179,000tpa of wet IBA will need to be collected from the facility. IBA will be discharged into an ash bunker for temporary storage awaiting final disposal, which will be situated inside the main facility, sized for 5 days of storage.

4.19.5 Details of IBA handling at the EfW facility are outlined in paragraphs 4.14.2 - 4.14.4.

<u>Flue Gas Treatment Residue</u>

4.19.6 FGT residues comprise fine particles of ash and residues from the flue gas treatment process which are collected in the bag filters. The FGT residue will be stored in a sealed silo adjacent to the FGT plant. It is estimated that the facility will generate approximately 20,600 tonnes per annum of FGT residue.

4.19.7 FGT residue is designated as hazardous waste (due to its alkaline nature) and therefore will be sent for off-site treatment prior to disposal at an appropriate facility. Should options for recovery of FGT become available then these will be explored.

4.19.8 Details of FGT residues handling at the EfW facility are outlined in paragraphs 4.14.5 - 4.14.6.

Process Effluent

4.19.9 Process effluents will be produced from the boiler water treatment system and from boiler blow-down. All process effluent will be fed to the ash discharger via the process water system. It is anticipated that all process effluent fed to the ash discharger will be uncontaminated, as only non-hazardous fuel will be combusted in the EfW facility, thereby ensuring that the IBA remains non-hazardous.

4.19.10 Process effluent will be collected in a storage tank to balance the amounts generated and disposed of to the ash quench. Any overflow from the process water tank will be discharged to the bottom ash pit; however if there is insufficient capacity in the bottom ash pit, then the overflow will be discharged to the foul sewer, following appropriate analysis, and in compliance with a Trade Effluent Discharge Consent.

4.19.11 It is not expected that any process effluent will be discharged to the foul sewer system under normal plant operation.

Other Wastes

4.19.12 Any ferrous material recovered from IBA would be stored in skips or bins prior to collection for off-site recycling.

4.19.13 Minor quantities of waste oils associated with maintenance activities will be generated. These will be stored in suitable waste oil containers prior to off-site disposal via a licenced waste management operator.

4.20 Energy Use

4.20.1 It is estimated that the facility will require approximately 6.5MW_e for plant operation.

4.20.2 Under normal operating conditions, the power requirements of the facility will be supplied by the steam turbine generator with the balance exported to the grid. In the event of a breakdown of the steam turbine generator, the power for the facility will be supplied from the distribution or transmission network.

4.21 Energy Efficiency

General

4.21.1 The generated steam will supply a steam turbine to generate electricity. The facility will supply electricity via a power transformer which will increase the voltage to the appropriate level.

4.21.2 The BAT-associated energy efficiency level (BAT-AEEL) included in the current draft of WI BREF for gross electrical efficiency of new EfW facilities incinerating municipal solid waste and other non-hazardous waste is 25 – 35% (for facilities with the primary purpose of electricity generation) or a gross heat efficiency greater than 72% (for facilities with the primary purpose of heat generation. However, no BAT-AEELs are provided for EfW facilities which operate as co-generation plants i.e. which are not oriented to produce mainly electricity or mainly heat.

4.21.3 The EfW facility will operate to produce up to 49.9MW of electricity of which 43.4MW will be available for export, with a capability to export approximately 84MW of heat energy as steam (gross). Due to the fairly balanced electrical and heat output from the facility, it is considered to represent a co-generation plant, instead of an electricity or heat generation plant. It is therefore considered to be outside the current drafting of the BAT-AEELs provided in the revised draft WI-BRef.

4.21.4 In accordance with the requirements of the EA CHP Readiness guidance note, the facility is being designed to be Combined Heat and Power (CHP) Ready. A CHP Readiness assessment has been prepared (see Appendix 8). This considers potential heat users in the vicinity and also the potential envelope for provision of CHP from the EfW facility. At this stage no additional infrastructure is anticipated to be required although space has been retained within the indicative concept layouts to ensure the EfW facility is CHP Ready.

4.21.5 A suitable BAT-AEEL calculation methodology for an EfW facility like SHBEC, i.e. for a facility operating with a condensing steam turbine that is not designed to condense all of the steam produced due to steam being exported at high pressure prior to the steam turbine inlet, has not been confirmed in the current WI-BRef draft. However, a method for calculating efficiency has been included in a proposed Annex to the BRef on BAT-AEELs (as proposed by the Confederation of European Waste-to-Energy Plants (CEWEP)); it should be noted that this method has not been confirmed by the EA and is subject to change.

4.21.6 Considering the absence of other suitable methodology, the methodology within the proposed WI-BRef Annex has been used for the purpose of estimating the energy efficiency of the EfW facility. The proposed methodology uses data for the steam flow to the steam turbine and the exported steam flow to create a ratio that is applied to the thermal input. This provides a thermal input that is applicable to electrical generation, and a thermal input that is applicable to heat export, allowing gross efficiency to be calculated for each element.

4.21.7 Based on a thermal input to the boilers of 240MW, the expected proportion of steam going to steam turbine (around 70%, based on mass flow rate), and the gross electrical output of 49.9MW, the gross electrical efficiency of the facility is expected to be 30%.

4.21.8 The facility will therefore be compliant with the required BAT-AEEL for an electricity generation facility.

<u>Basic Energy Requirements</u>

4.21.9 An indicative heat balance for the facility is shown in Figure 9. Final details of the energy flow will be confirmed during the commissioning of the plant.

4.21.10 The most significant electrical consumers at the facility are anticipated to be:

- combustion air fans;
- induced draft fans;
- boiler feed water and cooling water pumps;
- air cooled condenser fans;
- air compressors;
- fuel loading systems and ash and residue conveying systems; and
- offices and ancillary rooms.

4.21.11 The facility will be designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high standards of cladding and insulation etc.

4.21.12 The facility will be designed to achieve a very high thermal efficiency. In particular:

- the boilers will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the fuel that is being burnt;
- unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water; and
- steady operation will be maintained where necessary by using auxiliary fuel firing.

4.21.13 Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat transfer.

Operating and Maintenance Procedures

4.21.14 The existing general operating and maintenance procedures in place for the CCGT power station will be extended to include the operation of the EfW facility.

4.21.15 The operating and maintenance procedures include the following aspects:

- Good maintenance and housekeeping techniques and regimes across the whole EfW facility;
- Plant condition monitoring carried out on a regular basis, to ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks;
- The maintenance programme will include a system of regular visual inspection of equipment used to prevent uncontrolled air ingress into the combustion system. This will include undertaking inspections of compensators and seals; and
- Operators trained in energy awareness and encouraged to identify opportunities for energy efficiency improvements.

Energy Efficiency Measures

4.21.16 There are several aspects of the concept design that have been included to improve the efficiency of the water-steam cycle of the facility, including:

- primary and secondary air preheating;
- condensate and feedwater heating;
- a live steam temperature greater than 400°c;
- variable speed drives for boiler feed-water pumps, combustion air fans and ACC fans; and
- low energy lighting throughout the EfW facility, with proximity sensors.

4.21.17 An energy efficiency plan for the facility will be developed and added to the operation and maintenance procedures for the CCGT power station. This plan will be reviewed annually as part of the ISO14001 process.

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

Further Energy Efficiency Requirements

4.21.19 According to available guidance from the government[8], electricity generated from renewable sources of energy such as biomass and waste is considered to be 'renewable source electricity'. Fuels derived from waste are regarded as renewable fuel sources for energy generation, provided fossil fuel does not make up 90% or more of its energy content. Installations generating electricity using waste derived fuels are exempt from the requirements of the European Union Emissions Trading Scheme (EUETS). The EfW facility will therefore not be subject to a Climate Change Levy agreement, and it is exempt from the European Union Emissions Trading Scheme (EUETS).

4.21.20 The facility is currently designed to generate approximately 49.9MW_e gross (43.4MW_e net).

4.21.21 The section in the guidance relating to municipal solid waste (MSW) incinerators suggests that 5MW to 9MW of electricity should be recoverable per 100,000 annual tonnes of waste. The EfW facility will export up to 43.4MW of electricity from a maximum fuel throughput of 753,500tpa (at nominal operational availability), which equates to approximately 6.6MW per 100,000 annual tonnes of fuel. In addition to direct export to the electrical network, the facility will also recover heat as steam export to the CCGT power plant, where it will be used to generate electricity; this has not been included for this calculation. The efficiency of the proposed EfW facility therefore complies with the benchmark efficiency figures.

Maximising the Provision of Renewable Energy

4.21.22 The facility will be designed to be 'CHP-ready'. The facility will export heat to the CCGT power station as part of normal operation; furthermore, off-site opportunities for heat export from the EfW facility are also being explored by the operator. If viable CHP opportunities are identified in the future, then there would be additional carbon reduction benefits associated with the offset of grid gas and electricity to generate heat.

4.21.23 A CHP-Ready assessment has been prepared for the facility (see Appendix 8) which has identified that there are no viable external options for CHP to be utilised immediately. The assessment will be reviewed and updated if any additional heat or steam opportunities are identified in future.

4.22 Management Systems

4.22.1 SHBPS has an environmental management system (EMS) in place for the CCGT power station, which is certified to ISO14001. Specific procedures for the operation of the EfW facility will be developed by the operator, and included within the installation's EMS, which will be extended to include the operation of the EfW facility.

4.22.2 A system for keeping all relevant records will be developed and implemented for the EfW facility prior to commissioning, including but not limited to:

- waste transfer/duty of care documentation;
- records of incidents, accidents and emergencies including details of follow-up; and

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[8] Notice: Excise Notice CCL1/3: Climate Change Levy - reliefs and special treatments for taxable commodities, HMRC, updated 27 March 2018, accessed at https://www.gov.uk/government/publications/excise-notice-ccl13-climate-change-levy-reliefs-and-special-treatments-for-taxable-commodities/excise-notice-ccl13-climate-change-levy-reliefs-and-special-treatments-for-taxable-commodities#supplies-excluded-from-ccl on 14 September 2018

- any other records required to be kept by the permit.

4.22.3 The EMS for the installation will also be revised to include procedures to control the inspection, storage and onward disposal of unacceptable fuel at the EfW facility.

4.22.4 Prior to commencing commissioning of the EfW facility using RDF and similar fuels, all key procedures for operations and maintenance will be in place as detailed below.

4.22.5 Normal and emergency procedures will be put in place to ensure that those operations which have the potential to give rise to significant environmental effects are controlled. Procedures will not only cover normal operation but will also address abnormal operation, including start-up and shutdown.

4.22.6 In particular procedures will be developed in relation to:

- waste reception and handling, including waste acceptance procedures;
- control of the combustion process, to ensure good combustion is achieved and compliance with the requirements defined in the waste incineration articles of the IED and WI-BRef;
- operation of the flue gas treatment systems;
- storage, handling and removal of wastes from the facility;
- critical responses to abnormal key alarms and other abnormal operations.

Personnel

4.22.7 All personnel associated with the execution or the operation of the facility will have suitable experience and qualifications.

4.22.8 Site roles will be defined and will include details on relevant qualifications and training (including where relevant on the job training) required for that role. Records of training will be stored and maintained at the facility, and within the EMS.

4.22.9 The shift teams will be led by suitably qualified and experienced personnel who will have the responsibility for managing the operations. There will be a high degree of automation in the facility with the plant and key processes controlled from a control room using a DCS system based on programmable logic controllers. A fully automatic fuel grab crane is to be installed which removes the need to man the grab crane during the majority of normal operation. The weighbridge will also be fully automated with a vehicle recognition system and traffic barrier control system.

4.22.10 Key roles at the EfW facility are anticipated to be:

- Facility Manager;
- Operations Manager;
- Engineering Manager;
- Finance Manager;
- Supervisor/Engineer – Mechanical;
- Supervisor/Engineer – Instrumentation and Controls;
- Supervisor/Engineer – Electrical;
- Shift Team Leaders;
- Operators;
- Day Team Supervisor;

- Day Operators;
- Crane Operators;
- Weighbridge Operatives;
- Maintenance Technicians;
- Quality Assurance Manager; and
- Health, Safety and Environmental Manager.

4.22.11 All roles and responsibilities for the personnel at the facility will be finalised at the detailed design stage; some of the roles may be shared with the CCGT Power Station.

4.22.12 All induction procedures for the installation will be extended to include the operation of the EfW facility, and all Site personnel will be subject to Site specific inductions relating to operating either in the project execution or operation.

4.22.13 Existing procedures to ensure that only suitably qualified and experienced contractors are employed on Site will be applied to the proposed operations.

Training and Competence

4.22.14 The facility will be operated by competent personnel with appropriate qualifications. The facility manager (or Competent Duty Holder(s)) will hold relevant technical qualifications and experience appropriate to their roles and responsibilities.

4.22.15 WAMITAB certificates cannot be supplied at the time of application submission, as the Operator has yet to recruit key operational personnel. Copies of relevant certificates for appointed personnel will be provided to the Environment Agency prior to the facility becoming operational.

4.22.16 Operator training will be provided to ensure that the facility will be operated by a fully trained workforce. The operator will set out individual training programmes for personnel for specific operations, in line with technical operating requirements advised by the technology provider to ensure maximum safety and efficiency in operation. Training will not only address normal operations but will also include those actions required in the event of abnormal operations and emergencies.

4.22.17 On an ongoing basis employees will be trained and made aware of the possible environmental impacts of their activities and emergency response training will be undertaken in line with the existing management procedures.

4.22.18 Training will be reviewed to ensure competency and awareness of persons working at the facility in line with existing procedures, and as a minimum will be reviewed:

- at induction for new employees including identification of training needs and an opportunity specifically to provide overall awareness of the EMS, so that they understand the environmental and health and safety implications of their activities;
- annually as part of job specific competency assessments to ensure compliance with operating criteria, legal requirements and customer needs. At this time training needs will also be reviewed to identify any additional training requirements;
- as specified on a training certificate; and
- in response to change – particularly when responsibilities are revised, new methods of working are introduced, new or modified operations are to be implemented and when changes in Site conditions create the need for new skills and knowledge.

4.23 General Maintenance

4.23.1 All equipment within the EfW facility will be subject to a Planned and Preventative Maintenance Programme where appropriate to minimise unplanned failures. The existing maintenance procedures and programmes for the installation will be updated to include the maintenance of equipment at the EfW facility.

4.23.2 Planned maintenance routines are established to ensure all key plant components which have the potential to affect the environmental performance of the installation remain in good working order; these routines will be amended as appropriate to include the EfW facility. The plant preventative maintenance regime will include regular checks and calibration of the dosing systems to ensure optimum operation.

4.23.3 Work performed during outages include:

- major component service and repairs;
- life cycle replacements;
- condition surveys such as boiler tube thickness surveys and fabric filter condition surveys;
- turbine service inspections;
- annual inspections and replacements; and
- insurance and statutory inspections.

4.23.4 Inspections will include but not be limited to the:

- furnace;
- refractory;
- combustion system;
- heat recovery systems;
- ductwork;
- flue gas treatment plant; and
- ash handling and storage systems.

4.23.5 Data will be recorded and stored to build data files for each monitored component, for later planning and maintenance work requirements.

4.23.6 The turbine/generator statutory inspections will be planned to coincide with the annual outage.

4.23.7 Critical process control instrumentation will be calibrated and tested during annual outages.

<u>Maintenance Management System</u>

4.23.8 The maintenance management system for the installation will be updated to include a list of assets, prioritised maintenance schedules, work instructions, equipment history and maintenance records for the EfW facility. The schedule will be planned around the maintenance requirements and will also take account of any shut down periods, holidays and any other extraneous activities.

4.23.9 In summary, the planned preventative maintenance system for the EfW facility will comprise:

- routine maintenance in accordance with maintenance manuals provided by the technology supplier; and
- it is expected that each boiler will be taken offline for maintenance each year for approximately 3 weeks. In addition to annual outages, it is expected that major outages will be required on a less frequent basis, for example, every 6 years. A major outage could be expected to last for up to 5 weeks.

4.23.10 The programme covers all assets that require any form of planned or preventative maintenance, including mandatory tests and inspections such as pressure vessels, safety items and lifting gear. Maintenance tasks for all plant and equipment are based on manufacturer's guidance, warranty agreements, company standards and experience. All plant and equipment will be afforded an appropriate periodicity or critical measured parameter and a priority in accordance with facility requirements.

4.23.11 Various operational parameters and all alarms at the facility will be subject to routine checks and monitoring schedules. The routine monitoring requirements will be dependent on maintenance manuals provided by technology suppliers.

Reactive Maintenance

4.23.12 All reactive maintenance issues will be directed through correct communication channels to enable an immediate decision to be made regarding responsibility, priority, manpower requirements, authority levels and response time.

5.0 EMISSIONS TO AIR, WATER AND LAND

5.1 Emissions to Air

Source Characterisation

5.1.1 The main point source releases from the EfW facility to air will be from the two main stacks (Release Points A17 and A18), and one smaller stack (Release Point A19) for the auxiliary generator (back-up generator engine). In addition to these releases there are a number of pressure relief valves at the facility which are part of the plant emergency protection arrangements (Release Points A20 - A29).

5.1.2 The CCGT power station and the EfW facility are located in close proximity to each other so there is the potential for 99.79th percentile 1 hour NO_2 impacts to coincide in the same geographical location. Therefore separate analysis of this pollutant averaging period was also undertaken.

5.1.3 All release sources are identified in Table 5.1**Error! Reference source not found.** below.

Table 5.1: Point Source Releases to Air from the Installation

Point Reference	Plant Source	Emissions
A1-A3 - Existing CCGT units	Existing plant	As shown in existing installation permit reference EPR/MP3235LY/V006
A4 – A16 - Various vents	Existing plant	
A17 - EfW line 1 stack	Combustion of residual wastes	Oxides of nitrogen Sulphur dioxide Carbon monoxide Particulate matter Volatile organic carbons Hydrogen chloride Hydrogen fluoride Metals Dioxins and furans Water vapour Carbon dioxide
A18 - EfW line 2 stack		
A19 - Auxiliary generator	Auxiliary generator for start-up and shutdown	Oxides of nitrogen Sulphur dioxide Carbon monoxide Particulate matter
A20 - Steam/relief vent boiler/other	Pressure relief	Steam
A21 - Steam/relief vent boiler/other		
A22 - Steam/relief vent boiler		
A23 - Steam/relief vent boiler		
A24 - Diesel fuel tank vent	Breather vent from tanks	Hydrocarbon vapour
A25 - Steam/relief vent process auxiliaries	Pressure relief	Steam
A26 - Steam/relief vent		

Point Reference	Plant Source	Emissions
turbine		
A27 – Steam/relief vent boiler auxiliaries		
A28 - Steam/relief vent boiler		
A29 - Steam/relief vent boiler		

<u>Stack Characteristics</u>

5.1.4 The principal source of emissions to atmosphere from the normal operation of the proposed EfW facility will be from the two 100 metre stacks, one from each of the two combustion lines (Release Points A17 and A18). Emissions will include oxides of nitrogen, sulphur dioxide, particulate matter, trace metals, organic compounds, carbon monoxide, carbon dioxide and water vapour.

5.1.5 The dimensions of each stack are shown in Table 5.2 below.

5.1.6 In addition to the two main stacks, there will be a shorter stack servicing the auxiliary generator (Release Point A19).

Table 5.2: Main Stacks at Operational Design Load

Parameter	Unit	EfW Stack 1	EfW Stack 2
Stack position	(NGR) m	523169, 413484	523175, 413447
Stack release height (above ground level)	m	100	100
Effective internal stack diameter	m	2.75	2.75
Flue temperature	°C	120	120
Moisture content	% Volume	0.19	0.19
Flue O_2 content (dry)	%	7	7
Efflux velocity	m/s	15	15
Stack flow (actual)	Am^3/s	89.2	89.2
Stack flow at reference conditions (STP, dry)	Nm^3/s	66.5	66.5
Note: (a) Normalisation takes account of emission temperature, pressure, moisture and oxygen content.			

<u>Emissions Inventory</u>

5.1.7 Table 5.3 summarises the details of the predicted pollutants and the upper limits of the emissions during normal operations.

5.1.8 Emissions from sources A20 – A29 inclusive are primarily steam with a minor fugitive emission from the fuel storage tank. As such emissions are unlikely to be significant and no limits are proposed at this time.

5.1.9 The control techniques to manage the emissions are described in Section 4.12 above.

Table 5.3: Air Emission Levels

Parameter	Daily Average Emissions (BAT-AEL)	Half-Hour Average (IED ELVs)
	mg/Nm^3	mg/Nm^3
A17 and A18 EfW (each line)		
NO_X (as NO_2)	120	400
Total dust (assumed as PM_{10})	5	30
SO_2	30	200
TOC	10	20
CO	50	100
HCl	6	60
HF	1	4
Group 1 metals (Cd + Tl, total)	0.02	
Group 2 metals (Hg)(1)	0.02	
Group 3 metals (Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V, total)	0.3	
Dioxins and furans(9)	0.00000006	
Notes (1) Sample averaging times for metals are 30 minutes to 8 hours (2) Sample averaging times for dioxins are 6 hours to 8 hours, total concentrations of dioxins and furnace calculated as a toxic equivalent		

5.1.10 The Air Quality assessment for the Site is provided in Chapter 7 of the ES Volume I (see Appendix 6), with a summary of the predicted impacts from the emissions shown in Table 5-1 of that report.

5.1.11 The location of the release points for emissions to air for the EfW facility is shown in Figure 4 (Appendix 1).

5.1.12 Proposed emission limit value (ELV) benchmarks for the EfW facility are as defined in the WI BRef (draft) and the IED, as shown in Table 5.3.

5.1.13 No specific emission limit values are proposed for the exhaust from the auxiliary diesel generator.

5.2 Fugitive Emissions to Air

Dust

5.2.1 No significant fugitive emissions to air of gases, vapours, odours or particulates are expected from the facility operations. Potential sources of fugitive emissions to air from the facility are:

- waste delivery and despatch vehicles;
- waste discharge and offloading operations;
- tanker discharge during delivery of FGT reagents;

- raw materials storage and handling (including, FGT reagent silos and ammonia tanks);
- waste and treatment residue storage and handling operations;
- bottom ash storage, handling and loading operations;
- thermal treatment processes;
- material transport around the processes (e.g. conveyors, screws, etc);
- maintenance operations; and
- FGT residue loading operations from the storage silo.

5.2.2 Fugitive dust emissions will be minimised through:

- all loads being delivered or removed from the facility will be covered;
- enclosed tipping hall and fuel bunker where unloading of fuel takes place in an enclosed area;
- tipping hall is equipped with fast acting doors which assist maintaining the enclosed space while still facilitating vehicle entry.
- primary air is drawn from the fuel bunker and tipping hall thus maintaining a negative pressure within the hall and minimizing the release of particulates when the doors are open;
- there will be no outdoor stockpiles;
- closed transport systems will be used for FGT reagents and residue;
- FGT reagents and residue will be stored in purpose-designed silos;
- ash will be transported via enclosed conveyor to a covered IBA bunker for storage and onward transport. Due to the physical nature of bottom ash and quenching applied to it, fugitive emissions from this material are not considered to be significant. There is little potential for dust generation when removed off-site owing to the wet nature of the material.
- maintenance of high housekeeping standards;
- silos for FGT reagents and residue will be equipped with local dust filters;
- furnace system designed to operate under negative pressure to prevent gas escape; and
- waste feed acts as plug in feed chute and seals charging system.

5.2.3 These control measures are considered to represent BAT for the EfW facility. It is therefore not expected that there will be any significant fugitive dust issues with the EfW facility during operation under normal or abnormal conditions.

Litter

5.2.4 The potential for litter releases at the facility has been evaluated, and the likely sources noted include:

- waste delivery vehicles;
- waste discharge and offloading operations; and
- waste storage.

5.2.5 Litter prevention controls include the covering of vehicles delivering the RDF along with tipping and storage of RDF within the enclosed tipping hall.

Mud

5.2.6 The potential for mud has been assessed and is not anticipated to be an issue due to the use of hard-standing around the vehicle routes. In the unlikely event that an issue did arise, then the Operator would arrange for a road sweeper to remove any mud deposits from internal and external roads.

5.3 Emissions to Water

Process Water Discharges

5.3.1 There will be no direct discharge of process effluent to controlled waters from the EfW facility under normal operating conditions. All process effluent from on-site processes will be reused within the EfW facility (predominantly as ash quench). It is anticipated that all process effluent generated on Site will be collected in a storage tank to balance the amounts generated and disposed of to the ash quench. Any excess will be tested prior to being discharged to foul sewer, under a Trade Effluent Discharge Consent.

5.3.2 The combined capacity of the process water and bottom ash water pit will be designed so as to provide sufficient capacity to receive all water drained from at least one boiler. This will eventually be used up in the facility during operation e.g. in the bottom ash quench bath.

5.3.3 Each boiler may be drained annually to allow inspection inside boiler tubes. However, if the boiler is drained, refilled and then has to be drained again in quick succession or both boilers have to be drained simultaneously (primarily during commissioning) there may not be sufficient capacity in the process/bottom ash water tanks. This wastewater stream will in these instances be tested prior to the excess being discharged to foul sewer, under a Trade Effluent Discharge Consent. In case, such a situation arises during the operation of the facility (i.e. outside of commissioning period), the same procedure will be followed.

Surface Water Discharges

5.3.4 The EfW facility will give also rise to uncontaminated surface water run-off from roads, vehicle parking areas, roofs of buildings, other hard standings and landscaped areas. It is proposed that surface water be collected at the facility and conveyed to a surface water attenuation pond via the use of drainage gullies, ditches/swales where possible. Site topography is conducive for flows to be gravity drained to a surface water attenuation area located at the eastern edge of the EfW facility area. It is proposed that this attenuation pond will outfall into one of the existing land drainage ditches located along the boundary of the Site using a flow control mechanism such as a Hydro-Brake to limit the discharge to green field rates. An outline drainage strategy has been developed for the EfW facility as part of the ES Volume III (Appendix14B) and is included in Appendix 6 of this document.

5.3.5 The drains located adjacent to the Site flow east towards the Humber Estuary, and divert water either north to Middle Drain pumping station located on the South Humber Bank located approximately 550m north of the Site, or to Oldfleet Drain that outfalls via a flapped culvert into the estuary approximately 450m south-east of the Site.

5.3.6 A detailed drainage design will be developed prior to commissioning of the plant providing details of surface water discharge from the Site.

5.3.7 The detailed drainage design will need to confirm that the bed levels of the local land drains into which the attenuation solution will discharge are appropriate relative to the bed levels of the storage solution to ensure they are positively drained by gravity (i.e. to confirm that no additional pumping is required). Oil/water interceptors will be located in relevant areas to prevent contamination of the surface water. The detailed drainage design will need to confirm the storage volumes required once the exact impermeable area of the proposed land use is confirmed, and it will need to confirm the exact location and feasibility of the outfall from the attenuation pond into the existing land drainage network.

Fugitive Emissions to Water

5.3.8 The potential for fugitive releases to water (surface water, ground water and sewer) and land at the facility has been evaluated, and the potential sources noted as:

- run-off from waste and treatment residue storage;
- surface run-off from roads and pavements;
- process water storage; and
- fire-waters.

5.3.9 Preventative measures will be in place to prevent fugitive emissions to water, as outlined below.

5.3.10 It is anticipated that oil/water interceptors will be installed from drains in any areas where vehicles will be present. Under normal operational conditions, all drains from the process areas (i.e. within the facility and in reagent delivery areas) are likely to be routed to the bottom ash water tank for re-use in the ash quench bath and will not be discharged from the facility to controlled waters.

5.3.11 All storage facilities for chemicals will be designed in accordance with Environment Agency Pollution Prevention Guidance PPG 2, PPG 3 and PPG 18; although the Pollution Prevention Guidance documents were revoked in February 2016, it is considered that they present best practice measures and would be applied at the facility. The potential for accidents, and associated environmental impacts, is therefore limited.

5.3.12 Adequate quantities of spillage absorbent materials will be made available on-site, at an easily accessible location(s), where liquids are stored. A facility drainage plan, including the locations of foul and surface water drains and interceptors will be made available on-site. The final plan will be available upon completion of the detailed design for the EfW facility.

5.3.13 Tanker off-loading of diesel and ammonia solution/ urea will take place within a contained area. The storage tanks will be bunded at 110% of the tank capacity and the offloading point will be fully contained with the appropriate capacity to contain a spill during fuel or ammonia solution/ urea delivery. Drainage design, delivery area and refuelling area containment will be confirmed as part of the detailed design.

5.3.14 Fuel delivery areas will be served by an oil-water interceptor comprising either a sump capable of containing the maximum volume of a tanker compartment (7,800 litres) or a drainage system to a full retention class 1 forecourt style interceptor with maximum volume of a tanker compartment (7,800 litres). The final design of the interceptor will be confirmed as part of the detailed design process.

5.3.15 The delivery area will be equipped with an isolation valve which will be closed off to prevent spill of chemicals entering the interceptor.

5.3.16 Deliveries of IBC's will be unloaded and transferred to a bunded area for storage prior to use.

5.3.17 In the event of a fire, surface water drain points will be shut off and the firefighting water will be contained at the facility. Following a fire, contaminated water contained within the facility will be pumped out to tankers and transferred off-site to a licensed waste management facility. Details of containment of firewater will be developed as part of the detailed design stage.

5.3.18 All spillages will be reported to the Facility Manager, recorded and reported as required by the facility's EMS. If appropriate, the relevant authorities will be informed if spillages are over a certain volume threshold, as specified in the environmental management procedures.

5.3.19 The effectiveness of the Emergency Plan for spillages is subject to Management Review and will be reviewed following any major spillages and revised as appropriate.

5.3.20 Where contaminated water is not suitable for reuse in the process or discharge with surface water, then it will be discharged to sewer with the sanitary waste from the facility or isolated and removed for treatment. The potential for discharge to sewer will be confirmed as part of the final design for the EfW facility, and a trade effluent consent will be sought should this option be confirmed.

5.4 Emissions to Sewer

5.4.1 No process water will be discharged to the sewer under normal operations. A Trade Effluent Discharge Consent will be obtained by the operator for discharging to the foul sewer under infrequent abnormal conditions.

5.5 Emissions to Land

5.5.1 There will be no emissions to land from the facility. All operations will be situated on concrete hardstanding with sealed drainage so as to prevent accidental loss of materials to ground, and consequently affecting groundwater.

5.6 Odour

5.6.1 Several potential odour release sources have been identified at the EfW facility, predominantly around the presence of RDF. Some of the process residues, chemicals and reagents (such as ammonium hydroxide/urea) which are required to mitigate operational stack emissions are also a potential source of odour if experienced at high concentrations.

5.6.2 Odours from the storage of RDF will be contained within the tipping hall and bunker due to the negative pressure maintained by drawing air from the fuel reception into the combustion process. Air from within the building envelope is used as feed air to the combustion plant, which ensures destruction of odorous compounds before they are emitted to atmosphere. During normal operations, therefore, odour emissions from the main facility building are unlikely to occur.

5.6.3 Other control measures to minimise odour include various good housekeeping measures including: the cleaning of storage areas on a regular basis, monitoring odour, storing FGT residues in sealed containers, loading FGT residues to tankers using sealed systems, storing reagents in sealed containers, recording and investigating odour issues. These measures represent BAT for the control of odours from the EfW facility.

5.6.4 It is anticipated that venting of chemical storage tanks (where applicable) may be required, particularly when the tanks are being filled. It is expected that these events will last only for a short duration. As such, the odour emissions during such events are not considered to be significant, particularly considering the location of the plant near agricultural fields where use of nitrogen based fertilisers is common. Options to vent displaced air back into the delivery tanker will be considered as part of the detailed design for those materials with a high odour potential e.g. ammonium hydroxide solution

5.6.5 In the event that primary odour control measures (e.g. negative pressure and odour destruction by combustion) require additional support, odour suppression, including mist spray deodorising suppression systems would be implemented as necessary. Personnel will be trained in how and when to use the odour suppression system.

5.6.6 During planned maintenance, it is common practice where possible for facilities such as that proposed, to only shut down one of the two lines at a time, leaving the other line to draw feed air from within the building envelope. When both combustion lines would need to be shut down, alternative mitigation can be implemented, for example, the use of a deodorising mist spray within the RDF bunker or ensuring that where possible the bunker is empty prior to any outage.

5.6.7 Under normal operations, therefore, the containment measures built into the building design mean that fugitive odour emissions from the EfW facility would be unlikely to be perceptible at locations outside of the Site boundary, which would not be significant.

5.6.8 With respect to fugitive releases of odour from the facility, these are mainly associated with the waste handling process. To manage any fugitive emissions, in addition to the main odour control systems described above, controls will be put in place to mitigate fugitive releases, including:

- all wastes received at the facility will be in enclosed vehicles/containers;
- use of good housekeeping measures including regular washing down of the waste tipping hall;
- the facility will employ bunker management procedures and good mixing to minimise the potential for development of anaerobic conditions, thereby minimising the potential for generation of odours.
- the main access and egress points used for the tipping hall will be kept closed except during delivery/unloading times. To minimise the build-up of odours, if the fuel bunker is full, then fuel will be diverted away from the facility if it is deemed necessary.
- if possible, the plant would be managed with the intention that at least one line is always operational, using the air from the fuel bunker and tipping hall as primary air, thereby minimising odours. Therefore, it is considered that it would be unlikely for the facility to need further odour controls. Use of two combustion lines is therefore considered to represent BAT for the primary control of odours, through the use of air from the tipping hall and bunker in the combustion system.
- should periods of short term unplanned maintenance occur, when neither stream is operational, doors to the tipping hall will be kept closed and will limit odour egress while still allowing vehicle access.

5.6.9 At this stage, the proposed measures at the facility are considered to be sufficient to manage any odorous emissions from the facility; an Odour Management Plan (OMP) is therefore not considered to be required at this stage. Furthermore, considering the location of the proposed Site within a mainly industrial area, potential for odour issues is considered to be not significant.

5.6.10 Techniques will be in place to prevent and minimise fugitive emissions of ammonia to air in accordance with BAT.

5.6.11 A review of possible odour sources and their control is set out within the Environmental Risk Assessment (ERA) undertaken for the facility (see Appendix 7), undertaken in accordance with the Environment Agency's H1 guidance, Annex A.

5.7 Noise

5.7.1 Noise levels will be regulated as defined in Section 72 of the Control of Pollution Act 1974 (amended 1989) and conform to British Standard ISO 140-4 (1998).

5.7.2 An assessment of the potential noise impacts has been completed and is presented in Chapter 8 of the ES (included in Appendix 6). The location of potential noise sensitive receptors (NSRs) in proximity to the EfW facility has been considered when assessing the effects associated with noise and vibration levels from the operation of the facility. Key NSR locations have been selected which are considered to be representative of the nearest and potentially most sensitive existing receptors to the facility.

5.7.3 Predicted operational noise levels were assessed using the methodology given in BS 4142. A key aspect of the BS 4142:2014 assessment procedure is a comparison between the Background Sound Level in the vicinity of residential locations and the Rating Level of the sound source under consideration.

5.7.4 Predicted operational noise levels were assessed using the methodology given in BS 4142:2014. Based on experience of similar facilities, and due to the large distance between the EfW facility and the closest residential NSRs, the operation of the facility is unlikely to produce significant vibration levels at NSRs. Therefore, further assessment of operational vibration is scoped out of the detailed noise assessment.

5.7.5 Maintenance activities will be required periodically throughout the operational period, but as these are not part of the normal operation of the facility noise from maintenance activities is not specifically assessed in the noise assessment. Similarly the predictions do not account for irregular emergency operations, such as boiler safety valves or steam turbine bypass valves in operation.

5.7.6 As part of the assessment, noise levels at the short and long term monitoring locations (see Table 5.6 below) in the vicinity of the facility were recorded. The background noise levels at these locations include the contribution of noise from the existing CCGT power station.

Table Error! No text of specified style in document.**.4: Monitoring Locations in the Vicinity of the EfW Facility**

Monitoring Location	Address	Distance from EfW Facility
Long Term (LT) Monitoring Locations		
LT1	Poplar Farm, South Marsh Road	1.35km W
LT2	Cress Cottage, Stallingborough	1.52km SW
LT3	Site boundary	Along the southern boundary of the Site
Short Term (ST) Monitoring Locations		
ST1	Estuary edge	Along the wall bordering the Humber Estuary
ST2	Mauxhall Farm, Immingham	3.8km NW

5.7.7 The NSRs for the operational assessments are given in Table 5.7 below and are presented on Figure 8 in Appendix 1.

Table 5.5: Selected NSRs

NSR	NSR Classification	Details
NSR1	Residential	Poplar Farm, South Marsh Road
NSR2		Cress Cottage/ Field Cottage, Stallingborough
NSR3	Ecological	Humber Estuary (SSSI, SAC, SPA, Ramsar)
NSR4		Field to the south of the Site (Non-statutory ecological receptor)
NSR5		Field to the north of the Site (Non-statutory ecological receptor)
NSR6	Residential	Mauxhall Farm, Immingham

5.7.8 Operational noise modelling has been undertaken for the facility for a number of scenarios, depending on operational traffic. These scenarios are:

- Scenario 1: worst-case hour during the day (09:00 – 10:00);
- Scenario 2: worst-case hour at night including HGVs (06:00 – 07:00); and
- Scenario 3: typical one-hour at night – no HGVs (23:00 – 06:00)

5.7.9 Of the identified NSRs above, NSR6 is not expected to be affected by the operation of the proposed facility, due to the distance from the facility; however, the impact on NSR6 due to the increase in traffic when the proposed facility is operational has been assessed in the noise assessment. The assessment therefore reviews noise impacts on the NSR1 – NSR5 from the operation of the facility and the change in traffic volumes.

5.7.10 The BS 4142 assessments for NSRs R1 and R2 as the closest residential receptors during the three scenarios were undertaken for the operational noise. A penalty of 3 dB was added to the specific sound level to determine the Rating Level to account for intermittency as a result of HGV arrivals and departures.

5.7.11 During the worst-case hour during the daytime (Scenario 1) and night-time (Scenario 2), unattenuated operational noise effects at NSR1 and NSR2 were categorised as negligible. The BS 4142 assessment for a typical hour at night with no HGV movements (Scenario 3) was undertaken with no penalty added to the specific noise level. During the night-time period when there are no deliveries of waste (23:00 – 06:00), effects were found to be negligible for both NSRs, with no specifically designed mitigation in place.

5.7.12 Considering the operation of the EfW facility will be 24 hours, provided that noise levels are demonstrated to be acceptable during the worst-case night-time hour of 0600 – 0700 (when the facility is fully operational and there is the greatest number of HGV movements), they are expected to be acceptable during the daytime period when existing ambient noise levels are higher.

5.7.13 A summary of the BS 4142 assessment for the three scenarios at NSRs 1 and 2 is shown below in Table 5.8 below.

Table 5.6: BS 4142 Assessment for NSR1 and NSR2 for Scenarios 1 – 3

Parameter	NSR1			NSR2		
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 1**	**Scenario 2**	**Scenario 3**
Specific sound level Ls ($L_{Aeq,Tr}$), dB	35	35	34	34	35	34
Acoustic feature correction, dB	+3	+3	0	+3	+3	0
Rating level ($L_{Ar,Tr}$), dB	38	38	34	37	38	34
Representative background sound level ($L_{A90,T}$), dB	48	50	41	59	58	42
Excess of rating level over background sound level ($L_{Ar,Tr}$ - $L_{A90,T}$), dB	-10	-12	-7	-22	-20	-8
BS 4142:2014 assessment outcome	Low impact	Low impact	Low impact	Low impact	Low impact	Low impact
Magnitude of impact	Very low	Very low	Very low	Very low	Very low	Very low
Classification of effect	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse	Negligible adverse

5.7.14 With regards to impact on the ecological receptors (NSRs 3 – 5) due to the operation of the EfW facility, the effect on NSR3 is classified as negligible adverse (not significant). However, at NSRs 4 and 5, noise impacts from the operation of the facility are predicted to be greater due to their proximity to the operations.

5.7.15 The increase in the ambient noise level across the fields to the south of the Site (NSR4) is predicted to be between 1 and 6 dB during the night when there are no HGV movements and between 2 dB and 13 dB during the day. During the worst-case night-time hour (0600 – 0700) when the number of HGVs entering and leaving the facility is at predicted to be at its highest, the ambient noise level is predicted to increase from between 1 and 13 dB.

5.7.16 At the fields located to the north of the Site (NSR5), noise from the operation of the facility is predicted to increase the ambient noise level between 1 and 9 dB during the night when there are no HGV movements. During the day, and also during the hours of 0600 - 0700 when there are HGVs movements, ambient levels are expected to increase by between 1 and 11 dB. This is due to all vehicles entering and leaving the facility travelling along South Marsh Lane.

5.7.17 The noise sources that contribute the greatest to the overall predicted levels across NSR4 are noise from the top of the stacks and HGV movements at the facility. The stacks have been inputted into the noise model as unsilenced, therefore with appropriate mitigation to reduce the noise emitted by the stacks, noise levels across ecological sites should reduce.

5.7.18 During the operation of the facility, noise levels at the closest residential NSRs and at the ecological receptors located along the Humber Estuary to the east are predicted to fall well below the measured background noise levels. No significant noise effects are predicted.

5.7.19 At the ecological receptors located immediately north and south of the EfW facility (NSR4 and NSR5), noise levels at the closest parts of the fields to the Site are predicted to exceed ambient noise levels during operation. The ecological impact assessment concludes that, as the majority of waterbirds will be located in the central and eastern parts of these fields, the effects on waterbirds will be neutral, and therefore not significant.

5.7.20

5.7.21 Noise modelling has also been undertaken to determine the change in road traffic noise levels as a result of the operation of the EfW facility. As there are no public roads in close proximity to NSR3 (Humber Estuary), and NSR4 (fields south of the Site) changes in road traffic noise at these receptors have not been calculated.

5.7.22 The ecological impact assessment concludes that operational noise effects on receptors NSR3, NSR4 and NSR5 will be neutral (not significant).

5.7.23 A summary of the BS 4142 assessment for the three scenarios at NSRs 3 - 5 is shown below in Table 5.9.

Table 5.7: BS 4142 Assessment for NSRs 3 - 5 for Scenarios 1 – 3

PARAMETER	NSR3			NSR4			NSR5		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Predicted noise level $L_{Aeq,T}$ dB	47	47	46	45-61	45-62	44 – 55	41-59	41-59	40 – 58
Ambient noise level $L_{Aeq,T}$ dB	53	52	54	48	50	50	48	50	50
Ambient + Predicted $L_{Aeq,T}$ dB	54	53	55	50-61	51-63	51-56	49-59	51-60	50-59
Increase in ambient dB	+1	+1	+1	+2 to +13	+1 to +13	+1 to +6	+1 to +11	+1 to +10	0 to +9

5.7.24 On the basis of the above worst-case assessment and the resulting predicted levels falling well below background and ambient noise levels at NSRs, no significant noise or vibration effects are predicted to occur due to the EfW facility. However, it is proposed that as best practice during the detailed design of the facility, the following will be considered to reduce any noise impact upon the closest NSRs:

- selection of quiet equipment to ensure noise emissions are reduced;
- selection of external cladding that provides a minimum weighted sound reduction of 27 dB Rw;
- selection of louvres/ baffles that provide a minimum weighted sound reduction of 11 dB Rw;
- design of an acoustically treated stack, as the stack is the dominant source contributor to the overall noise levels. Therefore providing acoustic attenuation to the stack will help reduce the overall predicted noise levels, particularly to the Humber Estuary and other ecological receptors; and
- design of cladding, louvres/baffles, silencers and air inlets to ensure the reduction/ elimination of tonal noise from the facility during its operation.

5.7.25 The necessary noise controls will be built in to the detailed design. Therefore, no additional mitigation is considered to be required. During the detailed design phase, noise data/information will be reviewed and where there are likely to be significant changes to what has been assumed certain aspects of the noise assessment may need to be revisited.

5.8 Heat

5.8.1 The hot gases from the combustion process will pass through a boiler to raise steam. The steam generated from the two combustion lines will then be passed through a single steam turbine, which will generate up to 49.9MW of electricity, with the excess steam, comprising circa 84MW of thermal energy, being exported to the CCGT power station for use.

5.8.2 The facility will be designed to be CHP ready, with other off-site opportunities for heat export being reviewed regularly.

6.0 MONITORING

6.1 Infrastructure

6.1.1 An infrastructure monitoring plan will be implemented at the EfW facility once it is operational, so as to protect the soil and groundwater beneath the Site. This will form part of the installation's Site Protection and Monitoring Program (SPMP). Although implementation of formal SPMPs is not a regulatory requirement, it continues to be in place at the installation as a best practice measure.

6.1.2 The SPMP requires regular inspection of all infrastructure associated with bulk storage of oils, chemicals and fuels. The routine infrastructure audits are likely to comprise identification of issues relating principally to:

- minor leaks;
- standing water in bunded areas; and
- oil and chemical tank bunds.

6.1.3 The plan will cover the inspection and maintenance of the generating units, storage tanks, storage areas, drainage networks and surfacing; and will consist of a combination of regular periodic inspections, alongside more infrequent activities such as drainage surveys and bund integrity tests, in line with the systems currently applied at the existing facilities

6.2 Emissions to Air

6.2.1 Emissions from the stacks will be monitored continuously by CEMS equipment, which will be connected to the DCS system, and will be reported in accordance with the EA requirements for the operation of the EfW facility. Sampling and analysis of all pollutants will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards) to ensure the data is of suitable quality. In particular, the CEMS equipment will be certified to appropriate standard (such as MCERTS).

6.2.2 This continuous monitoring will provide the information necessary for the facility's DCS system to ensure safe and efficient operation and warn the operator if any emissions deviate from predefined ranges. The emissions records will be maintained to demonstrate regulatory compliance. Alarms will be configured for each control limit, thus allowing digital outputs to alert operators as emission limits are being approached.

6.2.3 Appropriately designed data acquisition software will be used with the monitoring system, which will be certified to appropriate standards (such as MCERTS) and encompass all the data logging requirements stipulated by EN14181[9]. Quality of recorded data will be undertaken in line with the requirements of Technical Guidance Note M20[10].

6.2.4 Digital signals will be provided to the DCS to indicate the system status and any faults. Daily reports will be generated to show compliance with daily and half hourly emission limits. The system will also generate monthly reports in a format to be agreed with the

[9] BS EN 14181:2014 - Stationary source emissions. Quality assurance of automated measuring systems, British Standards Institute, revised in 2014

[10] Technical Guidance Note (Monitoring) M20 Quality assurance of continuous emission monitoring systems - application of EN 14181 and BS EN 13284-2, Version 4, Environment Agency, July 2018

EA. The unit will also be maintained in accordance with the QAL3 maintenance schedule.

6.2.5 The following parameters will be monitored and recorded continuously at the stack using a Continuous Emissions Monitoring System (CEMS):

- oxygen;
- carbon monoxide;
- hydrogen chloride;
- hydrogen fluoride;
- mercury
- sulphur dioxide;
- nitrogen oxides;
- ammonia;
- VOCs (volatile organic compounds); and
- particulates.

6.2.6 Monitoring will be undertaken as detailed in Table 6.1 below.

6.2.7 Hydrogen fluoride and mercury are currently only required to be periodically monitored under the IED but, considering the mechanism outlined in paragraph 6.11 relating to Hydrogen fluoride, are proposed to be continuously monitored in the WI-BREF; the facility will therefore monitor these parameters as well in compliance with WI-BREF and IED.

6.2.8 The WI-BREF states that continuous monitoring of hydrogen fluoride (HF) is required but can be replaced with periodic monitoring if hydrogen chloride (HCl) levels are proven to be sufficiently stable; this is similar to the current situation under the IED. It is therefore proposed that periodic monitoring of HCl will be undertaken at the EfW facility to demonstrate compliance with the HF BAT-ELVs.

6.2.9 In addition, the flow, water vapour content, temperature and pressure of the flue gases will be monitored so that the emission concentrations can be reported at the reference conditions required by the WI-BRef and IED.

6.2.10 The continuously monitored emissions concentrations will also be checked by an independent contractor at frequencies agreed with the EA; these will be finalised prior to commencement of operations and detailed in the environmental permit.

6.2.11 The continuously monitored parameters plus heavy metals and dioxins and furans listed in Table 6.1 below will also be monitored by means of spot sampling at the frequencies shown.

6.2.12 The methods and standards used for periodic emissions monitoring will be in compliance with the EA guidance and the WI-BRef as indicated in the table.

6.2.13 A sampling point will be located on each stack in a location meeting the requirements of the M1 Monitoring Guidance Note to allow safe collection of representative isokinetic samples

6.2.14 There will be duty CEMSs (one per line) and hot stand-by CEMS. This will ensure that there is continuous monitoring data available even if there is a problem with one of the duty CEMS. The final choice of CEMS technology will be confirmed prior to plant being operational.

6.2.15 The proposed emission limits and monitoring frequency and methods are set out in Table 6.1. These are applied with reference to the BAT-AELs for the Incineration of Waste, and are standardised at 11% oxygen content, dry gas.

Table 6.1: Point Source Emissions to Air – Emission Limits and Monitoring Requirements

Emission Point Ref.	Parameter	Emission Limit (mg/m3)		Reference Period	Monitoring Frequency	Monitoring Standard Method
		Daily	Half-Hourly			
A17 & A18	NO_X (as NO_2)	120	400	½ hour & daily averages	Continuous and Extractive	BS EN 14181 ISO 10849: 1996 Note 1 BS ISO 11564: 1998/Corr 2000
	Total dust (assumed as PM_{10})	5	30	½ hour & daily averages	Continuous and Extractive	BS EN 13284-2 BS ISO 10155: 1995/Corr 2002 BS EN 13284-1
	SO_2	30	200	½ hour & daily averages	Continuous and Extractive	BS EN 14181 BS 6069-4: 1992 (ISO 7935)
	TOC	10	20	½ hour & daily averages	Continuous and Extractive	BS EN 14181 BS EN 12619: 1999
	CO	50	100	½ hour & daily averages	Continuous and Extractive	BS EN 14181 ISO 12039: 2001
	HCl	6	60	½ hour & daily averages	Continuous and Extractive	BS EN 14181 MCERTS performance standards for CEMS BS EN 1911: 1998, parts 1 - 3
	HF	1	4	½ hour & daily averages	Continuous and Extractive	BS EN 14181 CERAM special publication – Draft Std ISO-CD 15713 US EPA Method 26A
	Group 1 metals (Cd + Tl, total)	0.02		Periodic over minimum 30 mins, maximum 8 hour period	6-monthly	BS EN 14385

Emission Point Ref.	Parameter	Emission Limit (mg/m3)		Reference Period	Monitoring Frequency	Monitoring Standard Method
		Daily	Half-Hourly			
	Group 2 metals (Hg)[11]	0.02		Periodic over minimum 30 mins, maximum 8 hour period	6-monthly	BS EN 13211
	Group 3 metals (Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V, total)	0.3		Periodic over minimum 30 mins, maximum 8 hour period	6-monthly	BS EN 14385
	Dioxins and furans[12]	0.00000006		Periodic over minimum 30 mins, maximum 8 hour period	6-monthly	BS EN 1948: Parts 1,2 and 3

6.3 Emissions to Sewer

6.3.1 A Trade Effluent Discharge Consent will be obtained for discharging to the foul sewer under abnormal conditions. Any discharges to the foul sewer will be monitored to ensure compliance with the Trade Effluent Discharge Consent.

6.4 Emissions to Water

6.4.1 No process waters will be discharged to controlled waters during normal operation as these will be reused within the process. In the event of excess process waters, these will be tested prior to the excess being discharged to foul sewer

6.4.2 The key emissions to water will only comprise uncontaminated surface water run-off to a new attenuation pond located within the eastern boundary of the EfW facility, with an oil/water interceptor situated upstream of it to prevent oily contaminants from entering the pond, before being discharged to one of the drainage ditches flowing adjacent to the installation boundary towards the River Humber. The discharge rate from the attenuation pond will be restricted to green field discharge rate via implementation of hydrobrake (or similar equipment). The capacity of the attenuation pond and location of the final discharge point from the pond will be finalised during the detailed design stage.

6.4.3 Measures will be taken to ensure accidental releases such as oil or chemical spills, and/or firewater do not enter the surface water drains. Such measures will be confirmed as part of the final design prior to commencement of proposed operation,

[11] Sample averaging times for metals are 30 minutes to 8 hours
[12] Sample averaging times for dioxins are 6 hours to 8 hours, total concentrations of dioxins and furnace calculated as a toxic equivalent

and are likely to include isolation valves such as penstocks, or source control measures such as booms or absorbent systems.

6.5 Monitoring of Process Variables

6.5.1 The process variables which have particular potential to influence emissions will be monitored as follows:

- fuel throughput will be recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput will be recorded;
- combustion temperature will be monitored at suitable positions to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C;
- the oxygen concentration will be measured at the outlet from the boiler;
- the differential pressure across the bag filters will be measured, in order to optimise the performance of the cleaning system and to detect bag failures; and
- the concentration of HCl in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment.

6.5.2 Additionally, water use will be monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This will be achieved by monitoring the incoming Towns water, the water treatment plant, and the boiler water makeup.

7.0 ENVIRONMENTAL RISK ASSESSMENT (IMPACT ASSESSMENT)

7.1 Introduction

7.1.1 An assessment of the risk posed to the environment from emissions from the normal operation of the facility and foreseen abnormal operations has been undertaken in accordance with the EA's guidance on Environmental Risk Assessment[13]. Where necessary, appropriate modelling has been undertaken to ensure that any predicted significant effects on sensitive receptors can be avoided or mitigated. The results of the modelling assessments are reported in the Air Quality Assessment and Noise Assessment which are included in Chapters 7 and 8 of the ES Volume I (see Appendix 6) respectively.

7.1.2 Additionally, a qualitative risk assessment for potential fugitive releases and accident risks has been undertaken for the facility and is included in Appendix 7 of this document.

7.2 Site Location and Sensitive Receptors

Human Receptors

7.2.1 The surrounding area is characterised by a mix of industrial and agricultural land use with the main settlements being the villages of Stallingborough, Healing and Great Coates. The Site can be accessed from South Marsh Road which runs to the north of the Site.

7.2.2 The closest residential properties (individual receptors) are located approximately 1 km west. These are Poplar Farm located on South Marsh Road, and Primrose Cottage accessed via Station Road north of the A180.

7.2.3 Table 7.1 below lists the human receptors in the vicinity of the Site.

Table 7.1: Human Receptors in the Vicinity of the Site

Parameter	Description	Type of Receptor	Distance and Direction From Site (km)	
R1	South Humber Bank CCGT Power Station	Industrial	0.01	W
R2	Synthomer UK Limited	Industrial	0.02	NW
R3	NEWLINCS waste management facility	Industrial	0.36	NW
R4	BOC Gases	Industrial	1.02	NW
R5	BCA Automotive	Industrial	1.98	NW
R6	Bring Cargo	Industrial	2.08	NW
R7	Lincoln Oil	Industrial	2.45	NW
R8	Northside Truck and Van	Industrial	2.37	NW

[13] Risk assessments for your environmental permit, EA, published: 01/02/2016, last updated: 08/05/2018, accessed at: https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit on 10/10/2018

Parameter	Description	Type of Receptor	Distance and Direction From Site (km)	
R9	Stokesley Metals	Industrial	2.34	NW
R10	Immingham Fire Station	Industrial	2.62	NW
R11	Ambassador Sea Foods	Industrial	2.38	NW
R12	Lenzing Fibres	Industrial	0.83	S
R13	BASF Performance Products	Industrial	1.82	SE
R14	Morrisons Manufacturing	Industrial	1.87	SE
R15	Beechwood Farm, Dining and Carvery	Commercial	2.06	SE
R16	Dawn Til Dusk	Commercial	1.98	SE
R17	Cress Cottage	Residential	1.78	SE

7.2.4 Figure 8 in Appendix 1 shows the locations of the sensitive receptors in the vicinity of the Site.

Sensitive Environmental Habitats

7.2.5 The assessment of impacts of process emissions upon the locality should include consideration of potential impacts on those sites defined under The Habitats Directive. These 'Habitats Sites' include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). EA guidance requires that the effects of stack emissions on designated ecological sites be assessed where they fall within set distances of the source, up to 10km for European designated sites and up to 2km for nationally designated sites.

7.2.6 Statutory and non-statutory designated sites have been identified through the EA pre-application advice, and a desk study of the Defra Magic mapping[14] website. In line with the EA pre-application advice, Special Protection Areas (SPAs), Special Areas for Conservation (SACs) and RAMSAR sites within 10km of the Site and SSSIs, Local Wildlife Sites (LWSs) and Ancient Woodland (AWs) within 2km of the Site have been identified.

7.2.7 European designated sites up to 10km from the Site are listed in Table 7.2, whilst Table 7.3 lists the non-statutory ecological receptors within 2km of the EfW facility.

Table 7.2: Designated European Ecological Receptors in the Vicinity of the Site (within 10 km)

ID	Receptor	Designation	Area (Ha)	Distance And Direction From Site (km)	
E1 – E5	Humber Estuary	SSSI, SAC, SPA	36657.15	The eastern boundary of the installation is bordering the Humber Estuary	E
E1 – E5	Humber Estuary	RAMSAR	37987.8		

[14] Defra Magic mapping accessed at http://magic.defra.gov.uk/MagicMap.aspx on 10/10/2018

Table 7.3: Non – Statutory Ecological Receptors in the Vicinity of the Site (within 2 km)

ID	Receptor	Designation	Distance And Direction From Site (km)	
E5	Field West of the SHBPS installation, Stallingborough	LWS	0.30	S
E6	Laporte Road Brownfield Site	LWS	1	NW
E7	Sweedale Croft Drain	LWS	0.8	SE
E8	Healing Cress Beds Stallingborough	LWS	0.7	SW
E9	Fish Ponds Field to west of the SHBPS installation, Stallingborough	LWS	1	SW
E10	North Moss Lane Meadow	LWS	0.9	W

7.2.8 Figure 8 in Appendix 1 shows the locations of the sensitive receptors in the vicinity of the Site.

Hydrology

7.2.9 The Humber Estuary is situated adjacent to the east of the SHBPS installation boundary.

7.2.10 There is a system of drainage channels around the majority of the perimeter of the Site. The Oldfleet Drain is located approximately 140 m south of the Site boundary (at its closest point) and it connects to the Mawbridge Drain approximately 1 km south of the Site.

7.2.11 There are two surface water bodies (ponds) on the Site. A large pond lies off-site approximately 250 m south of the Site to the south of the Oldfleet Drain.

7.2.12 The adjacent CCGT power station has an existing abstraction licence (4/29/09/*T/0135) registered to EP SHB to remove water for the purposes of cooling from the River Humber from a point 1,991m northeast of the Site.

7.2.13 There are two further active surface water abstraction licences within a 0.5km radius of the Site. The first abstraction licence is held by Humberland Ltd by for cooling purposes, abstracted from an unidentified steam. The second abstraction licence is held by North East Lincolnshire Council for abstracting from Old Fleet Drain for Non-remedial River/Wetland Support.

7.2.14 Details of the hydrology at the Site and surrounding areas are provided in the Site Condition Report (Appendix 2).

Geology

7.2.15 The Site is underlain by a bedrock geology comprising chalk in the Flamborough Formation. The superficial geology of the Site comprises Tidal Flat Deposits comprising clay and silt.

7.2.16 Details of the geology at the Site are provided in the Site Condition Report (see Appendix 2).

Hydrogeology

7.2.17 Available DEFRA maps[15] show that the Site lies outside any designated Source Protection Zones.

7.2.18 The Site is identified to be located on a Principal Aquifer (both bedrock and superficial drift) having high groundwater vulnerability.

7.2.19 The Site is indicated to be outside the Groundwater Safeguard Zones for Drinking Water. No groundwater abstractions were identified within 1km of the Site. There are several groundwater abstraction licences between 1km and 2km of the Site, covering abstraction of process water from the underlying chalk aquifer at a point approximately 1,200m southwest of the Site for Cristal Pigment UK Limited, Millennium Inorganic Chemicals Limited and Trioxide Europe Ltd under License 4/29/09/*G/0051.

7.2.20 Details of the hydrogeology at the Site are provided in the Site Condition Report (see Appendix 2).

Pathways for Pollution

7.2.21 In order for a pollution risk to occur, there has to be a source – pathway – receptor (S-P-R) linkage.

7.2.22 Pathways to sensitive receptors primarily include, but are not limited to:

- fuel (RDF and similar fuels), chemicals and lubricating oil required for the operation of the EfW facility potentially leaching into the ground or being washed into surface water or groundwater through the underlying soils;
- combustion gases from the EfW facility might be dispersed in the air to sensitive receptors; and
- fugitive releases of particulates, odour and noise to air.

7.2.23 In order to prevent and minimise the risk of pollution, the EfW facility will be designed and managed to isolate these pathways, preventing contaminants from migrating off-site other than through properly managed abatement systems.

7.2.24 The detailed description provided in Appendix 2 demonstrates how best available techniques have been applied to prevent pollution from the facility.

7.3 Impact Assessment

7.3.1 The following sections provide an assessment of the impact of releases from the facility, so as to underpin and justify the measures that will be put in place for their control and that will adequately protect the environment.

7.3.2 The risk assessment approach has been based on the following sequential stages:

- identify risks from the activity;
- assess the risks and check that they are acceptable;
- justify appropriate measures to control the risks, if necessary; and
- present the assessment as detailed in the EA's Risk Assessment Guidance[16].

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15 DEFRA MAGIC mapping, available at https://magic.defra.gov.uk/MagicMap.aspx accessed on 29/10/2018
16 https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits, accessed on 10/10/2018

7.3.3 Activities with the potential to impact on the surrounding environment have been identified in line with guidance provided in the EA's Risk Assessment Guidance, including:

- amenity and accidents;
- emissions to surface water;
- emissions to air;
- waste;
- global warming potential; and
- emissions to groundwater.

7.4 Amenity and Accidents

7.4.1 A qualitative risk assessment has been undertaken for the EfW facility and is included in Appendix 7 of this document. The impact evaluation process has made reference to the appropriate guidance within:

- Environment Agency Guidance "Risk Assessments for Your Permit"; and
- Environment Agency "A Practical Guide to Environmental Risk Assessment for Waste Management Facilities."

7.4.2 The risk assessment methodology has been developed using a scoring mechanism, whereby scores are assigned to the:

- probability of the hazard occurring without the use of protective measures;
- consequences of the hazard to the environment or human health; and
- effectiveness of the control/mitigation used to prevent the hazard occurring.

7.4.3 The scoring system used for the assessment is shown in Table 7.4 – Table 7.6 below.

Table 7.4: Scoring Methodology for Frequency of Occurrence

Frequency	Comment	Score
Never	Incident occurs once every 100 to 10,000 years	1
Very unlikely	Incident occurs once every 10 to 100 years	2
Unlikely	Incident occurs once every 1 to 10 years	3
Somewhat unlikely	Incident occurs at least once per year	4
Fairly probable	Incident occurs at least once per month	5
Probable	Incident occurs at least once per week	6

Table 7.5: Scoring Methodology for Consequence of Hazard to Environment or to Human Health

Consequence	Comment	Score
Minor	Onsite nuisance only no outside complaint No breach of permit	1

Consequence	Comment	Score
Noticeable	Nuisance noticeable off-site Potential for 1 – 2 complaints Reportable breach of permit Minor plant damage Health and safety 'near miss'	2
Significant	Severe sustained nuisance Significant plant damage Injury requiring on-site medical treatment Major breach of environmental permit Numerous public complaints	3
Severe	Hospital treatment required for injured persons Site evacuation required (partial or full) Partial plant shutdown required Replacement of part of plant Hazardous substance release to water course with ½-mile effect Off-site emergency services involved Regulator (EA/HSE) involved	4
Major	Hospitalisation of injured persons Public warning and off-site emergency plan implemented Serious toxic effect on local protected habitat Widespread but temporary damage to land Significant fish kill over a 5 mile range Full plant shut-down required Regulatory prosecution likely	5
Catastrophic	Major airborne release requiring evacuation of local population Plant shutdown for longer than 1 week Partial or full rebuild of plant Significant contamination of land and/or water sources requiring significant	6

Table 7.6: Scoring Methodology for Effectiveness of Mitigation

Mitigation Factor	Comment	Score
Non-existent	No mitigation in place	1
Ineffective	Some minor controls in place but mitigation not achieved	2
Partly effective	Basic controls in place and hazard partly mitigated but significant residual risk remains	3
Effective	Basic controls in place and hazard mitigated to an acceptable level although moderate level of residual risk may exist	4
Very effective	Processes fully controlled (basic/advanced) and hazard mitigated to recognised standard. Some minor residual risk may remain	5
Entirely effective	Processes fully controlled to level in excess of recognised standards. Hazard mitigation entirely effective and no residual risk remains	6

7.4.4 A short description of the key potential risks from the proposed EfW facility is provided in section 5.0 above with the proposed controls and mitigation measures detailed in the risk assessment. Based on the fugitive release assessment in relation to the identified receptors, only those closest to the facility, (i.e. within 150m), are thought to be sensitive to fugitive releases. Implementation of the identified controls and mitigation measures which are felt to be BAT for the Site will significantly reduce any potential impact on these receptors, and as such will reduce this significance to an acceptable level.

7.5 Noise and Vibration

7.5.1 The noise assessment reviews the impact from the operation of the EfW facility as well as from the increased traffic due to the delivery of fuel to the facility, on both residential and ecological receptors. The noise assessment assesses the worst case operational scenarios i.e. waste delivery and plant operation during 'night time' hours (06:00-07:00), and demonstrates that design measures implemented at the facility during the detailed design stage will be sufficient to mitigate any noise and vibrational impacts from the facility.

7.5.2 The noise and ecological assessments identified that there is the potential for noise disturbance to some ecological receptors (water birds, water voles and otters) from the operation of the EfW facility. However, given the industrial nature of the surrounding land use which includes the CCGT power station, chemical plant (to the north) and cooling water pumping station (to the east), it is reasonable to assume that the water voles resident on ditches and the otters moving through ditches in this area would be habituated to current operational activity and associated noise. The 5m undeveloped buffer zone along the ditches within the Site will also minimise the risk of disturbance to water voles.

7.5.3 At the ecological receptors located immediately north and south of the EfW facility (NSR4 and NSR5), noise levels at the closest parts of the fields to the Site are predicted to exceed ambient noise levels during operation. However the ecological impact assessment concludes that, as waterbirds will position themselves away from boundary features and closest to the Estuary (where the predicted noise levels are lower), the effects on waterbirds will be neutral (not significant).

7.5.4 It is therefore concluded that operational activities at the EfW facility would give rise to neutral effects on any of the receptors.

7.5.5 Measures to be included in the design and operation of the production facility for the management and control of noise and vibration are discussed in Section 5.7 of this supporting document to the permit application; and are considered to be sufficient to prevent noise and vibration related nuisance issues from the proposed operations.

7.5.6 No additional mitigation measures are therefore considered to be required.

7.5.7 The noise assessment undertaken for the Site is shown in Chapter 8 of the ES Volume I (included in Appendix 6).

7.6 Visible Plumes

<u>Visibility of Plume from Main Stacks</u>

7.6.1 The 'average' visible plume length was estimated within the air quality dispersion modelling using Met office data from the past 5 years and based on the worst case water content of the flue gas. It is expected that the average visible plume length will be around 90m with plumes visible an average of 77% of the time. The longest plume can be expected to extend for 855 m with plumes over 100m visible 35% of the time on average.

7.6.2 However, the impact on the sensitive receptors comprising both the commercial operations and residential properties in the vicinity of the facility was found to be negligible.

Visibility of Plume from ACC

7.6.3 It is proposed to install an ACC system at the EfW facility for cooling purposes. There is no potential for visible plumes to occur from the cooling system of the facility on this basis.

7.7 Accidents

7.7.1 A qualitative risk assessment has been undertaken for the EfW facility and is included in Appendix 7 of this document. The assessment uses the same scoring mechanism as presented in Section 7.4 above.

7.7.2 With respect to the proposed controls and mitigations are presented in the risk assessment but it should be noted that the existing Accident Management Plan (AMP) for the SHBPS installation will be updated to include controls for the EfW facility prior to the commencement of operations, comprising specific risks from the operation of the facility and their management. The SHBPS installation has existing emergency procedures which will be updated to include emergency procedures for the EfW facility.

7.7.3 An outline Fire Prevention Plan (FPP) has been produced for the proposed facility, which identifies sources of risk and measures of management of identified risks. The Outline FPP is included in Appendix 5 and it should be noted that this is subject to detailed design and as such the final FPP for the facility will be submitted to the EA prior to the plant first accepting combustible waste.

7.7.4 Sufficient containment is proposed to be provided for firewater containment on Site. A firewater containment assessment including consideration of the requirements of CIRIA C736 will be undertaken following the completion of detailed design of the EfW facility. In case of a fire, the firewater will be contained on Site and will subsequently be disposed off-site if contaminated.

7.7.5 A number of environmental protection measures will be implemented at the facility via the EMS to prevent and control spill events, including but not limited to:

- plans to deal with accidental pollution and any necessary equipment (e.g. spill kits) will be held at the facility and all personnel will be trained in their use. The existing EMS incorporates details on how to appropriately deal with accidental spillages to ensure they are not released in to any surface water system, and these procedures will be extended to include the EfW facility;
- implementation of containment measures, including bunding or double-skinned tanks for fuels and oils. All chemicals will be stored in accordance with their COSHH guidelines;
- incorporation of an oil water interceptor into the drainage system to prevent spilled fuel entering the surface water drainage system or local water bodies.

7.7.6 A method statement will be produced specifically to manage spills of chemicals at the EfW facility appropriately. All plant operatives will be trained appropriately in managing any spills of chemicals.

7.7.7 In line with the requirements of WI-BRef, a management plan will be developed as part of the EMS in order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC) of the EfW facility that includes:

- set-up and implementation of a specific preventive maintenance plan for these relevant systems;
- review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary;

- periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.

7.7.8 It is therefore considered that all potential accident risks will be managed appropriately via suitable operating procedures and emergency response procedures implemented at the facility.

7.8 Flood Risk Assessment

7.8.1 The Humber Estuary is located adjacent to the east of the Site. The Humber Estuary poses the primary and most significant risk of flooding to the Site.

7.8.2 The EA 'Flood Risk from Surface Water' map[17] identifies the vast majority of the Site to be at a 'very low' risk from surface water flooding. Small areas along the roads and along adjacent land drains within the Site are identified to be at a 'low', 'medium' and 'high' risk from surface water flooding (>0.1% AEP, 3.3% to 1% AEP event and >3.3% AEP event respectively). The EfW facility location within the Site is illustrated as being predominantly at a 'very low' risk from surface water flooding, with very small areas at 'low risk' at the topographic low points.

7.8.3 Additionally, this information is supported by the fact that there are no significantly raised ground levels adjacent to the Site that could generate sufficient rates/ volumes of surface water runoff to pose a risk of overland flow coming into the Site.

7.8.4 The risk of surface water flooding within the proposed development area within the Site from elsewhere is therefore considered to be 'low' to 'very low'.

7.8.5 The Site is located in Flood Zone 3 (as shown on the Flood Map for Planning (Rivers and Sea)). Flood Zone 3 is land that has a 1 in 100 or greater annual probability of river flooding (1% Annual Exceedance Probability (AEP)); or land that has a 1 in 200 or greater annual probability (0.5% AEP) of sea flooding.

7.8.6 The Environment Agency's 'Flood Map for Planning' (see Annex 1 of the Flood Risk Assessment in Appendix 14A in ES Volume III) identifies there to be existing tidal flood defences located approximately 25m to the east of Site, extending from north-west to south-east alongside the Humber Estuary, which reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance) event.

7.8.7 Based on the information provided by the EA, it has been determined that during the existing scenario the Site is at a 'low' risk of flooding from tidal sources with the defences in place, or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) of flooding. If the defences were to fail and breach during the existing scenario, the Site would be at a 'high' risk of flooding during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

7.8.8 The Environment Agency's modelling has illustrated that there is a very low/negligible risk of fluvial flooding to watercourses. The residual high risk of tidal flooding (Flood Zone 3) would only be incurred in the unlikely event that the Humber Estuary defences were overtopped or experienced a breach failure.

7.8.9 A number of additional mitigation strategies will be considered during the design process for the proposed EfW facility to ensure the safety of people on at the facility

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[17] Long Term Flood Risk Map - Flood Risk from Rivers or the Sea,from Surface Water and from Reservoirs. Environment Agency, Available at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map, accessed on 10/10/2018

and to ensure it is resilient in the unlikely event of a flood. These strategies include, developing a Flood Emergency Response Plan and signing up to the Flood Warnings provided by the EA, providing flood resistance and resilience measures into the design of the buildings, and designing for failure, maintenance and capacity exceedance of the surface water drainage network.

7.8.10 As a best practice measure, flood resilience measures will be incorporated into the design of the EfW facility where appropriate so as to minimise the amount of damage and reduce the recovery time of the facility in the unlikely case of the Site becoming flooded. These measures may include:

- boundary walls and fencing designed with high water resistance materials and/or effective seals to minimise water penetration for low depth, short duration floods;
- tanks bunded to a level higher than the 0.5% AEP plus climate change breach flood level;
- the storage of spares above flood levels;
- pollution control to prevent/ reduce the chance of any fuel/ material stored on Site leaking;
- facility drainage and landscape design following such guidance as CIRIA C635[18] to minimise the risk from exceedance flows and any overland flow entering the EfW facility buildings;
- landscaping of the EfW facility area within the Site or building curtilage to direct or divert floodwater away from buildings; and
- sustainable drainage systems (SuDS) designed to manage surface water flood risk and water quality.

7.8.11 A Flood Risk Assessment was undertaken as part of the environmental impact assessment and outlines the identified flood risk at the Site and applicable flood resilience measures; this is included in Appendix 14A of the ES (presented in Appendix 6 of this document).

7.8.12 The assessment concludes that by implementation of appropriate design measures (to be applied during the detailed design stage), the facility will not lead to increased flood risk to the sites in the vicinity of the facility, in addition to protecting the facility itself from flood risk from surface water.

7.9 Point Source Emissions to Water

7.9.1 There will not be any direct discharges to the ground/groundwater of process water from the activities proposed by this application. It is expected that most of the process effluent will be directed to a storage tank on at the facility for use in the ash quencher. Alternatively if there was limited capacity the process effluent would be discharged to the foul sewer, following appropriate analysis, and in compliance with a Trade Effluent Discharge Consent.

7.9.2 The key emissions to water from the facility will comprise uncontaminated surface water run-off. An outline drainage strategy has been produced for the facility as part of

[18] Designing for exceedance in urban drainage - good practice. CIRIA, Available at: https://www.ciria.org/Resources/Free_publications/Designing_exceedance_drainage.aspx

the ES Volume III (Appendix 14B) describing the proposed management route for the surface water from the facility. The ES is included in Appendix 6 of this document.

7.9.3 It is proposed that uncontaminated surface water be directed to a new attenuation pond prior to discharge to one of the drains flowing adjacent to the Site boundary at green field discharge rates; the final pond design, capacity and discharge location will be confirmed during the detailed design stage. It is expected that oil/water interceptors will be installed upstream of the attenuation pond which will allow containment of any oil/grease in the surface water.

7.9.4 It is therefore considered that all process water will be managed appropriately at the facility, with appropriate segregation of surface water to prevent contamination. The operator will ensure all management procedures are followed and reviewed periodically, as required.

7.10 Point Source Emissions to Air

7.10.1 An air dispersion modelling exercise has been undertaken to:

- assess the impact on local air quality as a result of the anticipated emission levels identified in Table 5.4; and
- confirm the heights of the exhaust stacks so as to ensure adequate dispersion for the EfW facility and therefore ensure acceptable impacts at receptors.

7.10.2 A copy of the air quality assessment is included in Chapter 7 of the ES Volume I (included in Appendix 6 of this document) and the key findings are summarised below.

7.10.3 As the CCGT power station adjacent to the EfW facility is operational, the emissions from the CCGT power station will be captured within the baseline values from APIS website, Defra and the measured nitrogen dioxide diffusion tube concentrations. However, since the CCGT power station and the EfW facility are located in close proximity to each other, there is the potential for 99.79th percentile 1 hour NO_2 impacts to coincide in the same geographical location. Therefore, additional analysis of this pollutant averaging period has also been undertaken, and is outlined in the sections below.

<u>Impact on Local Air Quality</u>

7.10.4 The proposed EfW will be designed such that combustion plant emissions to air comply with the emission requirements specified in the WI-BRef (i.e. BAT-AELs).

7.10.5 An air quality impact assessment has been carried out for the EfW facility, with reference to the EA Risk Assessment methodology for Environmental Permitting.

7.10.6 Detailed dispersion modelling has been used to calculate the concentration of pollutants at identified sensitive receptors and these have been compared with National Air Quality Strategy objectives and Environmental Assessment Levels for human health receptors and Critical Levels and Critical Loads for ecosystem receptors, with consideration for the baseline air quality and ecological deposition rates, in accordance with EA methodology.

7.10.7 The assessment has been based on the worst-case operational scenarios with respect to potential air quality impacts, employing operational design parameters for the alternative technologies and configurations under consideration for the EfW facility. A number of other conservative assumptions have been made in combination, including:

- the use of the worst-case year of meteorological data modelled;

- the use of maximum building sizes within the design;
- the operation of the plant at WI-BRef emission limits; and
- conservative estimates of background concentrations of pollutants at the sensitive receptors.

Screening Assessment Results

7.10.8 The results of the screening assessment using the H1 EA's Risk Assessment software tool (see Appendix 9) indicate that a number of the pollutant species emitted to air from the EfW facility can be screened out as insignificant against the NAQS appropriate air quality standards objectives or EALs.

7.10.9 However, detailed dispersion modelling has been undertaken for all pollutant species for completeness and to better understand the impacts.

Detailed Dispersion Modelling Results

7.10.10 The impact of the installation's process contribution, from point source emissions, at human health receptors has been determined from isopleth figures for pollutant dispersion and the maximum model output has been used at discrete receptor locations.

7.10.11 The maximum NO_2 short-term process contribution (PC) off-site is screened as "insignificant" by the dispersion modelling and the maximum hourly mean PC (as 99.79th percentile) represents 4.7% of the NAQS. As such, the maximum NO_2 short-term process contributions at all human health receptors are less than 10%, and therefore can be screened as insignificant.

7.10.12 The maximum NO_2 annual mean process contribution (PC) off-site is 2.1µg/m^3, which represents 5.2% of the annual NAQS. When combined with the background centration it represents 35% of the NAQS, which is below the EA's 70% threshold for determining significance. At the worst case human health receptor the PC is 0.3µg/m^3, which is less than 1% of the annual average NAQS, and therefore can be screened as insignificant.

7.10.13 The maximum off-site PCs for particulates (PM_{10} and $PM_{2.5}$), SO_2, VOCs, HCl, HF, NH_3 and CO are below the screening criteria to be deemed insignificant for all average periods. The majority of metals are also below the screening criteria to be deemed insignificant for all average periods.

7.10.14 Impacts of PAH (as BaP), arsenic, chromium VI cannot be screened as insignificant, however further assessment of Group III metals lowered the predicted impacts of arsenic and chromium VI so that they could be screened as not significant. Discussion of the conservative nature of the PAH assessment (i.e. assessing the whole emission as BaP, when measured concentrations in emissions from comparable plants are much less than this), also indicated that the impacts from PAH were not significant.

<u>Habitats Assessment</u>

7.10.15 The impact of emissions of nitrogen oxides (as NO_2), sulphur dioxide, ammonia and hydrogen fluoride have been assessed through comparison of the maximum predicted process contributions, at any of the identified sensitive Habitat receptors, with the Critical Levels. Details of the assessment are provided in Chapter 7 of the ES Volume I (see Appendix 6) and a summary of the results of the dispersion modelling and impact assessment are provided in Table 7.7 for the worst case Habitats receptors (Humber Estuary) (E1-E3).

Table 7.7 Maximum Predicted Concentrations at any Habitat Receptor

Pollutant	Measured as	CLPVE ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC / CLPVE	Modified BC ($\mu g/m^3$)	PEC / CLPVE
NO_x	Annual mean	30	0.74	2.4%	29.2	100%
	Daily mean	75	12.2	16.3%	43.8	75%
SO_2	Annual mean	10[2]	0.19	0.9%	4.9	25%
NH_3	Annual mean	1[2]	0.062	2.1%	1.2	43%
HF	Weekly mean[1]	0.5	0.032	6.3%	0.006	8%
	Daily mean	5	0.098	2.0%	0.006	2%

Notes:
1. CL=Critical Level, PC = Process Contribution
2. BC = Baseline Concentration, annual mean concentration x 1.5 for short term estimation of NOx
3. PEC = Predicted Environmental Concentration

7.10.16 For other species potentially emitted from the installation, including those species defined in the waste incineration articles of the IED, there are no defined ecological air quality environmental assessment levels and therefore no assessment has been made of these species.

7.10.17 Table 7.7 indicates that the predicted impacts for all pollutant species except NO_x can be either screened as insignificant at the first stage of screening (PCs <1% of the CL) or can be shown not to be significant at the second stage of screening (PEC <70% of the CL).

NOx (as NO_2)

7.10.18 The maximum annual average process contribution at the worst-case receptor (Humber Estuary) is predicted to be 2.4% of the CL. Combined with the relatively high baseline concentration, this results in a PEC representing 100% of the CL for NO_2. Due to the high background concentration obtained from the APIS website, diffusion tube monitoring at the receptor location was carried out. A background concentration of 17.11$\mu g/m^3$ was measured, and therefore when used to calculate the PEC at the Humber Estuary receptor (SAC and SPA Atlantic Salt Meadows section (E1_1 to E1_3)), a PEC representing 59.5% of the CL is obtained, which is below the 70% screening threshold. It is therefore considered that, based on the conservative assumptions made in the assessment, the process contribution is unlikely to result in exceedance of the CL.

7.10.19 When the measured concentration is used together with the daily mean NOx PC, the PEC is 50.5% of the daily CL, and therefore indicates that the process contribution is unlikely to result in exceedance of the CL.

7.10.20 In addition to the effects of the EfW facility, an assessment of the potential for the maximum 99.79th percentile of 1-hour NO_2 concentration from the CCGT power station coinciding in the same geographical location as the facility was also carried out. The assessment demonstrates that the predicted maximum ground level concentration (as 99.79th percentile NO_2 concentration) for the CCGT power station, the EfW facility, Vireol Plc, North Beck and Energy Pyrolysis is in excess of the standard of 200 $\mu g/m^3$.

7.10.21 The isoline plot for the analysis shows that this exceedance occurs in a small uninhabited area to the south-east corner of SHBPS installation. Analysis of the same plot for emissions from the EfW facility show that the maximum contribution from the facility is 2µg/m^3, compared to 222.8µg/m^3 from the SHBPS. The PC from the EfW facility is therefore very small compared to the contribution from the CCGT power station, and it is unlikely to contribute to any exceedance of the Environmental Standard at this location.

7.10.22 For the purpose of this assessment, the conversion rate assumed for NO_X to NO_2 was 35%; and in the case of a very large emission source like the CCGT power station such a conversion rate is very unlikely to occur over such a short distance. It is therefore considered that the addition of the EfW facility is not likely to significantly increase the risk of an exceedance of the short term NO_2 Environmental Standard in the area around the existing CCGT power station.

Deposition Impacts - Nutrient Nitrogen and Acid

7.10.23 An assessment of nutrient enrichment and acidity has been undertaken by applying deposition velocities to the predicted annual average NO_2 and NH_3 (for nutrients) and SO_2 and NO_2 (for acidity) concentrations at the identified habitat sites, determined through dispersion modelling, to calculate nitrogen and acid deposition rates. These deposition rates have then been compared to the critical loads for nitrogen available for the habitat. The deposition rates have been taken from EA guidance AQTAG06.

7.10.24 The air quality impact assessment has concluded that the annual N deposition rate (kg N/Ha/year) process contribution at the nearest saltmarsh habitat would be 2.1% of the critical load at receptors E1_1, E1_2 and E1_3. As this is above the 1% screening threshold, it is therefore necessary to examine the output from the modelling in greater detail to establish whether this elevation in N deposition would result in any significant effects on the saltmarsh habitat.

7.10.25 The total annual N deposition predicted at these three receptors is 0.4 kg N/ha/yr, resulting from NOx and ammonia (NH_3), compared to the background deposition of 15.7 kg N/ha/yr. With the EfW facility, there would therefore be no exceedance of the critical load for this habitat type, which is 20 – 30 kg N/ha/yr. It is therefore assessed that N deposition resulting from the Proposed Development will result in a neutral effect on the Humber Estuary SPA/ SAC/ Ramsar/ SSSI that is not significant.

7.10.26 For acid and sulphur dioxide deposition(keq/Ha/year), the air quality impact assessment identified that there would be no exceedances of the 1% critical level screening threshold for potential adverse effects on sensitive habitat types within the Humber Estuary SAC/ SPA/ Ramsar/ SSSI.

7.10.27 Full details of the assessment are presented in Chapters 7 and 10 of the ES Volume I (see Appendix 6).

7.11 Other Impacts

Dioxins Statement

7.11.1 A Human Health Risk Assessment for Dioxin impacts has also been carried for this application and is provided as part of the air quality assessment (see Chapter 7 of the ES Volume III in Appendix 6). The assessment concludes that the contribution of emissions from the proposed facility to soil concentrations of each metal and the total dioxins/furans and dioxin-like PCBs are low. Additionally, a relatively low additional dietary intake of metals and dioxins/furans and dioxin-like PCBs, when compared to the typical dietary intake values, is predicted to be associated with the operation of the proposed facility. Therefore, the impact of dioxins/furans emissions from the EfW facility is expected to be insignificant.

7.12 Conclusion

7.12.1 It is therefore considered that the impact of the proposed EfW operations will not lead to a significant impact on the sensitive receptors (both human and ecological) in the vicinity of the Site.

7.13 Site Waste

7.13.1 The key waste generated by the proposed activities will include IBA, FGT residue and process effluent, in addition to general waste from the office and maintenance. Based on the fuel specification (see Table 4.1) and the maximum tonnage processed, the facility will produce up to 179,000tpa of IBA which is normally designated as non-hazardous waste. Following compliance testing it is anticipated IBA will likely be recovered for use in the construction industry (depending on identification of viable outlets). Up to 20,600tpa of FGT residue will be produced which is designated as a hazardous waste stream and will be sent off-site for suitable treatment or disposal. Routes for the management of FGT will be kept under review and potential routes for recovery will be explored for viability.

7.13.2 Other waste sources at the facility will comprise ferrous material recovered from IBA which will be stored in skips or bins prior to collection for off-site recycling.

7.13.3 Minor quantities of waste oils associated with maintenance activities will be generated. These will be stored in suitable waste oil containers prior to off-site recycling via a licenced waste management operator.

7.13.4 All operational waste will be dealt with in accordance with the facility waste management procedures and consigned via a registered waste carrier for treatment or disposal at a suitably licenced waste facility.

7.13.5 It is therefore considered that the management procedures for the wastes arising from the EfW facility are appropriate, and further assessment of the waste from the proposed operations is not required.

7.14 Global Warming Potential (GWP)

7.14.1 The primary energy consumption and the associated carbon dioxide (CO_2) emissions are summarised below in Table 7.8 and Table 7.9.

Table 7.8: Primary Energy Consumption

Energy Source	Delivered MWh	Primary MWh	% of Total Supply
Electricity (1)	291	291	0.01
Fuel Throughput	1,883,750(2)	1,883,750	99.7%
Diesel	4,992(3)	4,992	0.3%

Notes:
(1) It is anticipated that the facility will be able to provide for its own electricity requirements, and therefore will not need to import electricity during normal operation.
(2) Based on projected throughput of 753,500tpa at 9MJ/kg NCV.
(3) Based on the inputs in the R1 calculation (see Appendix 10). It is assumed that the thermal input capacity of the auxiliary burners will be 65% of that of boilers, and there will be 4 start-up events (16 hours each) per year per boiler.

Table 7.9: CO_2 Emissions Associated with Primary Energy Use

Energy Source	Annual Usage (MWH)	Emission Factor KG CO_2 / MWH	Annual CO_2 Emissions (tonnes)
Electricity(1)	291	166 kg CO_2/MWh	48.3
Fuel Throughput	1,883,750(1)	0kg CO_2/MWh(2)	0
Diesel	4,992	250 kg CO_2/MWh	1,248
Total			1,296.3
Notes: (1) Based on projected throughput of 753,500tpa at 9MJ/kg NCV. (2) Direct or indirect carbon dioxide emissions from renewable energy sources (e.g. from waste) as having an impact of '0' on global warming based on EA guidance[19].			

7.14.2 Table 7.9 does not incorporate the predicted savings in carbon dioxide from the generation of electricity, estimated to be 88,125Te CO_2 equivalent. This is based on the displacement of electricity generated from the typical UK coal/gas mix, using an average carbon intensity of the power generated at the EfW facility of 225kg of CO_2 per MWh of power generated[20].

7.14.3 When considering the overall global warming potential of the operation, the main additional pollutant to consider is nitrous oxide. The release of nitrous oxide has a global warming potential 310 times greater than carbon dioxide.

7.14.4 To calculate equivalent carbon dioxide emissions from emissions of nitrous oxide (N_2O) from the process, the following assumptions have been made:

- Based on published literature[21], it is understood that N_2O emissions represent <5ppm of the total emissions from combustion. This has been used to estimate N_2O emissions from the EfW facility.
- As stated within the air quality assessment, the total flue gas flow rate for the two streams will be 235,114 Nm^3/hr (at standard temperature and pressure (273 K, 5% O_2, dry, 101.3 kPa)).
- The facility will operate for 7,850 hours per annum (based on a nominal plant availability of 89.6%).

7.14.5 On this basis the facility will release approximately 17.9 tonnes of nitrous oxide per annum. This is equivalent to approximately 5,549 tonnes per year of carbon dioxide.

7.14.6 Therefore the overall Global Warming Potential for the operation is approximately 86,828 tonnes of carbon dioxide equivalent per annum.

7.14.7 It should be noted that, as required by the Environment Agency, this calculation does not take into consideration the benefit of diverting waste from landfill. If the waste was

[19] Assess the impact of air emissions on global warming, EA, 01/02/2016, accessed at https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-global-warming on 07/11/2018

[20] Electricity (2018), chapter 5, Digest of United Kingdom energy statistics' (DUKES), Department for Business, Energy & Industrial Strategy, published 25 July 2013, last updated 26 July 2018 accessed at https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes#2018 on 07/11/2018

[21] Emissions of Nitrous Oxide from Combustion Sources, A.N. Hayhurst and A.D. Lawrence, Progress in Energy and Combustion Science Volume 18, Issue 6, 1992, Pages 529-552, accessed at https://www.sciencedirect.com/science/article/pii/036012859290038 3 on 28/11/2018

not combusted as a fuel it would be disposed of in a landfill with emissions of methane from the decomposition of biodegradable material present.

7.14.8 It is therefore considered that the EfW facility will not lead to an increase in the gross carbon dioxide emissions in the vicinity of the Site, and thereby having a negligible global warming impact.

7.15 Abnormal Operations

Introduction

7.15.1 This section summarises the impact which abnormal operations may have on emissions, taking into consideration the legal definition of abnormal operation as previously specified in the Waste Incineration Directive (WID) Article 13 (1), which states that an abnormal operation is:

"any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed emission limit values."

7.15.2 Results presented in Section 7.10 above are based on normal operating conditions using daily emission limits where daily and half hourly values are provided. Annex VI, Part 3 of the Industrial Emissions Directive (IED) allows abnormal operation, where the emission limit values can be exceeded for certain periods without being in contravention of the Environmental Permit for the installation.

7.15.3 This assessment identifies foreseeable events at the facility which constitute abnormal operations which may have an impact on the subsequent emissions to air. The assessment then goes on to quantify the impacts to air quality in the vicinity of the plant as a result of these changes in emissions. The assessment focuses on the potential changes in emissions arising from failure of abatement plant and mechanical failure.

7.15.4 The assessment focuses on the abnormal emissions from the EfW facility and no consideration of the generator emissions has been undertaken.

Abnormal Events Overview

7.15.5 In the event of any process upset or mechanical failure the immediate action is to rapidly assess the situation and implement process control actions, which ensure that standby equipment, where available and associated abatement systems are operational.

7.15.6 In addition, various actions and monitoring procedures will be initiated by the Operator to ensure that the EfW combustion parameters and emissions remain within the Environmental Permit limits, thereby avoiding the abnormal operation where possible.

7.15.7 If any process upset or mechanical failure results in a significant change to the emission conditions or process that cannot be easily and quickly remedied, the primary response from the Operator will be to reduce load or initiate a controlled shutdown. This is a responsible precautionary measure and proactive action to minimise any potential environmental impact.

Carbon Monoxide and Volatile Organic Carbons

7.15.8 Abnormal operation is not applicable to high CO or total organic carbon (TOC) emissions; in the event of emission levels either being above the emission limit value (ELV) the plant load would be reduced and a controlled shutdown initiated. The proposed facility will have a fully operational and certified standby system for each line that will be capable of monitoring the one stream. This will minimise the risk of abnormal operation occurring due to failure of the CEMS such that CO and/or TOC could not be monitored.

7.15.9 Furthermore, it has been shown that high emission of CO and TOC generally occur concurrently; under a CEMS system failure each can be used as a surrogate for the other to give confidence that there are no excessive emissions.

7.15.10 The Operator does not therefore foresee periods where the plant continues to operate for extended periods with CO or TOC above the ELV.

Failure of the Export/Import Electrical Supply

7.15.11 Although this would not be classified as an abnormal operation, if the export/import supply fails then the plant continues to operate but in island mode (i.e. generating its own power). If the turbine then trips, the auxiliary generator starts up to produce sufficient power for a controlled shutdown. If the standby supply fails, then the operator initiates an Emergency Shutdown, using the Uninterruptable Power Supply (UPS) to supply power to the CEMS equipment and other key control systems.

Failure of Fabric Filter

7.15.12 Online maintenance is achieved through isolation of filter sections. In the unlikely occurrence of multiple bag failures, the Operator will need to isolate the failed bags. If isolation proves ineffective then a Controlled Shutdown will be initiated to minimise the risk of emissions being above the ELV set in the Permit.

Failure of FGT System

7.15.13 There are various standby items and storage capacities within the FGT system (e.g. a standby water injection nozzle that can be readily installed and both duty and standby lime or sodium bicarbonate injection systems). If a total lime (or sodium bicarbonate) system failure occurs, such that a repair cannot be completed immediately, then load would be reduced in preparation for a Controlled Shutdown. Unspent lime on the filter bags will minimise the risk of emissions being above the ELV set in the Permit while the plant is being shut down.

Failure of Ash Handling Equipment

7.15.14 While these would not be classified as an abnormal operation, in the event of a failure of bottom ash and FGT residue conveyors, then diverter chutes and bypasses are utilised to avoid shutdowns. In the event of a failure of grate rams and fans, the Operator initiates a Controlled Shutdown. The combustion conditions and emissions will comply with the Permit.

<u>Assessment of Impact</u>

Identifying Process Contribution Changes

7.15.15 The air quality impact assessment outlined in Section 7.10 above, utilised dispersions modelling. The modelling approach has been amended to look at the short-term impacts during periods of IED abnormal operation, assuming a worse case of complete abatement failure. A series of factors have been derived in order to ascertain the likely increases in emissions that may occur in each pollutant due to foreseeable abnormal operations.

7.15.16 It is considered that emissions of nitrogen dioxide from the EfW facility will be within the half-hourly IED emission limit of 400mg/Nm³ through the application of Selective Non-Catalytic Reduction (SNCR) technology. The half-hourly limit will enable the facility to remain compliant during times of potential blockage or failure of the ammonia injection system at the EfW facility, which could lead to reduced abatement efficiency and potentially elevated NOx emissions. For the purpose of this assessment, emissions of nitrogen dioxide have been modelled at the concentration typically emitted from existing waste incineration plants in the UK during periods of abnormal operation. The assumed emission concentration is 550mg/Nm³ which provides a release rate of 36.58g/s.

7.15.17 A fabric bag filter is proposed for the removal of particulate matter from the flue gas and the worst-case emission scenario assumes the system is bypassed, for example through the bursting of one or more bag filter units. The assessment is therefore based on the limits in IED Annex VI, part 3 which presents the maximum permitted release (i.e. 150mg/Nm³ as a half hourly average).

7.15.18 Emissions of sulphur dioxide and acid gases will be primarily controlled through hydrated lime or sodium bicarbonate injection plus fabric bag filtration. Abnormal emissions therefore have been based on failure of the abatement system, either through limited efficiency or complete failure (blockage or failure of the injection system). Abatement of acid gases would continue through the lime (or sodium bicarbonate) collected on the bag filters, so this is considered to be a conservative approach. The proposed maximum abnormal emission levels are presented in Table 7.9.

7.15.19 Emissions of metals and dioxins will be primarily controlled through a combination of the fuel specification and abatement technology (activated carbon injection plus fabric bag filtration). Abnormal emissions therefore have been based on the failure of the abatement systems, either through limited efficiency or complete failure. A number of assumptions have been made regarding the emissions of specific metal species, including:

- the normal emission concentration of mercury has been assumed to be 100% of the IED emission concentration of 0.05mg/m³;
- the normal emission concentration of cadmium has been taken as half the IED emission concentration for cadmium and thallium and compounds of 0.05mg/m³;
- the normal emission concentration of combined heavy metals is set at the hourly mean IED emission concentration; and
- the Predicted Abnormal Emissions for all metals have been calculated based on 5 times the normal operation emission limit concentration, as it is assumed that metals are in the particulate phase.

7.15.20 For the purposes of this assessment, the combined heavy metals have been compared with the lowest short-term EAL of 1ug/m³ for vanadium. This provides a conservative assessment of the potential short-term impact.

7.15.21 The use of SNCR has the potential to result in releases of ammonia through a process known as ‘ammonia slip’. Although ammonia injection for the SNCR process is closely controlled, it is assumed that over injection could occur resulting in emissions up to 5 times the proposed emission limit of 10mg/Nm³.

7.15.22 The dispersion modelling approach used to assess impacts under normal operating conditions (see Section 7.10 above) shows the short term incremental ground level concentrations based on daily emission limits. These predictions are then compared to AQSs. For the assessment of abnormal emissions, the impact on short term concentrations is of more importance since occasional excursion above the LEV would have negligible impact on long term air quality impacts.

7.15.23 For the purpose of this assessment, it has been assumed that the flow characteristics (i.e. air volume and temperature) remain within the design range as detailed in the Air Impact Assessment submitted as part of the ES Volume III (see Appendix 6).

7.15.24 The results of the assessment are shown in Table 7.10 below.

7.15.25 The results presented represent the highest process contribution (PC) off-site for each determinand, irrespective of receptor presence. This is then added to the ambient concentration (AC), calculated using twice the background concentration derived used in the Air Quality Assessment.

7.15.26 Where determinands are only assessed against annual average Environmental Assessment levels (EALs), these have been excluded from the assessment as abnormal emissions represent a short-term event only.

7.15.27 The predicted impacts shown in Tables 5.6 and 5.7 are considered to be highly conservative as they assume that the abnormal emissions coincide with worst case meteorological conditions.

Table 7.10: Short Term Ground Level Concentrations with the EfW facility operating for 4 Hours at Abnormal Emissions

Pollutant	Measured as	EAL/EQS	Ambient Level[(C)]	½ Hour Average Emission Limit	Increase Above ½ Hour Average Emission During Abnormal Event	Emission During Abnormal Event	Short Term Pc Based On Plausible Abnormal Operation Emission Levels	PC	Predicted Environmental Concentration (PEC)	PEC
		(ug/m^3)	(ug/m^3)	(mg/Nm^3)	%	(mg/Nm^3)	(ug/m^3)	% EAL	(mg/Nm^3)	% EAL
SHORT TERM IMPACT										
NO_2 [(a)]	Hourly mean (99.8th %ile)	200	23.6	400	37.50	550	13.17	6.59	36.77	18.39
SO_2	15 min mean (99.9th %ile)	266	33.4	200	125	450	16.30	6.13	49.70	18.69
	Hourly mean (99.7th %ile)	350	33.4				15.04	4.30	48.44	13.84
Dust (as PM_{10})	Hourly mean (90.41 %ile)	50	23.5	30	400	150[(b)]	1.90	3.80	25.40	50.80
HCl	Hourly mean (100th %ile)	750	0.4	60	1400	900	41.98	5.60	42.38	5.65
HF	Hourly mean (100th %ile)	160	0.006	4	2150	90	10.58	6.61	10.58	6.61
Ammonia	Hourly mean (100th %ile)	2,500	2.46	10	400	50.00	23.35	0.93	25.81	1.03
Mercury	Hourly mean (100th %ile)	7.5	0.004	0.05	400	0.25	0.13	1.71	0.13	1.76
Other Metals	Hourly mean (100th %ile)	1	0.443	0.5	400	2.50	0.19	19.09	0.63	63.39

7.15.28 The results presented in Table 7.10 show no exceedances of the relevant EALs or AQS objectives. Taking into consideration that this level of emission is considered to be a conservative assessment of an abnormal release, which is infrequent, therefore no significant environmental impact is predicted from such a release.

Conclusion

7.15.29 An assessment of the impact on air quality associated with abnormal operating conditions from the EfW facility has identified plausible abnormal emissions based on a review of monitoring data from operational facilities of a similar type in the UK. Notwithstanding the low frequency of occurrence of such abnormal operating conditions identified by the review, the potential impact on air quality has been assessed.

7.15.30 Detailed dispersion modelling has shown that these emissions are unlikely to have detrimental impacts on human health in the vicinity of the Installation, particularly when the location of sensitive receptors is compared to the predicted location of the highest impact.

7.15.31 It is concluded that use of the allowance for abnormal operating conditions (as detailed in Article 46 of the IED) is predicted not to give rise to an unacceptable impact on air quality or the environment.

8.0 CLOSURE AND DECOMMISSIONING

8.1.1 The EfW facility is expected to have a design and operating life of around 30 years. At the end of its design life it is expected that the EfW facility will have some residual life remaining and an investment decision would then be made based on the market conditions prevailing at that time.

8.1.2 At the end of its operating life, all above-ground equipment associated with the EfW facility will be decommissioned and removed from the Site. Prior to removing the plant and equipment, all residues and operating chemicals will be cleaned out from the plant and disposed of in an appropriate manner.

8.1.3 The bulk of the plant and equipment will have some limited residual value as scrap or recyclable materials, and the contractor will be encouraged to use materials that could be recycled.

8.1.4 Prohibited materials such as asbestos, polychlorinated biphenyls (PCBs), ozone depleting substances and carcinogenic materials, will not be allowed within the design of the EfW facility, and other materials recognised to pose a risk to health (but which are not prohibited) will be subject to detailed risk assessment.

8.1.5 Prevention of contamination is a specific requirement of the Environmental Permit for the operation of the EfW facility and therefore it is being designed such that it will not create any new areas of ground contamination or pathways to receptors as a result of operation. Once the plant and equipment have been removed to ground level, it is expected that the hardstanding and sealed concrete areas will be left in place. Any areas of the EfW facility that are below ground level will be backfilled to ground level to leave a levelled area.

8.1.6 A Decommissioning Plan (including Decommissioning Environmental Management Plan) will be produced and agreed with the Environment Agency as part of the Environmental Permitting and Site surrender process. The Decommissioning Environmental Management Plan will consider in detail all potential environmental risks on the Site and contain guidance on how risks can be removed or mitigated. This will include details of how surface water drainage should be managed on the Site during the decommissioning and demolition.

8.1.7 The Decommissioning Plan will include an outline programme of works. It is anticipated that it would take nine to twelve months to decommission the EfW facility, with demolition following thereafter.

8.1.8 During decommissioning and demolition there will be an electrical demand, as well as requirement for office, accommodation and welfare facilities.

8.1.9 Any demolition contractor would have a legal obligation to consider decommissioning and demolition under the CDM Regulations 2015, or the equivalent prevailing legislation at that time.

8.1.10 Decommissioning activities will be conducted in accordance with the appropriate guidance and legislation at the time of the EfW facility's closure. All decommissioning activities will be carried out in accordance with the waste hierarchy and materials and waste produced during decommissioning and demolition will be stored in segregated areas to maximise reuse and recycling. All materials that cannot be reused or recycled will be removed from the Site and transferred to suitably permitted waste recovery/ disposal facilities. It is anticipated that a large proportion of the materials resulting from the demolition will be recycled and a record will be kept to demonstrate that the maximum level of recycling and reuse has been achieved.

8.1.11 Upon completion of the decommissioning programme, including any remediation works that might be required, the Environment Agency will be invited to witness a post-decommissioning inspection by Site staff. All records from the decommissioning process will be made available for inspection by the Environment Agency and other relevant statutory bodies.

8.1.12 There is a closure and decommissioning procedure in place for the SHBPS installation, which will be updated to include procedures for decommissioning the equipment from the EfW facility to avoid pollution risk, taking into consideration clean-down and the removal of materials.

APPENDIX 1: FIGURES

APPENDIX 2: SITE CONDITION REPORT

APPENDIX 3: EUROPEAN WASTE CATALOGUE (EWC) CODES OF FUEL

EWC Code	Description of Fuel)
WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, 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 07	Wastes from forestry
Wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation	
02 02 03	Materials unsuitable for consumption or processing
Wastes from the dairy products industry	
02 05 01	Materials unsuitable for consumption or processing
Wastes from the baking and confectionery industry	
02 06 01	Materials unsuitable for consumption or processing
Wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)	
02 07 01	Wastes from washing, cleaning and mechanical reduction of raw materials
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 THE LEATHER, FUR AND TEXTILE INDUSTRIES	
Wastes from the textile industry	
04 02 15	Wastes from finishing other than those mentioned in 04 02 14
04 02 21	Wastes from unprocessed textile fibres
04 02 22	Wastes from processed textile fibres
WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
Packaging (including separately collected municipal packaging waste)	
15 01 01	Paper and cardboard packaging
15 01 02	Plastic packaging
15 01 05	Composite packaging
15 01 06	Mixed packaging
15 01 09	Textile packaging
Absorbents, filter materials, wiping cloths and protective clothing	
15 02 03	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
WASTES NOT OTHERWISE SPECIFIED IN THE LIST	
End-of-life vehicles from different means of transport (including off-road machinery) and wastes from	

EWC Code	Description of Fuel)
dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)	
16 01 03	End-of-life tyres
16 01 19	Plastic
CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)	
Concrete, bricks, tiles and ceramics	
17 02 01	Wood
17 02 03	Plastic
Other construction and demolition wastes	
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03
WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE	
Wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)	
19 02 03	Premixed wastes composed only of non-hazardous wastes
19 02 10	Combustible wastes other than those mentioned in 19 02 08 and 19 02 09
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
Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	
19 12 01	Paper and cardboard
19 12 04	Plastic and rubber
19 12 07	Wood other than that mentioned in 19 12 06
19 12 08	Textiles
19 12 10	Combustible waste (RDF)
19 12 12	Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	
Separately collected fractions (except 15 01)	
20 01 01	Paper and cardboard
20 01 08	Biodegradable kitchen and canteen waste
20 01 10	Clothes
20 01 11	Textiles
20 01 25	Edible oil and fat
20 01 38	Wood other than that mentioned in 20 01 37
20 01 39	Plastics

Notes:

- This is list of potential fuel sources for the EfW facility, to be finalised during commissioning stage. At this stage the fuel supply has not been resourced.
- Any edible oil and fat under municipal wastes (EWC code: 20 01 25) accepted on Site will only comprise solid wastes.
- Plastics under municipal wastes (EWC code: 20 01 39) accepted on Site will only comprise contaminated plastics, which are not suitable for recycling.

APPENDIX 4: BAT ASSESSMENT OF THE EFW FACILITY

- 4-1 - Indicative BAT Assessment against BAT Conclusions
- 4-2 - Assessment of Cooling Technology Options

APPENDIX 5: OUTLINE FIRE PREVENTION PLAN

APPENDIX 6: ENVIRONMENTAL STATEMENT

APPENDIX 7: QUALITATIVE ENVIRONMENTAL RISK ASSESSMENT

- 7-1 - Fugitive Risk Assessment
- 7-2 - Accident Risk Assessment

APPENDIX 8: CHP READINESS ASSESSMENT

APPENDIX 9: AIR QUALITY SCREENING ASSESSMENT USING THE EA'S H1 SOFTWARE

APPENDIX 10: INDICATIVE CALCULATION FOR R1 STATUS

APPENDIX 11: LIST OF DIRECTORS

- Tarloke Singh Bains

Date of birth: July 1968. Appointed on 26 July 2016

Nationality: British. Country of residence: United Kingdom. Occupation: Chartered Accountant

- Pavel Horsky

Date of birth: April 1973. Appointed on 8 October 2014

Nationality: Czech. Country of residence: Czech Republic. Occupation: Chief Financial Officer

- Victoria Rose Pearson

Date of birth: February 1985. Appointed on 31 August 2017

Nationality: British. Country of residence: United Kingdom. Occupation: Director

- Jan Springl

Date of birth: April 1978. Appointed on26 July 2016

Nationality: Czech Country of residence: Czech Republic. Occupation: Company Director

- Spurny, Marek

Date of birth: November 1974. Appointed on 8 October 2014

Nationality: Czech. Country of residence: Czech Republic. Occupation: Head of Legal Counsel

- Antonia Charlotte Stockton

Date of birth: May 1988. Appointed on 31 August 2017

Nationality: British. Country of residence: United Kingdom. Occupation: Director