Swadlincote Energy Recovery Facility (SERF)

Best Available Techniques

on behalf of R&P Clean Power Limited

Application for Environmental Permit

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1 Introduction

The Swadlincote Energy Recovery Facility (SERF) comprises of an Energy Recovery facility (ERF) which generates electricity from the energy harnessed in the incineration of fuel. The facility is to be located on land located off Willshee's Depot 3, Keith Willshees Way, Swadlincote, South Derbyshire DE11 9EN, grid reference SK268 190. The ERF comprises a multifueled conventional combustion plant, based on globally proven moving grate technology. The ERF would have a gross electricity generating capacity of approximately 20.5 MW. It has been designed to provide combined heat and power (CHP) and will be "CHP" ready from the outset, being capable of supplying heat to local consumers by means of a future heat network. The anticipated fuel throughput would be a maximum of 230,000 tonnes per annum (tpa).

The accepted wastes are defined with European Waste Catalogue (EWC) waste codes from the List of Wastes (LoW), the wastes are listed below, hereafter referred to as the 'fuel':

- 19 12 10 - Combustible Waste (Refuse Derived Fuel)
- 19 12 12 - Other Wastes (Including Mixtures of Materials) from Mechanical Treatment of Wastes other than those mentioned in 19 12 11
- 20 03 01 - Mixed Municipal Waste
- Other wastes listed in Table 1b of Form 3B

This activity is listed under the relevant schedule of the Environmental Permitting (England and Wales) Regulations 2016 and in addition to the Industrial Emissions Directive requires to be operated in accordance with "best available techniques" (BAT) for preventing pollution in order to ensure a high level of protection of the environment as a whole. The Environment Agency has produced guidance on what constitutes BAT for the incineration of waste (EPR 5.01[1]), and this is therefore the key reference document for this assessment. The tables in Section 4 of this report provide specific answers to the questions asked within the guidance. In addition, the tables in Section 4.1 reference the BAT conclusions (BATc) for waste incineration installations[2], as covered by Chapter II of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control).

This report covers the following BAT with respect to the following aspects of the facility:

- Choice of combustion processes;
- Abatement of point source emissions to air;
- Generation efficiency;
- Cooling arrangements; and
- Waste.

[1] How to comply with your environmental permit. Additional guidance for: The Incineration of Waste (EPR 5.01), Environment Agency (2009)

[2] COMMISSION IMPLEMENTING DECISION (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration

2 Combustion Process

2.1 Technology choice

A range of combustion technologies are available for the incineration in the UK, with the most commonly used technology being a moving grate - which is the technology proposed for the SERF.

It is acknowledged that alternative technologies are referenced within the guidance including fixed stepped hearths, pulsed hearth, however, it is considered that these technologies are not appropriate at the scale proposed for the Facility. In addition, whilst gasification and pyrolysis technology do show considerable potential, applications utilising fuel at the scale proposed at the SERF have proved problematical due to issues with the scalability of the technology leading to poor records on reliability.

The table below summarises the options considered:

Process Type	Comparative Observations
Moving Grate	**Moving Grate technology has a robust and has proven track record across Europe and is the most common technology for the incineration of waste in the UK. The moving grate allows agitation of the waste, improving aeration and therefore combustion, and the speed and throw of the grate can be adjusted to accommodate different waste types as they move through the process. This system therefore has the capacity to effectively handle fuel with varying ranges of size, CV, and moisture content.**
Gasification or Pyrolysis	Gasification and pyrolysis concepts provide the potential for a high level of energy recovery efficiency. However, the technology has proved problematic when implementing non-homogenous materials such as Refuse Derived Fuel (RDF) and municipal wastes leading to uncertain operating reliabilities.
Fluidised Bed Incinerator	Fluidised bed reactors can provide good levels of combustion effectiveness but require a uniform fuel particle size and is therefore unsuited to the combustion of semi-processed RDF or mixed wastes.
Fixed Bed Incinerator	Fixed bed technologies are well established but do not accommodate variations in the calorific value of the incoming waste. Whilst RDF does have a level of consistency, this would require an even spread to maximise combustion effectiveness.
Rotary Kiln Incinerator	Rotary Kiln Incinerators provide high levels of combustion effectiveness and can accommodate a wide range of fuels. However, overall energy recovery efficiency is reduced as such systems require a high level of excess air.

From the summary of technologies above, it can be seen that moving grate technology will deliver a robust and proven system for a waste stream that may have variable composition and calorific value. In addition, the speed of the moving grate can be adjusted to vary the quantity of waste on the grate, ensuring complete burn out of all the material. The system is designed so that there is no requirement for the grate to be cooled with water and the system is hardwearing requiring little maintenance.

The moving grate technology has been selected as the Best Available Technique for the SERF as it is a proven and robust technology which includes a number of mechanisms to ensure complete combustion.

2.2 Process Description

The incineration process incorporates a single incineration line, incorporating a reciprocating (moving grate) technology. When operating at MCR (Maximum Continuous Rating) the plant will have an hourly throughput of 23.2 tonnes per hour of non-hazardous fuel (with a calorific value of 10.5MJ/kg). The moving grate moves the waste through different phases of combustion, ensuring that complete oxidation is achieved and that emissions are minimised. In the first part of the process wastes are ignited and combusted on the surface of the grate. This is followed by a second stage of combustion, where further oxidation occurs and complete burn-out of the wastes is achieved. Both primary and secondary airflow are utilised with air being introduced in a controlled manner. Additional air is introduced in the boiler as a means of ensuring that the off-gases remain at a temperature within the range 850°C - 1,050°C for more than 2 seconds and that compounds such as carbon monoxide are oxidised. As these temperatures are in the range that may allow the formation of NO_x, measures for the control of these compounds are included and detailed in Section 3.1.

The temperature in the combustion chamber will be continuously monitored by means of infrared pyrometers.

There will be an automated system to prevent the feeding of waste both during start up, and when continuous emission monitors (CEMS) show that an emission limit value (ELV) is exceeded due to a failure of the abatement equipment.

Should the temperature in the combustion chamber fall below 850°C, then the feeding of waste will cease. In this scenario the auxiliary burners will be used to increase the temperature to >850°C, at which point the feeding of waste into the combustion chamber can recommence. The auxiliary burners are used for all shut down and start-up operations and are fuelled by burning diesel oil.

3 Abatement of point source emissions to air

Emissions to air from the combustion process include nitrogen oxides, acid gases (such as sulphur dioxide, hydrochloric acid, and hydrofluoric acid) and particulates. In addition, it is necessary to control the emission of carbon monoxide, metals, dioxins, furans, and other volatile organic compounds (VOCs). The Facility is designed with systems in place to ensure that emissions to air are acceptable and within the BAT-AEL limit values.

The selected technology choice(s) for the abatement of emissions to air is highlighted in bold in each of the tables.

3.1 Nitrogen Oxides (NOx)

Nitrogen oxides (NO_x) are formed when combustion takes place at high temperatures and can have direct respiratory impacts and also react with VOCs to increase ozone levels in the presence of sunlight, which can have a positive indirect global warming effect.

3.1.1 BAT assessment for NOx

EA guidance on what constitutes BAT for NO_x abatement details primary and secondary controls. The primary control strategies that apply to the SERF facility are set out in the table below.

Technique	Observations/application
Low NOx Burners	**These are used for supplementary firing**
Methane injection	This is an emerging technology which is not yet commercially proven
Fluidised Bed Combustor	Not suitable for large and mixed and non-homogeneous wastes
Sealing of combustions zones	Combustion zones are held under negative pressure, so the prevention of air ingress is achieved by good mechanical design
Optimising of air feeds	**The combustion of air feeds to the furnace are closely controlled and monitored via the plant combustion control system**
Flue gas recirculation	**It is possible to recirculate a proportion of the flue gases into the combustion chamber in order to control the oxygen levels and hence reducing the level of NO_x formation**

Once the above have been considered, different techniques may be used as the secondary control measure. The considered options are shown in the table below.

Technique	Comparative Observations
SNCR with Ammonia (Gas or Water Solution)	Selective Non-Catalytic Reduction (SNCR) with Ammonia. Ammonia is introduced into the flue gas and will reduce NO_x compounds to nitrogen and water. However, ammonia is a toxic and flammable gas and required carefully handling and management.
SNCR with Urea	**Urea solution is a safer, liquid reagent to use and can have a similar ability to reduce NO_x emissions to using ammonia. Urea will be dissociated in the furnace by heat into ammonia and carbon dioxide. Ammonia will then react with NO_x to produce N_2 and H_2O. An aliquot of unreacted NH_3 may be expelled via the stack (Ammonia slip). SNCR (with urea) to achieve BAT-AELs specified in the Waste Incineration BREF.**
SCR	Selective Catalytic Reduction (SCR) can achieve low levels of NO_x emissions, as the ammonia is reacted in the presence of a catalyst such as vanadium oxide (V_2O_5), particularly at lower temperatures. However, the technique entails significantly higher capital and operating costs, and a reduction of efficiency of the boiler.

3.1.2 NO_x abatement

The primary technique to reduce the formation of NOx that will be implemented in the facility are:

- Prevention of air oversupply (preventing the supply of additional nitrogen);
- Optimising the combustion with well distributed primary and secondary air in order to avoid unnecessary high temperatures in the combustion chamber
- If necessary, flue gas recirculation from the stack to control of the temperature and oxygen content in the upper stage of the combustion chamber.

Further NOx abatement will be carried out in the facility through the SNCR system with a 40% urea solution dosed directly into the combustion chamber.

A NO_x analyser will be installed between the combustion chamber and reactor to measure the effectiveness of the urea dosing by the SNCR system.

The intermediate NOx analyser and the continuous monitoring stack emissions system will allow the plant Distributed Control System (DCS) to adjust the injection rate of urea to provide the most effective treatment and minimise the level of ammonia 'slip' through the process.

3.1.3 NO_x emission concentration from selected abatement

The selected abatement technology has been specified to achieve a NO_x emission concentration of 120mg/Nm^3 (daily average, at reference condition dry gas temperature of 273.15K, pressure of 101.3kPa and 11% O_2).

The impact of NO_x emissions at this concentration are assessed in the Air Quality Assessment report submitted with this application.

The Air Quality Assessment concludes that "*the outcome of the air quality assessment demonstrate that the facility will have no significant impacts on either human health or designated ecological habitats*."

In reaching this conclusion, and with particular regard to impact upon human health, the assessment concludes that:

- *"The operational impacts of the emissions to air from the main stack, emergency generator plant and road traffic associated with the proposed ERF have been shown to be insignificant in relation to both human health and ecosystems. Annual mean nitrogen dioxide, PM10 and PM2.5 concentrations have been assessed in detail using the EPUK/IAQM impact descriptors, which are all negligible. Overall, the impacts of the ERF on human health and designated ecological sites are considered to be insignificant."*

  Further, *the assessment has demonstrated that the proposed 60 m stack height for the facility is appropriate in terms of air quality.*

The selected abatement technology and the corresponding NO_x emission concentration that it is designed to achieve has been specified to ensure that the modelled impacts are comprehensively demonstrated to be insignificant when measured against statutory objectives and guidance on risk assessment for air quality. Accordingly, a reduction in the NO_x emission concentration will not result in betterment in qualitative assessment, as set out in the concluding section of the air quality assessment.

3.2 Carbon Monoxide

Carbon monoxide (CO) is formed when combustion processes are incomplete. CO is toxic to human health at elevated concentrations in the atmosphere as it can prevent the uptake of oxygen within the blood.

3.2.1 BAT for Carbon Monoxide Abatement

The main method of control of CO is to ensure that the combustion process is designed to ensure complete combustion. BAT is normally provided by:

- Ensuring primary and secondary air is introduced to the furnace to make sure available excess oxygen is available to complete combustion
- Ensure that there is a turbulent gas mixing environment
- Ensure that waste is mobile and opened up to allow complete combustion during residence time

3.2.2 Proposed method for CO control

Within the SERF facility continuous monitoring for CO will be undertaken and the data interrogated by the plants DCS. In addition to adjusting process parameters (such as secondary air rates to maintain excess oxygen level to around 6%) to ensure emissions are minimised, CO formation would be an indicator of incomplete combustion and therefore inefficient operation. CO is monitored at the stack by the CEMS.

3.3 Acid Gases

Sulphur dioxides and other acidic gases such as hydrogen chloride react with moisture to form acids that can act as a respiratory irritant and when deposited can cause damage to sensitive vegetation. This can be transferred back to land via precipitation.

3.3.1 BAT for Acidic Gases

For many combustion processes, acid gases can be controlled by the selection of fuels, but this is not necessarily possible for waste incineration processes. Therefore, the main control is to provide a reaction with an alkaline reagent to neutralise them, typically sodium bicarbonate or lime. This reaction can be 'wet', 'dry' or 'semi-wet/dry' – depending on the form of the reagent introduced.

Alternatively, water towers can be used to dissolve the gas, but this technique creates the need to dispose of a mixed liquid acid waste (primarily sulphuric acid).

The table below presents options for acid gas control considered for the Facility.

Technique	Comparative Observations
Wet system with sodium hydroxide	High removal rates and low solid waste production Liquid effluent treatment required; reagent is hazardous This option would require facilities for the processing and discharge of effluent
Dry system with lime	**Good removal rates; low leaching potential of residues; high energy recovery** **Volumes of solid waste for disposal; reagent is hazardous** **Can be combined with other techniques such as pulverised activated carbon if required**
Dry system with Sodium bicarbonate	Good removal rates; non-hazardous reagent Residues are susceptible to leaching; efficacy reduces at lower temperatures Results in lower boiler efficiencies (as needs to operate at higher temperatures).

3.3.2 Proposed method for acid gas control

Acidic gases on the exhausts (typically HCl, SO_2 and HF) will be neutralised by adding alkaline reagents into the flue stream. The facility will achieve this by injection of hydrated lime into the flue stream after the boiler.

The exhaust gases, upon exiting the boiler, will be treated to further remove the pollutants that may be present. Acidic gases will be treated by injecting lime into the flue ducts before, or within, a vertical reactor tower. At this point, the gases will also be dosed with activated carbon to reduce any heavy metals, dioxins and furans that might be present within the flue gas stream.

Reacted residue will be collected at the of the bag filters, temporarily stored and sent to facilities for proper disposal.

In this instance hydrated lime delivers the BAT for the control of acid gases as it is compatible with the other flue gas treatment to be used, reduces the need for waste water effluent treatment, results in a stable waste product and allows energy recovery at the highest possible efficiency. Treatment with lime is effective at a lower temperature than can be achieved using sodium bicarbonate. This will allow the reaction temperature in the air pollution control system to be lowered, allowing a higher rate of energy recovery in the boilers. This, along with the reduced costs of the reagent, make use of lime preferable over sodium bicarbonate.

Combustion gases will be mixed with lime and activated carbon within a single vertical reaction tower, with the activated carbon intending to remove residual VOCs and metals from the flue gas. This system would have been incompatible with a wet acid removal system, as this would have necessitated drying of the flue gases prior to treatment in a separate carbon filter, with additional energy requirements for drying the flue gases.

3.4 VOCs, Dioxins and Furans

This group of pollutants have diverse toxic impacts on humans and ecology.

3.4.1 BAT for abatement of VOC, Dioxins and Furans

VOCs are primarily controlled by accurate and stable control of the combustion processes, as where there is sufficient oxygen these compounds will readily oxidise.

To guarantee the stability of the combustion, fuel shall be homogenous as far as possible.

To avoid the formation of precursors and oxidise VOCs, the IED requires that the combustion gases are maintained at a minimum 850°C for a minimum residence time of two seconds at a minimum oxygen level of 6%. The combustion chamber will be designed to achieve these conditions. It is therefore important that temperatures are closely controlled to maintain high temperatures in the combustion chamber to combust VOCs.

During the passage of the exhaust fumes in the boiler, these are cooled by exchanging energy within the boiler tubes. Potentially to the temperature window of between 200°C and 400°C, there could be a re-formation of dioxins and furans. Therefore, the boiler has been designed in such a way as to limit the residence time of the fumes within this temperature window.

For the same reason, boiler bundles shall be also equipped with soot removal systems to remove the particulate that could adhere to the boiler tubes.

As a secondary technique, powdered activated carbon (PAC) injected into the flue gas will absorb any remaining VOCs and volatile metals onto the surface of the carbon. This process can be carried out separately within the flue gas path or in conjunction with the injection of reagents to control acid gases in a reaction tower.

Any dioxins or furans adsorbed by PAC shall be removed by the use of filtration.

3.4.2 Proposed method for VOC, Dioxins and Furans control

The primary techniques to control the formation of dioxins, furans and other organic compounds that will be implemented in the facility are:

- Fuel mixing will be implemented within the storage bunker to guarantee fuel homogeneity in order to have optimal and as far as possible, homogeneous, and stable incineration conditions;
- Design and operation of the combustion chamber to achieve a good burnout of the combustion gases by ensuring that the combustion gases are maintained at a minimum 850°C for a minimum residence time of two seconds at a minimum oxygen level of 6%.
- Installation of auxiliary burners to always avoid the temperature of the combustion chamber from falling below 850°C;
- Design of the boiler in order to have a rapid flue gas cooling and limit the stay time of the fumes within the temperature range of 200 - 400°C; and
- Boiler bundles will be equipped with on-line cleaning systems to reduce the dust residence time and accumulation in the boiler. Off-line boiler bundles cleaning activities will be carried out during the maintenance periods.

The facility will be equipped also with the following secondary technique:

- Activated carbon injection where dioxins, furans and other organic compounds may be adsorbed.

3.5 Metals and Mercury

3.5.1 BAT for abatement of metals and mercury

The main methods from the abatement of metals and Mercury are provided in BAT Conclusion 31 of the Waste Incineration BREF.

3.5.2 Proposed method for Mercury control

The facility will use, as a primary technique for the control of mercury emissions, the use of fuel with a low content of mercury. As a secondary technique, activated carbon is injected into the gas flow. The activated carbon adsorbs, with high efficiency, the volatile mercury compounds. The carbon is filtered in the bag filter.

3.5.3 Proposed method for metals control

Differently from Mercury, other metals will be mainly converted by the incineration process into non-volatile oxides. The primary technique of abatement of metals from the flue gases is the same used for dust removal. The facility will be equipped with a baghouse filter and metal compound particles will be trapped by it. The bag filters will have a design temperature of 200°C while the operating temperature will be 165°C. The system will be equipped with flue gas temperature sensors and alarm will be implemented.

3.6 Incinerator Bottom Ash

The incinerator bottom ash is discharged via a wet conveyor system to a dedicated storage area, from which it is transferred into appropriate covered bulk vehicles for transport to reprocessing into secondary products and/or disposal.

Boiler ash that is precipitated by gravity in boiler hoppers will be routed to the incinerator bottom ash handling system.

3.7 Particulates

Particulate that may be expelled by the stack is composed of fly ash, reacted lime and activated carbon. Particulates of all sizes are injurious to health and may have wide ranging environmental and ecological impact through physical damage (for example to lungs) and via toxic impacts (for example as a transport medium for dioxins).

3.7.1 BAT for particulate abatement

The table below presents the methods considered for the control of particulates within the flue gases.

Technique	Comparative Observations
Wet scrubber	+ Good removal rates and low solid waste production + Wet scrubber can be designed as an integrated system to treat particulate and acid gases - Liquid effluent treatment required; unsuitable for hot gases and requires high water usage Whilst effective, wet scrubbers are incompatible with hot flue gases as the water used will evaporate
Electrostatic precipitator	+ Effective removal of larger particles; robust and not prone to degradation - Not effective enough to be considered BAT on their own for ERF; energy consumption and uncertain electrical charge of the particulate matter Often combined with other techniques, particularly with flue gases with high proportion of larger particles (for example coal combustion)
Ceramic filter	+ Good removal rates; can be effectively tailored to flue gases - Not suitable for high gas flows; susceptible to blinding in ERF Generally more suitable for smaller plants with homogenous fuel types
Bag filter	**+ Effective removal; can be tailored to specific pollutant challenges; robust proven technology** **- Bags careful temperature control, close management, and regular replacement** **Can be used on their own in conjunction with other techniques. Robust and reliable with high levels of redundancy and bag coatings can be specified to expected emissions**

In this instance the BAT for the control of particulates from the facility would be the use of bag filters as these would be compatible with the scale of particulates likely to be encountered and work effectively in conjunction with flue treatment techniques being employed on the site.

3.7.2 Proposed technique for particulate abatement

Following mixing with lime and activated carbon in the vertical reaction tower, the flue gases will pass through a bank of filter bags. These bags will trap the particulates along with the reacted lime and activated carbon. The bags are fitted with an air pulse cleaning system and the residues dropping into the baghouse filter's collection hoppers will then be transported via an enclosed conveying system into a sealed silo for specialist disposal. The air pulse cleaning system will be activated by a differential pressure switch: as soon as the pressure across a filter cell will reach the threshold of the differential pressure switch, this activates the solenoid valve to act the pulse cleaning. This system also provides monitoring to detect any bag ruptures.

4 The Incineration of Waste – EPR 5.01

This section details the required explicit answers to the questions as referenced in the EA Sector Guidance Note: *The Incineration of Waste – EPR 5.01*. Each of the questions are stated in the table below together with the answer to the question specific to the Swadlincote Energy Recovery Facility.

The Facility will comply with each of the indicative BATs as referenced in the EA Sector Guidance Note: *The Incineration of Waste – EPR 5.01*.

Guidance EPR 5.01 asks a number of questions with regards to the manner in which the plant would intend to demonstrate that it meets the required BAT standard.

The topics covered within the BAT specific questions include:

- Facility overview;
- Hazardous Waste Incineration;
- Emissions to surface water and sewer;
- Waste recovery and disposal;
- Continuous emission monitoring;
- Recovery and beneficial use of heat; and
- Minimising the amount and harmfulness of residues.

Describe how the plant is designed, equipped, and will be operated to ensure that the requirements of Council Directive 2000/76/EC on the incineration of waste are met, taking into account the categories of waste to be incinerated		
Ref	**Question**	**Response**
Facility Overview		
1	Does the installation contain more than one incineration line? Identify with a brief reference (e.g., L1, L2 etc) and provide a brief description (e.g., fixed hearth, chain grate) of each line.	The installation will comprise one incineration line using moving grate technology.
2	State the maximum design capacity (in tonnes/hour) for waste incineration for each line, and the maximum total incineration capacity (in tonnes/hour) of the plant.	The facility has a single incineration line. The maximum design capacity of 29.1 tonnes/hour when processing fuel with NCV of 8.5 MJ/kg. Fuel throughput will be 23/2 tonnes/hour when fuel at design NCV (10.5 MJ/kg) is processed.
3	Are any of the wastes you treat hazardous waste for WID purposes?	The facility will only accept non-hazardous wastes for incineration
4	For each line, provide the following information: a. Is the operating temperature of the plant, after the last injection of combustion air, 1,100°C for hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, or 850°C for all other wastes? b. If the operating temperature is below 1,100°C for incineration of hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, or below 850°C for all other wastes, you must request a derogation under WID Article 6(4) with a justification that the operation will not lead to the production of more residues or residues with a higher content of organic pollutants than could be expected if operation was according to WID conditions. c. State the residence time of gas at the operating temperature given above. Is it less than 2 seconds? d. Where the residence time is less than 2 seconds, you must request a derogation under WID Article 6(4) with a justification that the operation will not lead to the production of more residues or residues with a higher content of organic pollutants than could be expected if operation was according to WID conditions. e. Describe the technique that will be used to verify the gas residence time and the minimum operating temperature given, both under normal operation and under the most unfavourable operating conditions anticipated, in accordance with WID Article 6 (4). f. Describe where the temperature in the combustion chamber will be measured with a demonstration that it is representative in accordance with WID Article 6(1).	a. After the last injection of combustion air, the temperatures will be controlled within the range 850°C - 1,050°C. The facility will not accept any hazardous wastes. Temperature will be measured with suction pyrometer thermocouples. b. Not applicable, as the temperature will be above 850°C. c. The residence time of the gas at the normal operating temperature (>850°C) will be in excess of two seconds. d. Not applicable e. The plant will be designed to provide a minimum exhaust gas residence time after the last injection of combustion air of at least two seconds at a temperature of at least 850°C. This criterion has been using Computational Fluid Dynamic (CFD) modelling during the design stage. Gas temperatures measured at various points within the boiler during commissioning will be used to confirm the minimum two seconds gas residence time at minimum 850°C requirement. It will also be demonstrated during commissioning that the Plant can achieve complete combustion by measuring concentrations of carbon monoxide, volatile organic compounds and dioxins in the flue gases and analysis of the bottom ash. During the operational phase, the temperature at the two seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes will be selected using the results of the CFD model and commissioning tests. f. The location of the temperature probes will be selected by the technology supplier using the results of the CFD model. Temperatures will be measured at the top of the first boiler pass by IR optical pyrometers.

5	For each line, describe the automatic system to prevent waste feed under the following circumstances: a. During start-up b. When continuous emission monitors show that an emission limit value (ELV) is exceeded due to disturbances or failures of the abatement equipment c. Whenever the combustion chamber temperature has fallen below a set value.	a. Heating of the combustion chamber with the auxiliary burner takes place until the temperature reaches 850°C. Once the temperature is reached an interlock allows opening of the gate in the feeding chute and waste is allowed to enter the combustion grate where it will start to burn. b. In the event that an ELV as recorded by the continuous monitoring system is exceeded or there has been a fault recorded with the abatement equipment, waste feeding will cease. Feeding will only be permitted to recommence when the failure or fault condition has been resolved c. In the event that the temperature within the combustion chamber approach to fall below 850°C auxiliary burners will be brought into operation by the plant control system. In addition, the waste feed will be stopped, and process air requirement may be modified.
6	State the temperature set point at which waste feed is prevented. It must be at least the temperature specified in WID (1100°C for hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, or 850°C for all other wastes) or an alternative temperature as allowed by WID Article 6(4) in which case the applicant should demonstrate how WID Article 6(4)'s requirements are met	Waste feed will be prevented if temperatures in the combustion chamber fall below 850°C. The facility will not accept hazardous wastes
7	Does the plant use oxygen enrichment in the incineration combustion gas. If it does, specify the oxygen concentration in the primary air and secondary air (% oxygen). This is required to enable us to specify standards for measurement as required in Article 11(8).	No, primary and secondary air is supplied by a centrifugal air fan.
8	Does each line of the plant have at least one auxiliary burner controlled to switch on automatically whenever the furnace temperature drops below a set value in accordance with the requirements of WID Article 6 (1)?	Yes, the combustion chamber is fitted with 2 auxiliary burners. These burners act as a back-up heat source during the following circumstances: • At start up to heat the combustion chamber to a minimum temperature prior to waste feeding • To support temperatures should these approach to fall below 850 C during normal operation • At shut down to ensure that all waste on the grate has been incinerated
9	Which fuel type is used during start-up/shut-down? If it is not natural gas, LPG, or light fuel oil/gasoil, provide evidence that it will not give rise to higher emissions than burning one of those fuels, as specified by WID Article 6 (1)	The burners will be fuelled by a low-sulphur diesel oil.
10	Are pre-treatment methods required to ensure that the quality standard for Total Organic Carbon (TOC) content of Loss on Ignition (LOI) of the bottom ash or slag is achieved?	Mixing of fuel will be implemented within the storage bunker to promote fuel homogeneity in order to have an optimal and as far as possible, complete combustion limiting the content of TOC in the IBA.
11	If any line of the plant uses fluidised bed technology, do you wish to request a derogation of the CO WID ELV to a maximum of 100,g/m3 as an hourly average, as provided for in the WID Annex V(e)?	Not applicable, the facility does not use this technology
12	For each type of waste to be burned, provide the following information: a. Waste reference (e.g., WT1, WT2 etc) b. Waste description (e.g., chemical/physical description, trade name and firing locations) c. EWC classification number	WT1: 19 12 10 - combustible waste (refuse derived fuel) WT2: 19 12 12 - other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11 WT3: 20 03 01 - mixed municipal waste WTX: other wastes with EWCs listed in Table 1b of Form B3.

	d. Maximum and minimum annual disposal in tonnes e. State whether it is hazardous waste for the purposes of WID	d. Maximum disposal is 230,000 t/yr e. Hazardous waste is not to be accepted for incineration
13	Is any fraction of the hazardous waste generated by the installation of which the incinerator is a part? For hazardous wastes which fall into this category, you may request a derogation from the requirement to comply with the requirements in sections 14) - 16) below by virtue of Article 5(5) of the Directive.	Not applicable - hazardous waste is not to be accepted for incineration
	Describe how you ensure that information about the mass of waste (as categorised by the European Waste Catalogue (EWC)) to be delivered, is available before it is received? (WID Article 5 (2))	Not applicable - hazardous waste is not to be accepted for incineration
	How do you ensure that the requirements of WID Article 5(3) as listed below are satisfied before the hazardous waste streams identified are delivered? • hazardous waste consignment notes have been provided • the physical and chemical characterisation of the waste show that the waste is suitable for treatment at the plant • the hazardous characteristics of the waste are sufficiently known to enable safe handling and safe blending/mixing where appropriate	Not applicable - hazardous waste is not to be accepted for incineration
Hazardous waste incineration		
13	Is any fraction of the hazardous waste generated by the installation of which the incinerator is a part? For hazardous wastes which fall into this category, you may request a derogation from the requirement to comply with the requirements in sections 14) - 16) below by virtue of Article 5(5) of the Directive.	Not applicable - hazardous waste is not to be accepted for incineration
14	Describe how you ensure that information about the mass of waste (as categorised by the European Waste Catalogue (EWC)) to be delivered, is available before it is received? (WID Article 5 (2))	Not applicable - hazardous waste is not to be accepted for incineration
15	How do you ensure that the requirements of WID Article 5(3) as listed below are satisfied before the hazardous waste streams identified are delivered? • hazardous waste consignment notes have been provided • the physical and chemical characterisation of the waste show that the waste is suitable for treatment at the plant • the hazardous characteristics of the waste are sufficiently known to enable safe handling and safe blending/mixing where appropriate	Not applicable - hazardous waste is not to be accepted for incineration
16	Do you take representative samples from the hazardous waste streams? If not, provide justification or alternatives (e.g., for clinical waste safety hazards may limit access to the waste stream however the waste acceptance/pre-acceptance procedures from EPR SGN S5.07 on Clinical Waste Management provide robust alternatives). (WID Article 5(4) (b))	Not applicable - hazardous waste is not to be accepted for incineration
17	What is the retention period of samples after incineration of the batch has been completed? Minimum is 1 month. (WID Article 5(4) (b))	Not applicable - hazardous waste is not to be accepted for incineration
18	Do you incinerate H9 (as defined in Annex III of the Hazardous Waste Directive) infectious clinical waste?	Not applicable - hazardous waste is not to be accepted for incineration
19	If you incinerate H9 infectious clinical waste, will the material go straight from storage into the furnace without being mixed with other categories of waste and without direct handling during loading of the furnace as required by WID (Article 6 (7))?	Not applicable - hazardous waste is not to be accepted for incineration

Emissions to surface water and sewer		
20	If the technique by which you clean the exhaust gas from the incinerator generates waste water, you must give details of the waste water treatment process and demonstrate that you comply with the requirements of WID Annex IV and Articles 8(4) and 8(5). In particular, if you mix waste waters from your exhaust gas treatment with other waste waters prior to treatment, monitoring or discharge, you must demonstrate how you apply the mass balance requirements referred to in Articles 8(4) and 8(5) to ensure that you derive a valid measurement of the emission in the waste water.	Air pollution control system based on hydrated lime and activated carbon, followed by the use of bag filters, is proposed for the facility. These techniques do not generate a liquid effluent for disposal.
21	Describe your storage arrangements for contaminated rainwater run-off, water contaminated through spillages and water arising from fire-fighting operations. Demonstrate that the storage capacity is adequate to ensure that such waters can be tested and, if necessary, treated before discharge. (WID Article 8 (7)).	<u>Process Effluent</u> Excess process waters arising from boiler blowdown, the demineralisation unit and the cleaning/draining of equipment will be collected on the on-site wastewater pit to be re-used in the Facility for ash quenching. Any excess process effluents will be tankered off site under a suitable waste collection contract. No process effluent will be discharged to surface water or sewer. <u>Surface Water</u> The Installation is to be served by a new stormwater network which includes use of Sustainable Drainage Systems (SuDS). Surface water runoff from the proposed buildings and infrastructure will be collected and transferred via private storm networks towards a series of attenuation features. Prior to release into any attenuation features, runoff will first drain through a series of pollution control measures (i.e., trapped gullies, manholes with catch pits etc). The attenuation features will include a combination of belowground tank storage, together with above-ground Sustainable Drainage Systems (SuDS), each sized to accommodate up to the 100-year return period storm, including 40% allowance for climate change. The proposed SuDS will include freeboard allowances to assist in the mitigation of exceedance rainfall events. The proposed SuDS will be designed in accordance with CIRIA C753 The SuDS Manual to maximise treatment potential and to ensure the cumulative ‘SuDS Mitigation Indices’ exceed the ‘Pollution Hazard Index’ for residential developments, so that adequate treatment is being provided. Attenuated runoff from the Proposed Development will utilise a new stormwater outfall to the downstream watercourse which naturally receives flows from the catchment. <u>Fire Water</u> The engineered containment system on site will prevent the release of potentially polluting liquids (including firewater) to surface water and groundwater. <u>Foul Water</u> Foul waters arising from domestic water use will drain to a new private package treatment plant. Treated flows will discharge to the proposed swale and wetland area which can provide further polishing ahead of outfall to the downstream watercourse. The final discharge of treated foul waters will be in accordance with the general binding rules for small sewage discharges with effect from 2 October 2023.

22	For each emission point, give benchmark data for the main chemical constituents of the emissions under both normal operating conditions and the effect of possible emergency conditions. In this section we require further information on how you monitor the pollutants in these emissions. You must provide information for flow rate, pH, and temperature. Article 8 of WID requires that wastewater from the cleaning of exhaust gases from incineration plant shall meet the ELVs for the metals and dioxins and furans referred to in Annex IV of WID. Where the waste water from the cleaning of exhaust gases is mixed with other waters either on or offsite the ELVs in Annex IV must be applied to the waste water from the cleaning of exhaust gases proportion of the total flow by carrying out a mass balance. Monitoring for other pollutants is dependent on the process and the pollutants you have identified in response to the question.	Excess process waters arising from boiler blowdown, the demineralisation unit and the cleaning/draining of equipment will be collected within the on-site wastewater pit to be re-used in the Facility for ash quenching. Any excess process effluents will be tankered off site under a suitable waste collection contract. No process effluent will be discharged to surface water or sewer. The engineered containment system on site will prevent the release of potentially polluting liquids (including firewater) to surface water and groundwater.
23	For each parameter you must define: • emission point • monitoring frequency • monitoring method whether the equipment/sampling/lab is MCERTS certified measurement uncertainty of the proposed methods and the resultant overall uncertainty • procedures in place to monitor drift correction • calibration intervals and methods • accreditation held by samplers or details of the people used and their training/competencies	Excess process waters arising from boiler blowdown, the demineralisation unit and the cleaning/draining of equipment will be collected within the on-site wastewater pit to be re-used in the Facility for ash quenching. Any excess process effluents will be tankered off site under a suitable waste collection contract. No process effluent will be discharged to surface water or sewer. The engineered containment system on site will prevent the release of potentially polluting liquids (including firewater) to surface water and groundwater. All monitoring equipment, testing and sampling Labs will be to MCERTS standard.
24	Describe any different monitoring that you will carry out during Commissioning of new plant.	Additional inspections will be undertaken to ensure drainage connections have been appropriately made
25	Describe any different arrangements during start-up and shut- down.	None
26	Provide any additional information on monitoring and reporting of emissions to water or sewer.	None
Waste recovery/disposal		

27	How do you deal with the residue from the incineration plant? Explain how you minimise, recover, recycle, and dispose of it.	Incinerator bottom ash will be transported to, and stored within, an enclosed area. It shall then be loaded into appropriate covered bulk vehicles for transport to a suitably licensed recycling and recovery facility. APC residues will be collected and separately stored to await collection. The APC residues are classified as hazardous waste (on the basis of irritancy (H4) and ecotoxicity (H14)) and will be transported off-site for disposal at a suitably permitted landfill facility.
Continuous emission monitoring performance		
28	How do you intend to manage the continuous measurement system to satisfy WID Article 11 (11)? WID Article 11 allows a valid daily average to be obtained only if no more than: • 5 half-hourly averages, and • 10 daily averages per calendar year during the day are discarded due to malfunction or maintenance of the continuous measurement system. Give details of how calibration, maintenance and failure of the continuous measurement system will be managed in order to satisfy these limitations. If necessary distinguish between different incineration lines.	WID requirements for process operation will be written into the operational process control software for the facility. This ensures the plant operates in accordance with the requirements specified under WID and will provide a detailed record of how calibration, maintenance, and failure of the continuous emissions measurement system (CEMS) is managed.
29	Give details of how you define when start-up ends and shut- down begins. Describe any different arrangements for monitoring during start up or shut down. Note that the emission limit values specified for compliance with WID do not apply during start-up or shut-down when no waste is being burned. Explain how you will integrate these periods into the emissions monitoring system in such a way that the reportable averages are calculated between these times, but the raw monitoring data remains available for inspection. (WID Article 11(11)). If necessary, distinguish between different incineration lines.	The end of the start-up period is defined when the combustion chamber has reached 850 °C. At this point waste feeding will commence. Shut down begins when waste feeding stops, when the auxiliary burners will be used until all waste has been combusted and is empty. CEMS will commence monitoring emissions as soon as waste is fed into the grate. During shut down, CEMS monitoring will cease when there is no waste remaining on the grate. The control of this process is to be integrated into the plant operating software.
30	Describe each type of unavoidable stoppage, disturbance or failure of the abatement plant or continuous emission monitoring system during which plant operation will continue. State the maximum time anticipated before shut-down is initiated for each of these types of unavoidable stoppage.	The plant will not continue to operate normally in the event of a failure of a stoppage or failure of the emissions abatement plant. Should the CEMS fail at any time, the backup CEMS will commence measurement automatically; if this unit has also failed an automatic plant shutdown will be initiated.
31	Will the values of the 95% confidence intervals of a single measured value of the daily emission limit value, exceed the percentages of the emission limit values required by WID Article and Annex III point 3, as tabulated below? (We will accept that MCERTS certified instruments satisfy these quality requirements)	MCERTS instruments will be used for all measurements
32	Describe the monitoring of process variables, using the format tabulated below. For emissions to air, include at least the arrangements for monitoring oxygen content, temperature, pressure, and water vapour content at the points where emissions to air will be monitored (WID Article 11 (7)). For emissions of waste water from the cleaning of exhaust gases include at least the arrangements for monitoring pH, temperature, and flow rate (WID Article 8 (6)).	For process monitoring arrangements, please refer to the Operating Techniques document submitted with the application. There are no emissions of waste water from the cleaning of fuel gases.
Describe how the heat generated during the incineration and co-incineration process is recovered as far as practicable		

33	You must assess the potential for heat recovery from each line, using the guidance in this Sector Guidance Note. You must justify any failure to recover the maximum amount of heat.	See Appendix 14 – Heat Opportunity Report
Describe how you will minimise the amount and harmfulness of residues and describe how they will be recycled where this is appropriate		
34	Describe how you will minimise the amount and harmfulness of residues and describe how they will be recycled where this is appropriate.	Non-hazardous incinerator bottom ash will be collected and sent to disposal / recycling centres. for recovery of metals and further processing and recycling into an aggregate where possible. Efficient operation of the plant through close process control will be the primary method to control the quantities air pollution control residues (APCR) generated by the process. Whilst disposal of these wastes to approved contractors is currently the most practicable option, the plant operator will regularly review the disposal options and will consider sending APC wastes for further use / recycling should practical options become available.
35	For each significant waste that you dispose of, provide the following information: • Incineration line identifier • Residue type reference (e.g., RT1, RT2 etc) • Source of the residue • Description of the residue • Details of transport and intermediate storage of dry residues in the form of dust (e.g., boiler ash or dry residues from the treatment of combustion gases from the incineration of waste). Article 9 of WID requires operators of incineration plant to prevent dispersal in the environment in the form of dust. • Details of total soluble fraction and soluble heavy metal fraction of residues. Article 9 of WID requires operators of incineration plant to establish physical and chemical characteristics and polluting potential of incineration residues. Route by which the residue will leave the installation – e.g., recycling, recovery, disposal to landfill, other.	• L1 (only one incineration line) • RT1 – Incinerator Bottom Ash. Incinerator bottom ash developed in the combustion chamber will primarily be extracted from the bottom of the grate and quenched with water. The incinerator bottom ash is then discharged via a wet conveyor system to a dedicated storage area, from which it is transferred into appropriate covered skips or bulk vehicles for transport to reprocessing into secondary products and/or disposal. RT2 – Air Pollution Control Residues. APCR from the bag filter are conveyed to enclosed silos. This material is subsequently discharged into tankers through enclosed unloading systems (Screw conveyor and flexible hose to tanker ports) for onward transport to reprocessing and/or disposal. • Handling and transport of IBA and APC residues within the facility is undertaken using fully enclosed systems, based on a combination of belt/chain/screw conveying systems, depending on the material to be handled. Intermediate storage is provided by silos for APC residues whilst intermediate storage for IBA will be within a dedicated enclosed area from where it is transferred into appropriate covered bulk vehicles for transport to reprocessing into secondary products and/or disposal. • The composition of the IBA and APC residues will be established during the commissioning phases of the project. • Route for disposal or reprocessing will be established during the operational phase and may be modified during the life of the plant within the conditions of the permit.
36	Article 6(1) of WID requires incinerators to be operated in order to achieve a level of incineration such that the slag and bottom ashes have a total organic carbon (TOC) content of less than 3%, or their loss on ignition (LOI) is less than 5% of the dry weight of the material. Where the incinerator includes a pyrolysis stage or other stage in which part of the organic content is converted to elemental carbon, the portion of TOC which is elemental carbon may be subtracted from the measured TOC value before comparison with the 3% maximum, as specified in the Defra Guidance on the Waste Incineration Directive. Note that WID Article 6(1) requirements are complied with if either TOC or the LOI measurement referred to below is achieved.	• Total organic carbon (TOC) or loss of ignition (LOI) will be used for monitoring of bottom ash.

	TOC: for waste incinerators, 3% as maximum as specified by WID Article 6(1). LOI: for waste incinerators, 5% maximum as specified by WID Article 6(1). Specify whether you intend to use total organic carbon (TOC) or loss on ignition (LOI) monitoring of your bottom ash or slag.	

4.1 *Waste Incineration: Best Available Techniques Conclusions*

The following tables reference the BAT conclusions (BATc) for waste incineration installations[3], as covered by Chapter II of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control). For each of the BAT conclusions, the compliance status and compliance measures are provided.

4.1.1 Environmental Management System

BATc Ref.	BATc Standard	BATc Compliance Status	Compliance Measure
BAT 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the following features:		
(i)	Commitment of the management, including senior management;	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(ii)	Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	✓	Environmental policy to be a part of the EMS (See Appendix 1 EMS Summary)
(iii)	Planning and establishing the necessary procedures, objectives, and targets, in conjunction with financial planning and investment;	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(iv)	Implementation of procedures paying particular attention to: (a) Structure and responsibility (b) Recruitment, training, awareness, and	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)

[3] COMMISSION IMPLEMENTING DECISION (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration

	competence (c) Communication (d) Employee involvement (e) Documentation (f) Effective process control (g) Planned regular maintenance programmes (h) Emergency preparedness and response (i) Safeguarding compliance with environmental legislation		

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
(v)	Checking performance and taking corrective action, paying particular attention to: (a) Monitoring and measurement (see also the Reference Report on Monitoring of Emissions to Air and Water – ROM) (b) Corrective and preventive action (c) Maintenance of records (d) Independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained.	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(vi)	Review, by senior management, of the EMS and its continuing suitability, adequacy, and effectiveness;	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(vii)	Following the development of cleaner technologies;	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(viii)	Consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life including; a) Avoiding underground structures b) Incorporating features that facilitate dismantling	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
	c) Choosing surface finishes that are easily decontaminated d) Using an equipment configuration that minimises trapped chemicals and facilitates drainage or cleaning e) Designing flexible, self-contained equipment that enables phased closure f) Using biodegradable and recyclable materials where possible;		
(ix)	Application of sectoral benchmarking on a regular basis. Specifically for this sector, it is also important to consider the following features of the EMS described where appropriate in the relevant BAT	✓	To be included in EMS documentation (See Appendix 1 EMS Summary)
(x)	Quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9)	✓	Fuel sampling and testing procedures to be provided in accordance with BAT 9.
(xi)	A management plan in order to reduce emissions to air and/or to water during other than normal operating conditions, including start-up and shutdown periods (see BAT 10 and BAT 11);	✓	OTNOC management plan will be issued and put in place during the commissioning activities in accordance with BAT 10 and BAT 11.
(xii)	A waste management plan to ensure that waste is avoided, prepared for reuse recycled or otherwise recovered, including the use of techniques given in BAT 16	✓	Waste streams to include IBA, fly ash and APCR, to be generated from the facility. Specific procedures for the collection of any waste materials, such as oil and spent components will be incorporated into the EMS. (See Appendix 10 Waste Management Plan)

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
(xiii)	A systematic method to identify and deal with potential uncontrolled and or/unplanned emissions to the environment, in particular: a.) Emissions to soil and groundwater from the handling and storage of fuels, additives, by products and waste b.) Emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities	✓	Part a. Will be dealt with by way of Standard Operating Procedure to be incorporated into the EMS. Part b. is not relevant to this operation. A spill prevention and response plan will be incorporated into a SOP upon commencement of operations.
(xiv)	A dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues, and additives;	✓	A Dust Management Plan has been completed which details the measures that will be employed to control dust emissions and manage the potential environmental impacts from dust that could arise during the operation of the Facility. (See Appendix 12 Dust Management Plan)
(xv)	A noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including: a.) A protocol for conducting noise monitoring at the plant boundary b.) A noise reduction programme c.) A protocol for response to noise incidents containing appropriate actions and timelines d.) A review of historic noise incidents, corrective action, and dissemination of noise incident knowledge to the affected parties;	***N/A***	A Noise and Vibration Assessment has been completed which determines that the magnitude of impact is negligible for all sensitive receptors. Should a noise nuisance at sensitive receptors be expected or sustained, then a noise management plan will be put in place, as required. See Appendix 8 - Noise and Vibration Assessment

(xvi)	For the combustion, gasification or co-incineration of malodorous substances, and odour management plan including: a.) A protocol for conducting odour management b.) Where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions c.) A protocol to record odour incidents and the appropriate actions and timelines d.) A review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties.	✓	See Appendix 7 - Odour Management Plan

4.1.2 Monitoring

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or all of the relevant parts of the incineration plant.	✓	Gross electricity efficiency is calculated to be 30.3%. Gross energy efficiency - a 65% efficiency threshold will be met (See Appendix 18 – R1 Energy Efficiency Formula)
BAT 3	BAT is to monitor key process parameters relevant for emissions to air and water including those given below:-		
	Flue-gas from the incineration of waste	✓	See Appendix 6 – Air Quality Assessment
	Combustion chamber	✓	See Appendix 6 – Air Quality Assessment
	Waste water from wet FGC	***N/A***	All process effluents will be tankered off site under a suitable waste collection contract. No process effluent will be discharged to surface water or sewer.
	Waste water from bottom ash treatment plants	***N/A***	
BAT 4	BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 and in accordance with EN standards. If EN standards are not available, BAT is to use ISO national or other international standards that ensure the provisions of data of an equivalent scientific quality.	✓	The plant will be equipped with a Continuous Emission Monitoring System in line with MCERTS and in accordance with EN Standards. See Appendix 6 – Air Quality Assessment
BAT 5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during OTNOC (other than normal operating conditions)	✓	See Appendix 6 – Air Quality Assessment

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 6	BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given below and in accordance with EN standard. If EN standards are no available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	***N/A***	There are no such emissions from the installation.
BAT 7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency given below and in accordance with EN standards. Loss on ignition Total Organic carbon A minimum of once every three months	✓	To monitor unburnt substances in slags and ashes loss on ignition testing will be carried out. Total organic carbon (TOC) or loss of ignition (LOI) will be used for monitoring of bottom ash.
BAT 8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g., slags and bottom ashes, flue gas, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	***N/a***	No hazardous waste incineration is proposed.

4.1.3 Environmental Combustion and Performance

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is the use all of the techniques (a) to (c) given below, and where relevant, also techniques (d), (e) and (f)		
(a)	Determination of the type of waste that can be incinerated	✓	The plant will operate with waste fuel subject to classification checks undertaken by the third-party supplier to ensure all waste is non-hazardous. Visual inspections will be undertaken when the waste is unloaded into the storage bunker. If necessary, inspections may also be carried out at the weighbridge or in the waste reception hall. A conceptual flow diagram illustrating the fuel acceptance procedures is included in Appendix 4 Operating Techniques. Periodic sampling of the fuel will also be undertaken (either at the Facility or at the fuel suppliers' premises) to monitor compliance with the fuel supply contracts' specifications.
(b)	Set-up and implementation of waste characterisation and pre-acceptance procedures.	✓	
(c)	Set-up and implementation of waste acceptance procedures	✓	
(d)	Set-up and implementation of a waste tracking system and inventory	✓	
(e)	Waste segregation	N/a	
(f)	Verification of waste compatibility prior to the mixing or blending of hazardous waste	N/a	
BAT 10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system	N/a	No IBA treatment is to be undertaken on the site. All IBA treatment will be undertaken off-site by a third party.
BAT 11	In order to improve the overall environmental performance of the incineration plant BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk proposed by the incoming waste, the elements given below.	✓	All fuel received by the facility is subject to waste acceptance protocols established with the fuel provider (refer to the compliance measures for BAT 9 above).

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below:- a.) Impermeable surface with adequate drainage infrastructure b.) Adequate waste storage capacity	✓	All areas where waste is handled and stored are supplied with sealed drainage systems and are located on impermeable hard standing. An ERF pond will provide stormwater attenuation, treatment, and biodiversity benefits.
BAT 13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given below:-	***N/a***	Applicable to facilities accepting clinical waste only
BAT 14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use a combination of the techniques given below:- a.) Waste blending and mixing b.) Advanced control system c.) Optimisation of the incineration process.	✓	Waste homogenisation to be undertaken by suitably trained and experienced operative utilising the loading grab. See BAT 15 for information pertaining to the advanced system control, and optimisation of the incineration process.

BAT 15	In order to improve the overall environmental performance of the incineration of waste, to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based upon the characterisation and control of the waste.	✓	The plant will be equipped with a microprocessor-based distributed control system (DCS) (with full redundancy) which will manage and supervise the complete operation of the plant. For the purpose of optimising environmental parameters, the control system will act on: - fuel supply - supply and balancing of primary, secondary air and (if necessary) recirculation fumes, - Temperature control in the combustion chamber - Feeding of reagents to optimise the reduction of acidic gases - Feeding of activated carbon - Urea supply for SNCR. The plant will be equipped with pressure, temperature, flow, and analysis sensors directly connected to the control system which will act on the final acting elements with feedback and feedforward algorithms. The plant operators will have man-machine interfaces in which it will be possible to display all of the operating parameters of the plant and act on a real-time basis to adjust the behaviour of the plant. The various parameters will be recorded continuously, and it will be possible to view current and historical trends. An alarm system will be implemented with recording of events. Finally, the DCS system will also manage the plant automatic shutdowns. Automatic plant shutdowns cannot be overridden by operators.

BAT 16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g., organisation of the supply chain, continuous rather than batch operation) to limit as far as is practicable shutdown and start-up operations.	✓	The plant has been designed to operate continuously for approximately 8,000 hours a year. The foreseen scheduled stops are 2 per year during which the system maintenance activities will be carried out. Many of the system components are redundant to ensure continuity of operation. For non-redundant components, procedures for the preventive maintenance of critical components will be implemented to avoid unexpected breakages. To guarantee the supply of fuel, framework agreements will be stipulated with various suppliers which will therefore guarantee the full operability of the plant.
BAT 17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g., considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability.	***N/a***	There are no process emissions to water from the installation. See Appendix 6 – Air Quality Assessment
BAT 18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk based OTNOC management plan as part of the Environmental Management System that includes all of the elements, as detailed in BAT 18.	✓	At OTNOC management plan will be prepared during the commissioning phase of the plant. See Appendix 6 – Air Quality Assessment

4.1.4 Energy Efficiency

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 19	In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	✓	See Appendix 19 CHP Readiness Assessment of the Environmental Permit application
BAT 20	In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given below:- a. Drying of sewage sludge b. Reduction of the flue-gas flow c. Minimisation of heat losses d. Optimisation of the boiler design e. Low temperature flue-gas exchanges f. High steam conditions g. Cogeneration h. Flue-gas condenser i. Dry bottom ash handling	✓	See Appendix 19 CHP Readiness Assessment of the Environmental Permit application

4.1.5 Emissions to air

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 21	In order to prevent or reduce emissions from the incineration plant, including odour emissions, BAT is to:- Store solid and bulky pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled sub-atmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion. Store liquid waste in tanks under appropriate controlled pressure and duct the tank vents to the combustion air feed. Control the risk of odour during complete shutdown periods when no incineration capacity is available e.g., by:- - sending the vented or extracted air to an alternative system e.g., a wet scrubber, a fixed adsorption bed; - minimising the amount of waste in storage, e.g., by interrupting, reducing, or transferring waste deliveries, as a part of waste stream management - storing waste is properly sealed bales	✓	The reception hall and bunker building are kept at negative pressure by the operation of the boiler's combustion process air intake fan which extracts the air from the bunker building. In situations where the boiler fan may not be available due to breakdown or maintenance, an auxiliary air extraction system will provide permanence of negative pressure within the hall to prevent odour escape. The auxiliary system will consist of an appropriately sized air extraction fan passing through a wet scrubbing unit and/or activated carbon filters. No liquid waste to be imported to the site.
BAT 22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances as incineration plants, BAT is to	N/a	Not applicable to the waste types to be accepted.

	introduce them in to the furnace by direct feeding.		

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the environmental management system (BAT 1) the following diffuse dust emissions management features: - Identification of the most relevant diffuse dust emission sources (e.g., using EN 15445) - Definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given timeframe.	*N/a*	No treatment of slags or bottom ashes is proposed.
BAT 24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below:- a. Enclose and cover equipment b. Limit height of discharge c. Protect stockpiles against prevailing wind d. Use water sprays e. Optimise moisture content f. Operate under sub-atmospheric pressure	*N/a*	No treatment of slags or bottom ashes is proposed.
BAT 25	In order to reduce channelled emissions to air of dust, metals, and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given below:- a. Bag filter	✓	The bag filters will have a design temperature of 200°C while the operating temperature will be 165°C. The system will be equipped with flue gas temperature sensors and alarm will be implemented to alert the operator if the flue gas temperature will approach the design value. A further higher threshold will be implemented to

	b. Electrostatic precipitator c. Dry sorbent injection d. Wet scrubber e. Fixed or moving bed adsorption		shut-down the boiler.
BAT 26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 (f), BAT is to treat the extracted air with a bag filter.	N/a	No treatment of slags or bottom ashes is proposed.
BAT 27	In order to reduce channelled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given below:- a.) Wet scrubber b.) Semi-wet scrubber c.) Dry sorbent injection d.) Direct desulphurisation e.) Boiler sorbent injection	✓	BAT is achieved through the injection of dry sorbent in the flue gas, achieved by the dosing of hydrated lime into the flue stream after the boiler.
BAT 28	In order to reduce channelled peak emission of HCl, HF and SO_2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a), or both of the techniques given below:- a.) Optimised and automated reagent dosage b.) Recirculation of reagents	✓	A NO_x, SO_2 and HCl analyser will be installed after the boiler and before the lime injection. The SO_2 and the HCl concentration will be used as feedforward signal for the lime injection (2nd step of acidic gases abatement). The lime injection rate will be further optimised by using the concentration of SO_2 and HCl read at stack by CEMS.

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 29	In order to reduce channelled NO_x emissions to air while limiting the emissions of CO and N_2O from the incineration of waste and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given below. a.) Optimisation of the incineration process b.) Flue-gas recirculation c.) Selective non-catalytic reduction d.) Selective catalytic reduction e.) Catalytic filter bags f.) Optimisation of the SNCR/SCR design and operation g.) Wet scrubber	✓	This BAT conclusion is met by implementation of the following measures:- Primary techniques: The primary technique to reduce the formation of NO_x that will be implemented in the facility are:- • Prevention of air oversupply (preventing the supply of additional nitrogen); • Optimising the combustion with well distributed primary and secondary air in order to avoid unnecessary high temperatures in the combustion chamber • If necessary, flue gas recirculation to control temperature and oxygen content in the upper stage of the combustion chamber. Secondary techniques: Further NO_x abatement will be carried out in the facility with secondary techniques. The plant will be equipped with a SNCR system. The reducing agent that will be used in the facility will be a 40% urea water solution. The urea solution will be dosed directly into the combustion chamber as part of the SNCR system.

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d) and one or a combination of techniques (e) to (i) given below. (a), (b), (c) and (d) and one or a combination of techniques (e) to (i). a. Optimisation of the incineration process b. Control of the waste feed c. Online and offline boiler cleaning d. Rapid flue-gas cooling e. Dry sorbent injection f. Fixed or moving bed adsorption g. SCR h. Catalytic filter bag i. Carbon sorbent in a wet scrubber	✓	The primary techniques to control the formation of dioxins, furan and other organic compounds that will be implemented are:- - Mixing of the fuel will be implemented at site to promote fuel homogeneity in order to have optimal and, as far is possible, homogenous and stable incineration condition. - Design and operation of the combustion chamber to achieve a good burnout of the combustion gases by ensuring that the combustion gases are maintained at a minimum of 850°C for a minimum residence time of two seconds at a minimum oxygen level of 6%. - Installation of auxiliary burners to always avoid the temperature of the combustion chamber from falling below 850°C. - Design of the boiler in order to have a rapid flue gas cooling and limit the residence time of the fumes within the temperature range 200 - 400°C. Boiler bundles will be equipped with on-line cleaning systems to reduce the dust residence time and accumulation in the boiler. Off-line boiler bundles cleaning activities will be carried out during the maintenance periods. The facility will be equipped with the following secondary technique:- - Powdered Activated Carbon (PAC) injection where dioxins, furans and other organic compounds may be adsorbed.

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
31	Mercury Emission	✓	The facility will use, as a primary technique for the control of mercury emissions, the use of fuel with a low content of mercury. As a secondary technique, activated carbons are injected into the gas flow. The activated carbon adsorbs, with high efficiency, the volatile mercury compounds. The carbon is filtered in the bag filter.

4.1.6 Emissions to water

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 32	In order to prevent the contamination of uncontaminated water, to reduce emission to water and to increase resource efficiency, BAT is to segregate waste water stream and to treat them separately, depending on their characteristics.	✓	All waste water streams will be collected within the Facility and tankered off site. The following are the water effluents arising from the SERF Facility: Surface Water The Installation is to be served by a new stormwater network which includes use of Sustainable Drainage Systems (SuDS). Surface water runoff from the proposed buildings and infrastructure will be collected and transferred via private storm networks towards a series of attenuation features. Prior to release into any attenuation features, runoff will first drain through a series of pollution control measures (i.e., trapped gullies, manholes with catch pits etc). The attenuation features will include a combination of belowground tank storage, together with above-ground Sustainable Drainage Systems (SuDS), each sized to accommodate up to the 100-year return period storm, including 40% allowance for climate change. The proposed SuDS will include freeboard allowances to assist in the mitigation of exceedance rainfall events. The proposed SuDS will be designed in accordance with CIRIA C753 The SuDS Manual to maximise treatment potential and to ensure the cumulative 'SuDS Mitigation Indices' exceed the 'Pollution Hazard Index' for residential developments, so that adequate treatment is being provided. Attenuated runoff from the Proposed Development will utilise a new stormwater outfall to the downstream watercourse which naturally receives flows from the catchment.

			Foul Water Foul waters arising from domestic water use will drain to a new private package treatment plant. Treated flows will discharge to the proposed swale and wetland area which can provide further polishing ahead of outfall to the downstream watercourse. The final discharge of treated foul waters will be in accordance with the general binding rules for small sewage discharges with effect from 2 October 2023. Process Effluent Excess process waters arising from boiler blowdown, the demineralisation unit and the cleaning/draining of equipment will be collected in the on-site wastewater pit to be re-used in the Facility for ash quenching. Any excess process effluents will be tankered off site under a suitable waste collection contract. No process effluent will be discharged to surface water or sewer.

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 33	In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given below: a.) Waste water free FGC techniques b.) Injection of waste water from FGC c.) Water reuse recycling d.) Dry bottom ash handling	✓	The plant has been designed with the aim to reduce as much as feasible the water consumption. The following criteria have been followed: - Utilisation of dry FGC techniques - Utilisation of air-cooled steam condenser - Utilisation of air-cooled radiators for plant's auxiliary cooling services Maximisation, as far as possible of water reuse in the process through the following operating techniques: 1. Maximisation, as far as is possible, of water reuse in the process. The site requires an average raw water supply of approximately 5 tonnes per hour. More details can be found in Appendix 22 Raw and Waste Water Balance Scheme in the Environmental Permit application.

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
34	Reduction of emissions to water	✓	The BAT 34 applies to waste water generated in slag / IBA treatment system and in wet flue gas systems. The facility will use dry FGC system with no waste water production. The wet IBAs will be drained as much as possible, and the recovered water will be sent back to the quenching system through closed impermeable collecting pit and sump pump. IBAs will be temporarily stored in an enclosed storage area and transferred into appropriate covered bulk vehicles for transport off site for reprocessing into secondary products and/or disposal.

4.1.7 Material Efficiency

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	✓	All waste water stream is treated according to their source and nature of potential contaminants.
BAT 36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes. a.) Screening b.) Sieving c.) Aeraulic separation d.) Recovery of ferrous and non-ferrous metals e.) Ageing f.) Washing	***N/a***	

4.1.8 Noise

BATc Ref.	BATc Standard	BATc Status	Compliance Measure
BAT 37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the technique given below:- a.) Appropriate location of equipment and buildings b.) Operational measures c.) Low-noise equipment d.) Noise attenuation e.) Noise-control equipment infrastructure.	✓	See Appendix 8 – Noise and Vibration Assessment