FICHTNER

Consulting Engineers Limited

Ferrybridge 1 - Line 3

enfinium Ferrybridge 1 Limited

Substantial Variation - Supporting Information

ENGINEERING CONSULTING

Document approval

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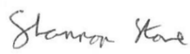
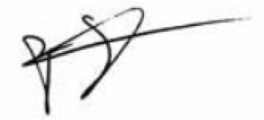
Prepared by:	Shannon Stone		Senior Consultant	15/12/2025
Checked by:	James Sturman		Principal Consultant	16/12/2025

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Non-technical Summary

An Environmental Permit (EP) was granted by the Environment Agency (EA) for the operation of Ferrybridge 1 in November 2012. The EP allows for the operation of a two-line waste incineration plant. Since it was granted eight separate variations to the EP have also been granted by the EA. The variations included transferring the EP to the current Operator – enfinium Ferrybridge 1 Limited (herein referred to as enfinium). The most recent variation was granted in March 2023 to amend the list of wastes to be accepted, to include mixed municipal wastes. As stated in the Introductory Note of the EP, Ferrybridge 1 is designed to generate up to 80 MWe, and exports up to 73 MWe.

Planning consent for the development of Ferrybridge 1 was granted under section 36 consent in accordance with the requirements of the Electricity Act 1989. The section 36 consent allows for the construction of up to three boiler and steam turbines, and restricts the power generation of Ferrybridge 1 to 108 MWe.

In accordance with the constraints of the planning consent, enfinium is applying to vary the EP to allow for the construction of an additional waste processing line and flue gas treatment and energy generation systems (herein referred to as Line 3). This application is being submitted as a substantial variation.

Line 3 will incinerate the same wastes as Lines 1 and 2. Line 3 will have a thermal capacity of up to 95.4 MWth assuming operation at 106% Maximum Continuous Rating (MCR). The design fuel will have a net calorific value (NCV) of 10.5 MJ/kg, but Line 3 will be designed to process waste with a range of NCVs (9 – 13 MJ/kg) without reducing load. At the design point, Line 3 will have an hourly waste processing throughput of 32.7 tonnes per hour (tph) per line. Assuming the operational availability of 8,200 hours per annum, Line 3 will process up to 268,210 tonnes per annum of waste. The addition of Line 3 will bring the total annual throughput of Ferrybridge 1 to 1,018,000 tonnes.

Line 3 will generate approximately 30.9 MWe of electricity with a parasitic load of approximately 3.8 MWe. Therefore, the Facility will be designed to export approximately 27.1 MWe of electricity.

Line 3 will utilise the same abatement and combustion technologies as Line 1 and Line 2. The EP application for Line 1 and Line 2 demonstrated that they represent BAT for the Facility; therefore, quantitative and qualitative BAT assessments have not been provided within this application.

A review of the Waste Incineration BREF has been undertaken. Given that Line 1 and 2 has already been required to demonstrate compliance with the requirements of the BREF, the review has primarily focused on the BATc's which are directly applicable to Line 3.

Contents

1 Introduction

An Environmental Permit (EP) was granted by the Environment Agency (EA) for the operation of Ferrybridge 1 in November 2012. The EP allows for the operation of a two-line waste incineration plant. Since it was granted nine separate variations to the EP have also been granted by the EA. The variations included transferring the EP to the current Operator – enfinium Ferrybridge 1 Limited (herein referred to as enfinium). The most recent variation was granted in March 2023 to amend the list of wastes to be accepted, to include mixed municipal wastes. As stated in the Introductory Note, Ferrybridge 1 is designed to generate up to 80 MWe, and exports up to 73 MWe.

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In accordance with the constraints of the planning consent, enfinium is applying to vary the EP to allow for the construction of an additional waste processing line and flue gas treatment and energy generation systems (herein referred to as Line 3).

This document and its appendices contain the supporting information for the application for an Environmental Permit (EP) for the Facility. They should be read in conjunction with the formal application forms. An overview of the activities to be undertaken at the Facility is provided in section 2. Further information and detail on each component at the Facility is provided in sections 3, mostly in response to specific questions raised in the application forms.

Section 1 of this document provides a brief overview of the application, including the proposed changes and type of variation. Section 2 provides a high-level description of Line 3; and section 3 describes Line 3 in more detail, considering the different information requested within the application forms. This document should be read in conjunction with the formal application forms and the supporting Appendices.

1.1 Proposed changes

This application is being submitted to vary the EP for the Ferrybridge 1 facility to implement Line 3. Line 3 is a standalone waste incineration line with a nominal design capacity of 32.7 tonnes per hour, which will share the waste bunker with the existing Line 1 and Line 2.

The proposed changes are explained in more detail in section 2.

1.2 Type of variation

The Environment Agency's guidance on Charging Schemes states that there are four types of variations – administrative, minor technical, normal and substantial.

Enifinium acknowledges that the proposed changes will not constitute either an administrative or minor technical variation.

The Environment Agency has published guidance (Regulatory Guidance Note 8 – Substantial Change) which defines a substantial change. It is acknowledged that the guidance has subsequently been withdrawn but any replacement guidance is not as prescriptive. The guidance defined a substantial change as:

> *'… a change in operation of installations or mining waste facilities, which in our opinion may have significant negative effects on human beings or the environment. Certain changes are automatically regarded as substantial, namely:*
>
> > *a. a change in operation of a Part A installation which in itself meets the thresholds, if any, set out in Part 2 of Schedule 1 EPRs; or*
> >
> > *b. a change in operation of an incineration or co-incineration plant for non-hazardous waste which would involve the incineration or co-incineration of hazardous waste.'*

As Line 3 is a standalone waste incineration activity (section 5.1 (b) of the EPRs) with a capacity of more 3 tonnes per hour, it is understood that the application will be classified as a Substantial Variation. This was confirmed by the Environment Agency through the pre-application discussions.

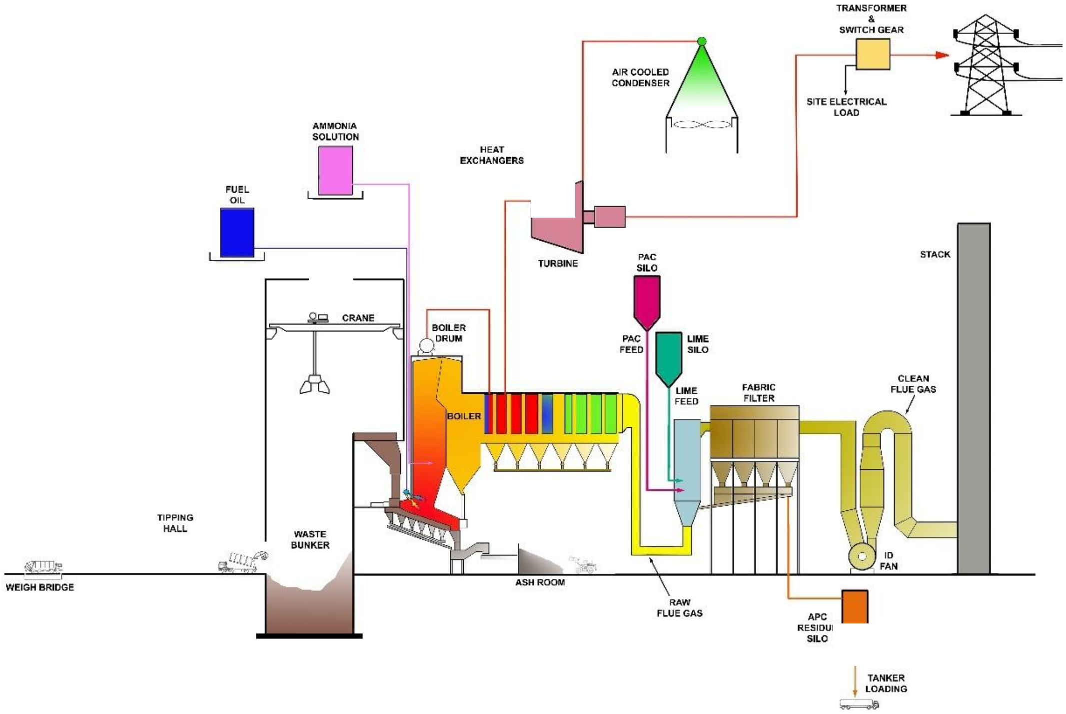
2 Ferrybridge 1 - Line 3

Line 3 will incinerate the same wastes as Lines 1 and 2. Line 3 will have a thermal capacity of up to 95.4 MWth assuming operation at 106% Maximum Continuous Rating (MCR). The design fuel will have a net calorific value (NCV) of 10.5 MJ/kg, but Line 3 will be designed to process waste with a range of NCVs (9 – 13 MJ/kg) without reducing load. At the design point, Line 3 will have an hourly waste processing throughput of 32.7 tonnes per hour (tph) per line. Assuming the operational availability of 8,200 hours per annum, Line 3 will process up to 268,210 tonnes per annum of waste. The addition of Line 3 will bring the total annual throughout of Ferrybridge 1 to 1,018,000 tonnes.

Line 3 will generate approximately 30.9 MWe of electricity with a parasitic load of approximately 3.8 MWe. Therefore, the Facility will be designed to export approximately 27.1 MWe of electricity.

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

Figure 1: Indicative Process Schematic



2.1 Raw materials

The existing waste bunker which serves Line 1 and 2 will be utilised for the receipt and storage of incoming waste. Therefore, the installation of Line 3 will not require any changes to the arrangements associated with the storage of waste; however, the waste crane will be extended to allow for the feed of waste into Line 3.

The primary raw materials to be used at the Facility include lime, activated carbon, ammonia solution, auxiliary fuel, water treatment chemicals and various maintenance materials (oils, greases, insulants, antifreezes, welding and firefighting gases etc).

Further detail on the storage arrangements for reagents and raw materials at the Facility are presented in section 3.1.3.

2.2 Combustion process

Conventional moving grate technology will be utilised which will agitate the fuel bed to promote a good burnout of the waste and a uniform heat release. The moving grates will enable the waste to be moved from the feed inlet along the grates to the ash discharge.

As required by the Industrial Emissions Directive (IED), the boiler will be designed to ensure that exhaust gases are raised to a minimum temperature of 850°C and kept at this temperature for a minimum of 2 seconds (flue gas residence time), to ensure the sufficient destruction of dioxins, furans, PAHs and other organic compounds. The flue gas temperature will be continually monitored and recorded via the distributed control system (DCS). Audible and visible alarms will trigger in the control room (and the auxiliary burners will fire) if the temperature starts to fall towards 850°C.

Primary combustion air for Line 3 will be extracted from the waste bunker area, maintaining negative pressure in this area. The primary combustion air will then be fed into the combustion chamber beneath the grate to create turbulence and ensure complete combustion. Secondary combustion air will be injected into the flame body above the grate to create turbulence and facilitate the complete combustion of waste on the grates whilst minimising levels of oxides of nitrogen (NOx) emissions. A combustion control system will regulate both primary and secondary air flows.

A Selective Non-Catalytic Reduction (SNCR) system will be employed to reduce NOx emissions. As part of this, a NOx abatement reagent will be injected into the high temperature region of the boilers. The reagent will react with oxides of nitrogen (NOx) formed in the combustion process and produce water, carbon dioxide and nitrogen. The dosing rate of the reagent will be controlled to achieve NOx concentrations below the proposed emission limit.

To achieve and maintain the required 850°C in the combustion chamber both prior to waste charging and at any time when waste is on the grate, low-NOx auxiliary burners will be provided which will be fuelled using low sulphur fuel oil.

Interlocks will prevent waste charging until the temperature in the combustion chamber has reached the required 850°C. Furthermore, should the temperature fall below 850°C during normal operation, the burners will operate to maintain the required temperature.

Combustion air flow will be controlled and optimised by measuring excess flue gas oxygen content, and will be set to maximise the efficiency of both the heat recovery process and the combustion process.

2.3 Energy recovery

A steam boiler will recover heat released by the combustion of waste. The boiler will be integral to the furnace and will, in combination with superheaters, produce high pressure superheated steam at approximately 430°C and 72 bar(a).

The steam generated by the boiler will feed a steam turbine which will generate electricity. The remainder of the steam left after the turbine will be condensed back to water; this generates the pressure drop to drive the turbine. A fraction of the steam will condense at the exhaust of the turbine in the form of wet steam; however, the majority will be condensed and cooled using an air-cooled condenser. The condensed steam will be returned as condensate to the feedwater tank –

the water is re-circulated into the process as boiler feedwater within the closed-circuit pipework system to the boilers.

2.4 Flue gas treatment

NOx levels will primarily be managed by careful control of the combustion air. An adequate supply of primary air will be maintained (and monitored) to provide the correct volume of oxygen for optimum combustion. Both oxygen content and temperature will be monitored within the primary combustion chamber, with combustion control systems maintaining stable conditions within the process. Low-NOx auxiliary burners will also be provided and will ignite should the temperature within the combustion chamber fall below the required 850°C under the IED.

Selective non-catalytic reduction (SNCR) will also be employed as secondary abatement to further reduce NOx levels. In the SNCR system, a NOx reduction reagent will be injected into the boiler (specifically, directly into the hot flue gases above the flame) to convert both nitrogen oxide (NO) and nitrogen dioxide (NO_2) to nitrogen, carbon dioxide and water. For the purposes of this application it has been assumed that the reagent is ammonia solution. The injection of this reagent would be via a bank of nozzles to provide flexibility in dosing locations/amounts.

The temperature window at which the SNCR system will operate will be selected based on the effectiveness of abatement. Reactions will take place between 850 – 1,050°C; however, maximum efficiency is typically achieved between 850 – 950°C. Secondary air will be preheated and control systems will help maintain a high temperature level in the secondary combustion zone. Secondary air injection will therefore be optimised to ensure that the SNCR system is operating at optimal temperatures.

Further upstream of the boiler, a flue gas treatment system will be installed. Acid gases produced during the combustion process will be reduced through a dry sorbent injection system within a reactor vessel. It is proposed to use hydrated lime as the reagent in this system. The acid gases (including hydrogen fluoride, hydrogen chloride and sulphur dioxide) will be neutralised as they react with this reagent. In addition to lime injection, it is also proposed to inject Powder Activated Carbon (PAC) into the reactor vessel, to reduce emissions of dioxins, mercury (volatile metals) and other heavy metals.

The lime dosing system will be controlled by upstream acid gas concentration measurements and proportioned to the volumetric flow rate of the flue gases. The lime and activated carbon dosing systems will have separate control systems for the injection into the flue gas stream, but they may be injected through the same injection points.

After the flue gas has passed through the reactor vessel, a fabric bag filter will provide filtration of particulates (including the lime and PAC reagents, which will remain on the inside of the bag filter as a 'cake') prior to release of the flue gas from the stack. Some of this residual material (cake) will be re-circulated in the flue gas treatment system to reduce the overall consumption of reagents in the process, as not all the reagents will have fully reacted.

The bag filter will be divided into compartments. Regular bag filter cleaning will be performed online by pulsing compressed air through the filter bags, and the cake will be regularly displaced. Air pollution control residues (APCr) will be collected in fully enclosed hoppers beneath the flue gas treatment systems and stored in silos. Individual compartments (chambers) can be isolated and repaired in case of failure in the integrity of the bag filter. Online monitoring of pressure will identify where failure has occurred, and the bag filters will also be subject to regular preventative maintenance to assess wear and tear.

The treated flue gases will be discharged to atmosphere via a 100 m stack.

2.5 Emissions monitoring and stacks

The flue gas treatment system(s) will be designed to ensure that Line 3 operates within the BAT-AELs required by the Waste Incineration Best Available Techniques Reference Document (BREF) for a 'new plant'. As the treated flue gas is discharged from the stack, it will be monitored for pollutants.

A Continuous Emission Monitoring System (CEMS) will be installed to monitor concentrations of the following pollutants in the flue gas:

- Particulates (dust);
- sulphur dioxide (SO_2);
- hydrogen chloride (HCl);
- carbon monoxide (CO);
- oxides of nitrogen (nitric oxide NO, nitrogen dioxide NO_2 and nitrous oxide, N_2O);
- ammonia; and
- VOCs, expressed as total organic carbon.

In addition, periodic sampling and measurement will be carried out for:

- hydrogen fluoride;
- Group 3 heavy metals: antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V);
- cadmium (Cd) and thallium (Tl);
- mercury (Hg);
- dioxins and furans;
- dioxin-like PCBs; and
- PAHs.

The Continuous Emission Monitoring System (CEMS) will be MCERTS approved. There will be a duty CEMS and a stand-by CEMS which can be switched as required. This will ensure that there is continuous monitoring data available even in the event of a problem with the duty CEMS.

Periodic measurements will be carried out once every 6 months. In the first year of operation, monitoring may be carried out more frequently as required by the EP.

2.6 Drainage arrangements

During normal operation the Facility will not give rise to process effluents and will be classified as a 'zero discharge' process.

As per the existing operation of Line 1 and 2, potentially contaminated rainwater from the hard standings such as roads and car parking areas will be contained by kerbs and collected by gullies before passing through appropriately sized oil interceptors and silt traps into an attenuation pond. The uncontaminated rainwater from the attenuation pond will be discharged to Fryston Beck via a penstock valve.

Surface water run-off from building roofs and areas of hardstanding will be discharged into the surface water attenuation pond.

2.7 Ancillary operations

The Facility will be provided with auxiliary burners to support start-up and shutdown operations by raising the temperatures of the furnaces. The burners may also ignite during operations should the furnace temperature fall below the required 850°C. The auxiliary burners will be fired on low sulphur fuel oil.

An emergency generator, fuelled on diesel, will provide safe shutdown of the site in the event of a loss in grid connection. The generator would typically only operate for short-term periods for testing and maintenance purposes, i.e. <50 hours per year.

3 Additional Information

3.1 Raw materials

3.1.1 Types and amounts of raw materials

The main raw materials which will be utilised within Line 3 will be the same as those utilised within Line 1 and 2, but they will be stored within dedicated raw material storage facilities. The estimated annual consumption for Line 3 are presented in Table 1.

Table 1: Consumption of primary raw materials

Material	Estimated annual consumption (tpa)
Lime	4,930
Ammonia solution	842
Activated carbon	121

Various other materials may be used in small quantities for the operation and maintenance of Line 3, and will be the same/similar to those stored within Line 1 and 2.

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

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

enfinium will maintain a detailed inventory of raw materials used on-site and ensure that procedures are implemented for the regular review of the development in new raw materials.

3.1.2 Reagent unloading and storage

3.1.2.1 Unloading of reagents

A range of chemical substances and hazardous materials associated with the process, including ammonia solution, lime and activated carbon, will be delivered to the site. Ammonia will be delivered in sealed tankers and off-loaded to an ammonia storage tank via a standard hose connection. The delivery will be supervised by site operatives trained in unloading practices. Regular inspection of the unloading equipment will be undertaken. Spillages will be prevented by good operating procedures such as high tank level alarms or trips. In addition, unloading activities will only be undertaken on areas of hardstanding with contained drainage. These measures will ensure that fugitive emissions of ammonia are contained.

The lime and activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo. Exhaust air will be de-dusted using a fabric filter located at the top of the silo – cleaning of the filter will be done automatically with compressed air after filling operations, with the filter inspected regularly for leaks. Silos will also be fitted with high-level alarms.

The tanker offloading area at the site will be constructed from an impermeable concrete hardstanding, to create an impermeable layer to the underlying ground and prevent contamination in the event of a spill/leak from the tanker. It can be confirmed that sealed construction joints (water stop joints) will be installed between each concrete slab to ensure the integrity of the hardstanding, reducing the risk for contamination of the underlying ground/groundwater. The tanker offloading area will be constructed in accordance with the requirements of CIRIA 736 and in accordance with recognised standard '*Eurocode 2 – Design of Concrete Structures – Part 3: Liquid retaining and containment structures*'. Quality assurance checks will be undertaken during construction to confirm the integrity of the hardstanding (and drainage systems). A regular preventative maintenance scheme will ensure the integrity of the tanker offloading area is maintained throughout the lifetime of the Facility. Preventative maintenance will include for periodically emptying any sumps in the tanker unloading area and undertaking visual inspections of the concrete or other material from which the sumps are constructed. Visual inspections of the hardstanding will also be undertaken. In the event that the visual inspection identifies that the integrity of the sumps or hardstanding has been compromised, additional pressure tests, leak tests and material thickness checks would be undertaken.

Should it be identified that damage has occurred to any of the structure, repairs will be undertaken to ensure that integrity is suitably maintained. These measures will ensure that liquids do not leak from the tanker unloading area and contaminate the underlying groundwater.

The tanker offloading area will have contained drainage which will ensure that any fugitive emissions are contained. Tanker off-loading of auxiliary fuel and liquid chemicals will take place within areas where the drainage is contained with the appropriate capacity to contain a spill during delivery – this will be achieved by the use of sumps to the ammonia and auxiliary fuel unloading areas (i.e. they will drain to a blind collection point).

Sumps will be:

- Designed to be impermeable and resistant to the liquids collected within them.
- Subject to regular visual inspection, with any contents removed accordingly after checking for contamination.
- Should any concerns regarding the integrity of sumps be raised following programmed visual inspection or maintenance, this will be trigger water testing.
- Any sub-surface tanks and sumps, where appropriate, will be designed with leak detection systems. Preventative maintenance will be implemented for all subsurface structures. This will include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc.

Furthermore, adequate quantities of spillage absorbent materials will be made available at easily accessible location(s) where chemicals are either stored or unloaded.

The measures outlined above are considered to be sufficient to prevent in the first case, or mitigate, any leaks from tanker offloading of materials.

3.1.2.2 Storage of reagents/raw materials

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

Ammonia solution will be stored within a tank in a dedicated storage area, with secondary containment such as bunding. The ammonia storage tank itself will be well-designed and be bunded to 110% of the tank's capacity; therefore, minimising the risk of any fugitive emissions from leaks whilst the ammonia is stored within the tank. Good design of pipework and regular preventative maintenance will allow for the safe transfer of ammonia into the SNCR system.

Lime and activated carbon, used within the flue gas treatment process, will be stored within separate storage silos located to the west of the flue gas treatment system. The storage of these reagents will be in dedicated steel silos with equipment for filling from a tanker through a sealed pipework system. Lime and activated carbon will be dosed into the flue gas treatment process with separate dosing controls.

Low sulphur fuel oil will be used on site for the start-up and auxiliary support burners and will be stored in dedicated storage tanks with suitable secondary containment.

Boiler make-up water will be supplied from an onsite demineralisation water treatment plant. Boiler water treatment chemicals will be used to control water hardness, pH and scaling and will be delivered in sealed containers and stored in an area with suitable secondary containment (e.g. bunding) within the water treatment room.

Various maintenance materials (oils, greases, insulants, antifreezes, welding and firefighting gases etc.) will be stored in an appropriate manner. Any gas bottles on-site will be kept secure in dedicated area(s).

3.1.3 Raw materials and reagents selection

3.1.3.1 Acid gas abatement

There are several reagents available for acid gas abatement. Sodium hydroxide (NaOH) or lime (CaO) can be used in a wet FGT system. Quicklime (CaO) can be used in a semi-dry FGT system. Sodium bicarbonate ($NaHCO_3$), lime (CaO) or hydrated lime ($Ca(OH)_2$) can be used in a dry FGT process.

A semi-dry lime system will be utilised for the abatement of acid gases. This is the same abatement option utilised within Line 1 and 2. It was determined in the EP application for Line 1 and 2; therefore, this is considered to represent BAT for Line 3.

3.1.3.2 NOx abatement

NOx abatement systems can be operated with urea or ammonia solution. There are advantages and disadvantages with both options:

- urea is safer to handle than ammonia – the handling and storage of ammonia can introduce additional safety and environmental risks;
- ammonia tends to give rise to lower nitrous oxide formation than urea;
- when using urea, the SNCR system can operate in a wider effective temperature range; and
- ammonia emissions (or 'slip') can occur with both reagents, but good control will limit this.

An SNCR system utilising ammonia as a reagent will be utilised for the abatement of NOx. This is the same abatement system and reagent as is utilised within Line 1 and 2. It was determined in the EP application for Line 1 and 2; therefore, this is considered to represent BAT for Line 3.

3.1.3.3 Abatement of volatiles

An activated carbon dosing system will be utilised for the abatement of volatiles. This is the same reagent as is utilised within Line 1 and 2. It was determined in the EP application for Line 1 and 2; therefore, this is considered to represent BAT for Line 3.

3.1.3.4 Auxiliary fuel

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

"The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (1) OJ L 121, 11.5.1999, p. 13., liquefied gas or natural gas."

Therefore, as identified by the requirements of IED the only 'available' fuels that can be used for auxiliary firing are:

1. liquefied petroleum gas (LPG);
2. fuel oil; or
3. natural gas.

Auxiliary burner firing on a well-managed incineration plants is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to 850°C.

A low sulphur fuel oil supply tank can be easily installed at Line 3, and is also the auxiliary fuel used on Line 1 and 2. Whilst it is acknowledged that fuel oil is classed as flammable, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of fuel oil will lead to some emissions of sulphur dioxide, but these emissions can be minimised as far as reasonably practicable through the use of low sulphur fuel oil.

Taking the above into consideration, fuel oil is considered to represent BAT for auxiliary firing at the Facility.

3.2 Incoming waste management

As Line 3 will utilise the same waste bunker as Line 1 and 2, it will process the same EWC codes as allowed within the existing EP. Furthermore, the same waste pre-acceptance and acceptance procedures will be applied.

3.2.1 Waste minimisation audit (Minimising the use of raw materials)

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

4. feedstock homogeneity;
5. dioxin & furan reformation;
6. furnace conditions;
7. flue gas treatment control; and
8. waste management.

All of these techniques meet the Indicative BAT requirements from EPR5.01 and the waste Incineration BREF.

3.2.1.1 Feedstock homogeneity

Improving feedstock homogeneity will improve the operational stability of the Line 3, leading to reduced reagent use and reduced residue production. As with Line 1 and 2, waste will originate from a variety of sources and suppliers. Therefore, the mixing of waste deliveries within the waste bunker ensures homogeneity of the waste input to the furnaces.

3.2.1.2 Dioxin & Furan reformation

As identified within EPR5.01 and the Waste Incineration BREF, there are a number of BAT design considerations required for the boilers. The boilers will be designed to minimise the formation of dioxins and furans as follows.

- Slow rates of combustion gas cooling will be avoided via boiler design to ensure the residence time is minimised in the critical cooling section and to avoid slow rates of combustion gas cooling to minimise the potential for de-novo formation of dioxins and furans. The boilers will be designed so that the external heat transfer surface temperature will be above a minimum of 170°C, where the flue gas is in the de novo synthesis temperature range.
- The residence time and temperature profile of flue gas will be considered during the detailed design phase to ensure that dioxin formation is minimised.
- It is reported in the guidance that the injection of ammonia compounds into the furnaces – i.e. an SNCR NOx abatement system – inhibits dioxin formation and promotes their destruction.
- Computational Fluidised Dynamics (CFD) will be applied to the design, where considered appropriate, to ensure gas velocities are in a range that negates the formation of stagnant pockets / low velocities. A copy of the CFD model will be supplied to the EA prior to commencement of commissioning. It is proposed that this is allowed for via pre-operational condition.
- Minimising the flue gas volume in the critical cooling sections will ensure high gas velocities.
- Boundary layers of slow-moving gas along boiler surfaces will be prevented via design and a regular maintenance schedule to remove build-up of any deposits that may have occurred.
- Design features will be optimised to maintain critical surface temperatures below the 'sticking' temperatures. The arrangement of cooling surfaces will be optimised, and peak combustion temperatures will be avoided through acceptance of a relatively homogeneous fuel (waste), uniform waste feed and good primary and secondary air control. This will reduce the level of boiler deposits which would otherwise catalytically enhance dioxin formation.

Taking the above into consideration, it is understood that the Facility will meet the requirements as detailed in EPR5.01.

3.2.1.3 Furnace conditions

Furnace conditions will be optimised in order to minimise the quantity of residues arising for further disposal. To be consistent with Line 1 and 2, and in accordance with Article 50(1) of the Industrial Emissions Directive, burnout in the furnace will either reduce the Total Organic Carbon (TOC) content of the bottom ash to less than 3% by optimising the waste feed rate and combustion air flows.

3.2.1.4 Boiler conditions

Online boiler cleaning will be achieved through the cleaning systems installed within the boiler which will remove boiler ash which accumulates within the boiler. The boiler cleaning systems will be designed to remove boiler ash from the surfaces within the boiler when it is in operation. The exact specifications of the boiler cleaning systems will be subject to the detailed design of the Facility; however, it is expected that these will include the following elements:

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

Additional off-line boiler cleaning will also be undertaken as part of scheduled maintenance activities.

Close control of the flue gas treatment system will minimise the consumption of reagents and quantities of APCr generated.

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

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

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

3.2.1.5 Flue gas treatment control – NOx

The SNCR system will require the injection of ammonia solution, into the radiation zone of the boilers at several levels.

The first boiler pass is divided into several segments. Each segment consists of a distribution module and injection nozzles on several levels. The configuration of the nozzles makes it possible to achieve full-area coverage of the injection medium across the entire cross section of the radiation zone.

The optimal adjustment of the SNCR ammonia injection ensures the maximal NOx reduction through the SNCR system.

Following commissioning of the Facility it is proposed to submit to the EA a report which describes the performance and optimisation of the SNCR system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in the Environmental Permit.

3.2.1.6 Residue management

The arrangements for the management of residues produced by the installation are presented in section 3.9. In particular, bottom ash from the combustion process and APCr from the flue gas treatment system will be transferred, stored and disposed of separately, i.e. there will be no mixing of these residues.

The procedures for handling of wastes generated by Line 3 will be consistent with those applied within Line 3.

3.2.1.7 Waste charging

As with Line 1 and 2, Line 3 will comply with the BAT requirements outlined in EPR5.01 and the Waste Incineration BREF for waste charging and the specific requirements of the IED.

3.3 Water use

Process water use

Mains water will be treated in an on-site water treatment plant to produce high-quality demineralized boiler feedwater. The demineralised water will be used to compensate for boiler blow down losses. It is anticipated that Line 3 will consume approximately 4 tonnes per hour of mains water.

Process effluents will be recycled (for example, used in the ash quench), to allow a zero-discharge system during normal operations. Process effluents would be temporarily stored within a wastewater pit or similar structure, prior to reuse and recycling within the process.

Integrity of structures

The exact type of structures will be confirmed during the detailed design of the Facility; however, the wastewater pit will be designed and constructed to be impermeable to the liquids that are being stored within them. Therefore, there will be negligible risk of process effluents leaking to the underlying groundwater or surrounding environment. During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of the process effluent storage facilities. This will minimise the potential for damage of the structure during operation of the Facility.

In addition to the preventative maintenance systems, the dirty water pit will be designed with a leak detection system. The preventative maintenance systems will include (if appropriate) pressure tests, leak tests, material thickness checks, CCTV etc – to be confirmed during detailed design.

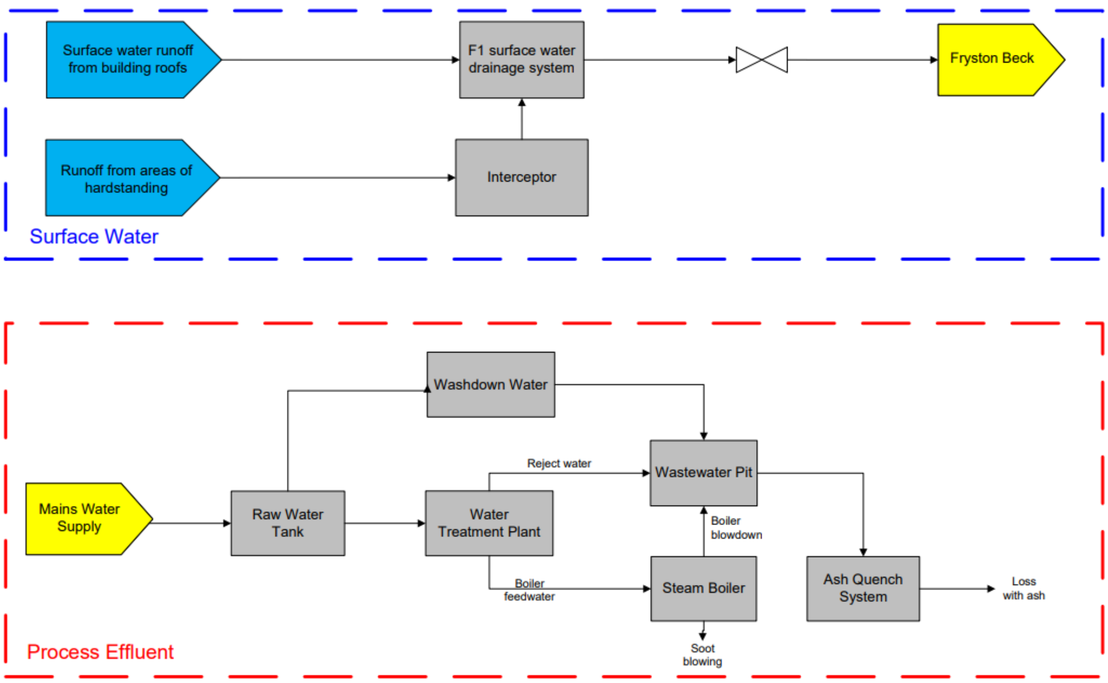
Sources and types of process effluent

It is expected that excess process effluents will include the following sources:

- boiler water resulting from emptying the boiler;
- small quantities of boiler blowdown;
- reject water from the water treatment plant; and
- washdown water from process areas, including the waste reception areas.

An indicative water flow diagram is presented in Figure 2.

Figure 2: Indicative water flow diagram



3.3.1.1 Surface water

Surface water run-off from buildings, roadways and areas of hardstanding will be discharged into the existing surface water drainage system for Line 1 and 2 prior to discharge to Fryston Beck.

The surface water drainage system will be installed with a penstock valve or similar which will prohibit the discharge of contaminated surface water offsite in the event of a fire or other emergency.

During construction and commissioning, quality assurance checks will be undertaken to prove the structural integrity of the surface water attenuation storage. This will minimise the potential for damage during operation of Line 3.

The drainage systems for Line 3 will be covered by the same preventative maintenance systems as Line 1 and 2. Preventative maintenance will include for undertaking inspections of the drainage systems. Should it be identified that damage has occurred to the drainage systems, repairs will be undertaken to ensure that integrity is suitably maintained.

3.3.1.2 Process effluents

It is expected that excess process effluents will include the following sources:

- boiler water resulting from emptying the boiler;
- small quantities of boiler blowdown;
- reject water from the water treatment plant; and
- washdown water from process areas, including the ash handling facility and waste reception areas.

Where practicable process effluents will be re-used within the process. Process effluents will be stored within a process water tank or similar prior to reuse and recycling within the process. In the unlikely event that excess process effluents are generated, such as during emptying of the boilers, these will require discharge. It is intended to tanker these off-site for treatment at a suitably licensed waste management facility.

The exact type of structure will be confirmed during the detailed design of the Facility; however, it can be confirmed that the material from which the process effluent tank/pit will be constructed will be impermeable to the liquids that are being stored

3.3.1.3 Contaminated firewater

Contaminated effluents will be managed in the same way as they are in Line 1 and 2.

3.4 Emissions

The source of point source emissions from Line 3 are presented in the table below.

Table 2: Proposed emission points

Emission Point Reference	Source
Regulated	
A5	Line 3 Stack
Non-regulated	
A6	Line 3 Emergency diesel generator

An updated emissions point drawing to incorporate the additional emission points is provided in Appendix A.

The following sections provide further detail on both point source and fugitive emissions, as a result of the implementation of Line 3.

3.4.1 Point source emissions to air

The full list of proposed emission limits for atmospheric emissions from Line 3 is provided in Table 3.

Table 3: Proposed ELVs for emissions to air – Line 3

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
Particulate matter	mg/Nm^3	30	5	
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10	
Hydrogen chloride	mg/Nm^3	60	6	
Carbon monoxide	mg/Nm^3	150*	50	
Sulphur dioxide	mg/Nm^3	200	30	
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	100	
Ammonia	mg/Nm^3		10	
Hydrogen fluoride	mg/Nm^3			1

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit
Cadmium & thallium and their compounds (total)	mg/Nm^3			0.02
Mercury and its compounds	mg/Nm^3			0.02
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3			0.3
Dioxins & furans	ng I-TEQ $/Nm^3$			0.04
Dioxin & furan-like PCBs	ng WHO-TEQ$/Nm^3$			0.06
All expressed at 11% oxygen in dry flue gas at standard temperature and pressure. **Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.*				

3.4.2 Fugitive emissions to air

3.4.2.1 Waste handling and storage

Primary combustion air will be drawn from the waste bunker area to maintain negative pressure in the waste bunker area and fed into the combustion chamber beneath the grates.

Bottom ash would first be dampened and cooled using a water quench prior to discharge/storage. This highly reduces the likelihood of dust being generated. Mobile plant (e.g. bucket loaders) and vehicle operators will be provided with suitable training for the equipment they are operating. Supervision of mobile plant operation and regular site inspections will ensure that any leaks, trailing or tracking of residues from vehicles are quickly identified and suitably addressed. It is expected that there will be a wheel wash facility (e.g. pressure washer) in the bottom ash storage area to prevent dust/ash being tracked across the site.

3.4.2.2 Silos

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

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

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

The unloading chute from the APCr silo will be designed with an inner core, which will be used for the unloading of APCr of the silo, and an outer ‘bellow’ which will extract displaced air from the silo and pass it through a filter with the air subsequently vented back into the silo.

The site operatives will assist the delivery driver in positioning the tanker underneath the loading chute. The delivery driver will be responsible for connecting the unloading chute to the tanker. Site operatives will be responsible for checking that the loading chute is closed following completion of unloading and will be required to clear up any spilled material. Cleaning of the tanker will be prohibited outside the enclosed loading area. The APCr unloading area will have a dedicated drainage system, with all runoff/leachate diverted to the process effluent tank.

3.4.3 Point source emissions to water and sewer

During normal operations, process effluents from the Facility (such as washdown water) will be reused within the site (e.g. for the ash quench). In the event that excess process effluents are generated, these will be tankered off site for disposal.

Surface water run-off from building roofs and areas of hardstanding will be collected in an on-site surface water drainage system and collected in an attenuation pond, prior to discharge into the existing surface water drainage system for Lie 1 and Line 2 prior to discharge into Fryston Beck.

3.4.4 Odour

The storage and handling of waste has the potential to give rise to odour. The Facility will be designed in accordance with the requirements of EA Guidance Note '*H4: Odour'* and will include a number of controls to minimise odour during normal and abnormal operation, as set out in the following sections.

3.4.4.1 Delivery and storage of waste

The controls for odour associated with the delivery and storage of waste to Line 3 will be as per the existing controls for Line 1 and 2.

3.4.4.2 Inspections and monitoring

During normal operation of the Facility, daily inspections will be undertaken to monitor for odour and would include, but not be limited to, the following:

- olfactory checks for odour in the waste reception areas and external installation boundary;
  - staff undertaking olfactory surveys will do so upon arrival to site (i.e. before being exposed to odour at the site for a prolonged period of time).
- monitoring the positions of louvres (e.g. ensuring doors are kept shut when no waste deliveries are occurring); and
- monitoring combustion air flow, with odorous air extracted via the boilers and the stack.

During periods of shutdown, the frequency of the above inspections would be extended, including monitoring combustion air flow if the ID fan operation can be maintained, for instance during periods of maintenance. Doors to the waste reception hall would be kept closed. In addition, during shutdown, additional 'sniff test' and inspection around the boundary of the Facility would be conducted. In the unlikely event that odour is detected outside the building or if odour complaints are received from neighbours, full odour surveys would be undertaken. If it is deemed appropriate, operating procedures would be amended to deal with any issues identified at the site.

3.4.4.3 Bunker management

Bunker management procedures have been implemented within the waste bunker to avoid the development of anaerobic conditions and decomposition, which could generate further odorous emissions. These management procedures include the frequent mixing and rotation of waste to ensure regular and well distributed turnover of waste. As explained previously, this ensures that the fuel is a homogenous mix. During periods of shutdown, the bunker management procedures would not normally be implemented, to avoid the generation of odorous emissions especially when waste volumes within the bunker are low.

3.5 Monitoring methods

3.5.1 Emissions monitoring

Sampling and analysis of all pollutants will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards) and in accordance with the Environment Agency's MCERTS scheme. This ensures the provision of data of an equivalent scientific quality and compliance with the requirements of the EP in relation to emissions monitoring.

Methods and standards used for monitoring of emissions will be in compliance with EPR5.01 and the IED. In particular, CEMS equipment will be certified to the MCERTS standard.

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

The purpose of monitoring has three main objectives:

1. To provide the information necessary for efficient and safe plant operation;
2. To warn the operator if any emissions deviate from predefined ranges; and
3. To provide records of emissions and events for the purposes of demonstrating regulatory compliance.

Monitoring emissions to air

The following parameters for the emissions from the Facility will be monitored, as per the EP requirements, and recorded continuously using a Continuous Emissions Monitoring System (CEMS):

1. Carbon monoxide;
2. Hydrogen chloride;
3. Sulphur dioxide;
4. Nitrogen oxides;
5. Ammonia;
6. Total Organic Carbon (TOC); and
7. Particulates.

In addition, the oxygen and water vapour content, temperature and pressure of the flue gases will be monitored so that the emission concentrations can be reported at the reference conditions required by the Industrial Emissions Directive (IED). The CEMS will also monitor emissions of carbon dioxide and nitrous oxide, but there are no emission limits for these pollutants.

There will be two CEMS systems for Line 3 - Duty and Standby (in the event of a CEMS failure).

In addition to the CEMS system, the following emissions from the Facility will also be monitored by means of periodic spot sampling at frequencies agreed with the Environment Agency:

1. Hydrogen fluoride;
2. Group 3 Heavy Metals [antimony (Sb), arsenic (As), lead (Pb); chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V)];
3. Cadmium (Cd) and thallium (Tl);
4. Mercury (Hg);
5. Dioxins and furans;
6. Dioxin like PCBs; and
7. PAHs.

enfinium would propose that an improvement condition is included within the EP which would allow it to demonstrate that emissions of mercury and dioxins and furans are 'low and stable' following commissioning as allowed under the Waste Incineration BREF Implementation Plan.

The frequency of periodic measurements will comply with the IED as a minimum. Periodic monitoring will be undertaken by MCERTS accredited stack monitoring organisations. The flue gas sampling techniques and the sampling platform will comply with the following EA guidance (formerly called 'M1' and 'M2'):

- Monitoring stack emissions: measurement locations
- Monitoring stack emissions: environmental permits
- Monitoring stack emissions: techniques and standards for periodic monitoring.
- Monitoring stack emissions: guidance for selecting a monitoring approach

All monitoring results shall be recorded, processed and presented in such a way as to enable the EA to verify compliance with the operating conditions and the regulatory emission limit values within the EP.

Reliability

IED Annex VI Part 8 allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. IED Annex VI Part 8 also requires that no more than 10 daily averages are discarded per year. These reliability requirements will be met primarily by selecting MCERTS certified equipment.

Calibration of the CEMS will be carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN 14181 and the BS EN 15267-3. Regular servicing and maintenance will be carried out under a service contract with the equipment supplier. Therefore, the installation and functioning of the CEMS is subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.

As previously stated, there will be Duty and Stand-by CEMS in the event of a CEMS failure. This will ensure that there is continuous monitoring data available even if there is a problem with the duty CEMS.

Start-up and shut-down

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

3.5.2 Monitoring of process variables

Line 3 will be controlled from a dedicated control room. A modern control system, incorporating the latest advances in control and instrumentation technology, will be utilised to control operations, optimising the process relative to efficient heat release, good burn-out and minimum particle carry-over. The system will control and/or monitor the main features of the plant operation including, but not limited to, the following:

- combustion air;
- fuel feed rate;
- SNCR system;

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

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

The following process variables have particular potential to influence emissions:

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

Water use will be monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This will be achieved by monitoring the incoming water supplies and the boiler water makeup.

In addition, electricity and auxiliary fuel consumption will be monitored to highlight any abnormal usage. Annual reports of process variables (such as water and raw material consumption) will be submitted to the EA in accordance with the requirements of the EP.

3.5.2.1 Validation of combustion conditions

As described in section 2.2, the Facility will be designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of at least 850°C. This criterion will be demonstrated using Computational Fluid Dynamic (CFD) modelling during the design stage and confirmed by the recognized measurements and methodologies during commissioning in accordance with Guidance Note EPR5.01.

It will be demonstrated during commissioning that Line 3 can achieve complete combustion by measuring concentrations of carbon monoxide, VOCs and dioxins in the flue gases, and TOC in the bottom ash.

During the operational phase, the temperature at the 2-seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes will be selected using the results of the CFD model. If it is not possible to locate the temperature probes at the precise point of the 2-seconds residence time, then a correction factor will be applied to the measured temperature.

Ammonia solution will be injected into the flue gases at a temperature of between 750 – 1,000°C. This temperature range is required to efficiently reduce NOx and avoid unwanted secondary reactions. This means that multiple levels of injection points will be required in the radiation zone of the furnace. During detailed design of the Facility, the SNCR system will be optimised to achieve a balance between high reaction rates, low NOx emission concentrations and low reagent consumption, and it will be designed to operate within the temperature range stated in the Waste Incineration BREF. Secondary air will be preheated to help maintain a high temperature level in the secondary combustion zone, with the control systems maintaining the required temperatures. Furthermore, flue gas recirculation will be employed which will further reduce NOx generation due to lower oxygen concentrations. Air injection and distribution is therefore optimised to ensure that the SNCR system is operating at optimal temperatures.

3.5.2.2 Measuring oxygen levels

The oxygen concentration at the boiler exit will be monitored and controlled to ensure that there is adequate oxygen for complete combustion of the combustible gases. The oxygen concentration at the boiler exit will be controlled by regulating the combustion airflows and the waste feed rate.

3.6 Technology selection (BAT)

The technologies and reagents which will be utilised for the abatement of emissions, as well as the combustion technology will be the same for Line 3 as they are for Line 1 and 2. Therefore, the quantitative and qualitative BAT assessments submitted in support of the application for Line 1 and 2 will also apply for Line 3:

- combustion technology;
- NOx abatement;
- acid gas abatement;
- particulate matter abatement; and
- cooling technology.

Taking this into consideration, the proposed technologies for Line 3 are all considered to represent BAT.

3.7 The Legislative Framework

3.7.1 Specific requirements of the Industrial Emissions Directive (2010/75/EU)

This section presents information on how the Facility will comply with the Waste Incineration requirements of the Industrial Emissions Directive (IED).

Chapter IV of the IED includes 'Special Provisions for Waste Incineration Plants and Waste Co-incineration Plants'. Review of provisions for waste incineration as presented in the IED has identified that the following requirements could be applicable to the Facility:

- Article 46 – Control of Emissions;
- Article 47 – Breakdown;
- Article 48 – Monitoring of Emissions;
- Article 49 – Compliance with Emission Limit Values;
- Article 50 – Operating Conditions;
- Article 52 – Delivery & Reception of Waste;
- Article 53 – Residues; and
- Article 55 – Reporting & public information on waste incineration plants and waste co-incineration plants.

Table 4 identifies the relevant Articles of the IED and explains how Line 3 will comply with them. Many of the articles in the IED impose requirements on regulatory bodies, in terms of the permit conditions which must be set, rather than on the operator. Table 4 only covers the requirements which the IED imposes on 'Operators' and either explains how this is achieved or refers to where within the EP application an explanation of how Line 3 satisfies this requirement can be found.

Table 4: Summary table for IED compliance

Article	Requirement	How met or reference
15(3)	The competent authority shall set emission limit values that ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques as laid down in the decisions on BAT conclusions referred to in Article 13(5) through either of the following.	Refer to sections 3.4.1 and 3.5.
22(2)	Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for under paragraph 3. The baseline report shall contain at least the following information: (a) information on the present use and, where available, on past uses of the site; (b) where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned. Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.	Refer to Appendix B – Updated Site Condition Report.
44	An application for a permit for a waste incineration plant or waste co-incineration plant shall include a description of the measures which are envisaged to guarantee that the following requirements are met: (a) the plant is designed, equipped and will be maintained and operated in such a manner that the requirements of this Chapter are met taking into account the categories of waste to be incinerated or co-incinerated;	Refer to section 3.2 of the Supporting Information which lists the categories of waste to be incinerated at the Facility.

Article	Requirement	How met or reference
	(b) the heat generated during the incineration and co-incineration process is recovered as far as practicable through the generation of heat, steam or power;	Refer to section 3.8 of the Supporting Information.
	(c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;	Refer to section 3.9 of the Supporting Information.
	(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Union law.	Refer to section 3.9 of the Supporting Information.
46 (1)	Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Refer to Appendix D – Dispersion Modelling Assessment.
46 (2)	Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex.	Refer to Section 3.4.1 of the Supporting Information.
46 (5)	Waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater. Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.	Refer to Appendix B – Updated Site Condition Report, and Environmental Risk Assessment and Appendix C.
46 (6)	Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded. The cumulative duration of operation in such conditions over 1 year shall not exceed 60 hours. The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	Refer to Appendix F – Abnormal Emissions Assessment.
47	In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.	Refer to section 2.7 of the Supporting Information.

Article	Requirement	How met or reference
48 (2)	The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Refer to section 3.5.1 of the Supporting Information.
48 (4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Refer to section 3.5.1 of the Supporting Information.
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	There will be no emissions from flue gas treatment systems to water/sewer from the waste incineration plant.
50 (1)	Waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3% or their loss on ignition is less than 5% of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used.	Refer to section 3.2.1.3 – TOC testing.
50 (2)	Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850oC for at least two seconds.	Refer to section 3.2.1.7 and 3.1.3.4 of the Supporting Information.
50 (3)	Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 121, 11.5.1999, p. 13.), liquefied gas or natural gas.	Refer to sections 3.2.1.7 and 3.1.3.4 of the Supporting Information.
50 (4)	Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations:	Refer to section 3.2.1.7 of the Supporting Information.

Article	Requirement	How met or reference
	(a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached;	
	(b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained;	Refer to section 3.2.1.7 of the Supporting Information.
	(c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Refer to section 3.2.1.7 of the Supporting Information.
50 (5)	Any heat generated by waste incineration plants or waste co-incineration plants shall be recovered as far as practicable.	Refer to section 3.8 of the Supporting Information.
50 (6)	Infectious clinical waste shall be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.	This requirement will not apply as the Facility will not receive infectious clinical waste.
52 (1)	The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health.	Refer to Section 3.2 of the Supporting Information.
52 (2)	The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	Refer to section 3.2 of the Supporting Information.
53 (1)	Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	Refer to Section 3.9 of the Supporting Information.
53 (2)	Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment.	Refer to Section 3.9 of the Supporting Information.
53 (3)	Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	Refer to Section 3.9 of the Supporting Information.

3.7.2 Requirements of the Waste Incineration BREF

The Waste incineration (WI) BREF BAT conclusions were published by the European IPPC Bureau in December 2019. New waste incineration plants are required to demonstrate that they meet the requirements of the BREF when applying for an EP. As such, the table below identifies the requirements of the Best Available Techniques (BAT) conclusions as set out in the BREF and explains how Line 3 will comply with them. Given that Line 1 and 2 has already been required to demonstrate compliance with the requirements of the BREF, this review has primarily focused on the BATc's which are directly applicable to Line 2.

#	BAT Conclusion	How met or reference
1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the features as listed in BAT 1 of the BREF.	The existing management systems will be extended to incorporate the operation of Line 3.
2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the combined boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.	Line 3 will have a gross electrical efficiency of 31.25%
3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in BAT 3 of the BREF.	As set out in section 3.5 of the Supporting Information, the process parameters for monitoring of emissions to air are as follows: • water vapour content • temperature; and • pressure. The oxygen content and flow rate of the flue gases will also be monitored. Temperature will be monitored in the combustion chamber. There will be no emissions of water from FGC systems. Furthermore, there will be no emissions to water from the adjacent IBA facility – any process effluents would be contained and re-used in the process. Excess process effluents will be tankered off-site for treatment.

#	BAT Conclusion	How met or reference
4	BAT is to monitor channelled emissions to air with at least the frequency given in BAT 4 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Emissions to air will be monitored as set out in section 3.5.1 of the Supporting Information, the methods and standards used for emissions monitoring will be in compliance with EPRS5.01 and the IED. In particular, the CEMS equipment will be certified to the MCERTS standard and will have certified ranges which are no greater than 1.5 times the relevant daily average emission limit. Sampling and analysis of all pollutants including dioxins and furans will be carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.
5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).	The existing OTNOC management plan will be extended to incorporate the operation of Line 3.
6	BAT is to monitor emissions to water from Flue Gas Cleaning (FGC) and/or bottom ash treatment with at least the frequencies set out in BAT 6 of the BREF and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Line 3 will utilise a dry flue gas treatment system. Therefore, there will not be any emissions to water from the FGC systems.
7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency as given in BAT 7 of the BREF (at least once every 3 months) and in accordance with EN standards.	As per the requirements for Line 1 and Line 2, the bottom ash will be analysed for TOC to confirm that it is less than 3%.
8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, wastewater) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	The Facility will not incinerate hazardous waste.

#	BAT Conclusion	How met or reference
9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) as listed in BAT 9 of the BREF, and, where relevant, also techniques (d), (e) and (f).	Line 3 will employ the following techniques as required by BAT 9: • Determination of the types of waste that can be incinerated. The Facility will incinerate waste in accordance with the list of EWC waste codes listed in the EP, and waste that falls into the range of calorific values in accordance with the design of the Facility. The list of EWC codes will characterise the physical state, general characteristics and hazardous properties of the waste. • Implementation of waste acceptance procedures. The Facility accepts a mix of wastes delivered directly to the site. Enfinium has developed acceptance procedures for wastes delivered to the Facility, in order to ensure that only the wastes which the Facility is permitted to receive are received at the Facility. • Periodic inspections of the waste are undertaken as part of the scope where practicable, prior to transfer into the bunker, to confirm that it complies with the specifications of the waste transfer note (WTN). Waste delivered in road vehicles are inspected by the crane operator as it is tipped into the bunker and mixed. • Waste acceptance procedures are used to identify any unacceptable wastes which are not suitable for processing within the Facility and require quarantine and transfer off-site. It is understood that technique (f) of BAT 9 does not apply as the Facility will not incinerate hazardous waste.
10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 10 do not apply.
11	In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk posed by the waste, the elements as listed in BAT 11 of the BREF.	enfinium has implemented the following measures for the monitoring of waste deliveries to the installation: • Weighing of the waste deliveries by use of a weighbridge at the entrance/exit of the Facility. • Periodic visual inspection of waste either prior to being tipped into the bunker, or where this is not practicable, as it is tipped into the bunker by the crane operator. • Periodic sampling of waste deliveries and analysis of key properties, such as calorific value and metal content.

#	BAT Conclusion	How met or reference
		– Sampling will be undertaken when accepting a new waste stream at the Facility (e.g. from a new waste supplier), or to determine the NCV of waste sources accepted should the plant be operating outside the permitted range shown on the firing diagram. The Facility does not undertake radioactivity detection tests as it is not anticipated that any radioactive waste will be received.
12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the following techniques: Use impermeable surfaces with an adequate drainage infrastructure; and Have adequate waste storage capacity.	The surfaces of the waste reception, handling and storage areas have been designed and constructed as impermeable structures. The integrity of areas of hardstanding is periodically verified by visual inspection. Regular maintenance of the drainage systems is undertaken in accordance with documented management procedures for the Facility. Adequate waste storage capacity is available on site – the maximum waste storage capacity of the waste bunker has been established and is not exceeded. During periods of planned maintenance, quantities of waste within the bunker will be run down where possible.
13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques as listed in BAT 13 of the BREF.	The Facility does not process clinical or hazardous waste.
14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below:	Bunker crane mixing and advanced control systems are employed at Line 3. A modern and advanced control system, incorporating the latest advances in control and instrumentation technology, is utilised to control operations, optimise the process relative to efficient heat release, good burn-out and minimum particle carry over. As described in section 3.5.2, the system controls and/or monitors the main features of operations of Line 3 including, but not limited to the following: • combustion air; • waste feed rate; • SNCR system; • flue gas oxygen concentration at the boiler exits;

#	BAT Conclusion	How met or reference
		• flue gas composition at the stack (including HCl measurements); • combustion process; • boiler feed pumps and feedwater control; • steam flow at the boiler outlets; • steam outlet temperature; • boiler drum level control; • flue gas control (including differential pressure across the bag filters); • power generation; and • steam turbine exhaust pressure. Water, electricity and auxiliary fuel usage will also be monitored to highlight any abnormal usage.
15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the waste.	Line 3 operations will be controlled from the existing control room, with an advanced control system to optimise the process. The system will control and/or monitor the main features of the plant operation, as described in the response to BAT 14 above. Emissions to air will be reduced by the adjustment of the plants settings through the advanced control system: for example, ammonia solution dosing will be optimised and adjusted to minimise the ammonia slip. Lime usage will be minimised by trimming reagent dosing to accurately match the acid load using fast response upstream acid gas monitoring. Activated carbon dosing will be based on flue gas volume flow measurement.
16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	Line 3 will operate continuously, with planned shutdowns for maintenance limited as far as reasonably practicable (it is expected that each line would be shut down for maintenance in succession – i.e. it would be very unlikely for all three lines to be shut down at once). Waste will be kept at suitable levels in the waste bunker to maintain operation during periods when waste is not delivered. Operational procedures will be developed to limit as far as practicable shutdown and start-up operations.
17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the wastewater treatment plant are	The FGC and wastewater treatment systems will be appropriately designed and operated within the design range. The FGC and wastewater treatment systems will be subject to regular maintenance through the implementation of documented management procedures.

#	BAT Conclusion	How met or reference
	appropriately designed (e.g. considering the maximum flow rate and pollutant concentration), operated within their design range, and maintained so as to ensure optimal availability.	
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 EMS that includes the elements as identified in BAT 18 of the BREF.	The existing OTNOC management plan will be extended to incorporate the operation of Line 3.
19	In order to increase resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	Line 3 will use steam boilers to produce steam which is used to produce electricity. Line 3 will also have the provision to export heat to local users.
20	In order to increase energy efficiency of the incineration plant, BAT is to use an appropriate combination of techniques as listed in BAT 20 of the BREF.	Line 3 will use the following techniques to increase energy efficiency from its operation: • Minimise heat losses via the use of an integral furnace boiler – heat will be recovered from the flue gases by means of steam boiler integral with the furnace; • Optimisation of the boiler design to improve heat transfer – the boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste that is combusted; • High steam conditions (approximately 430°C and approximately 72 bar(a), subject to detailed design), to increase electricity conversion efficiency; • Cogeneration of heat and electricity – Line 3 has been designed as a combined heat and power plant and will have the capacity to provide heat to local users. Subject to commercial agreements with heat users, a scheme for the export of heat will be implemented.
21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to use the methods as stated in BAT 21 of the BREF.	In accordance with the BREF, Line 3 will employ the following measures to reduce odour emissions: • Waste in the Facility will be stored in an enclosed bunker area under negative pressure. The extracted air will be used as combustion air for incineration.

#	BAT Conclusion	How met or reference
		• The operation of Line 3 will not give rise of odorous liquid wastes. Therefore, the requirement to store liquid wastes in tanks under controlled pressure and duct the tank vents to the combustion air feed or other suitable abatement system will not apply to Line 3. • Odour will be controlled during shutdown periods by minimising the amount of waste in storage. Waste will be run-down prior to periods of planned maintenance. In addition, doors to the tipping hall will be kept shut during periods of shutdown.
22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	Gaseous wastes and liquid wastes will not be accepted at the Facility.
23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the EMS the following diffuse dust emission management features:	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 23 do not apply.
24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as given in BAT 24 of the BREF.	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 24 do not apply.
25	In order to reduce channelled emission to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 25 of the BREF.	In accordance with the BREF, the following techniques will be utilised at Line 3 to reduce channelled emissions to air: • Bag filters – to reduce particulate content of the flue gas. • Dry sorbent injection – adsorption of metals by injection of activated carbon in combination with injection of lime to abate acid gases. The concentrations of metals and metalloids will be monitored in accordance with the requirements of the emission limits prescribed in the EP.
26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 26 do not apply.

#	BAT Conclusion	How met or reference
	extraction of air, BAT is to treat the extracted air with a bag filter.	
27	In order to reduce channelled emissions of HCl, HF and SO2 to air from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 27 of the BREF.	BAT 27 of the BREF states that BAT is to use one or a combination of the following techniques: • Wet scrubber; • Semi-wet absorber; • Dry sorbent injection; • Direct desulphurisation (only applicable to fluidised beds); and • Boiler sorbent injection. In a dry sorbent injection system, the reagent is injected into the flue gas stream within the flue gas treatment system, located after the boiler. In direct boiler sorbent injection, the reagent is injected directly into the flue gas stream within the boiler. This only achieves partial abatement of the acid gases and does not eliminate the need for additional flue gas cleaning stages. It is acknowledged that using a combination of both boiler sorbent injection and the additional acid gas abatement system would provide a higher level of abatement than either system alone; however, the operating and maintenance costs and also reagent consumption would be higher. Due to the additional costs and reagent consumption associated with the use of direct boiler injection, this is not considered to represent BAT for Line 3. As determined in the EP application for Line 1 and Line 2, it is considered BAT for Line 3 to utilise a dry sorbent injection system to abate acid gases. The dry system will be designed to ensure that Line 3 will operate in accordance with the relevant ELVs, assumed to be the BAT-AELs, without the requirement for any additional abatement measures. The design of the dry sorbent injection system will include the following controls to ensure that Line 3 operates in accordance with the relevant ELVs: • A flue gas monitoring system at the exit of the boilers to control reagent dosing rate within the flue gas treatment system; and • Recirculation of a proportion of the flue gas treatment residues to reduce reagent consumption.

#	BAT Conclusion	How met or reference
28	In order to reduce channelled peak emissions of HCl, HF and SO2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use optimised and automated reagent dosage, or both the previous technique and the recirculation of reagents.	In accordance with the BREF, the following techniques will be implemented at Line 3 to reduce peak emissions of HCl, HF and SO_2 whilst limiting reagent consumption and residue generation from dry sorbent injection: • The concentration of hydrogen chloride in the flue gases upstream of the flue gas treatment system will be measured in order to optimise the performance of the emissions abatement equipment, including automated reagent dosage. • A proportion of the APC residues will be recirculated to reduce the amount of unreacted reagent in the residues. • The concentrations of HCl, HF and SO_2 released from Line 3 will comply with BREF limits.
29	In order to reduce channelled NOx emissions to air while limiting emissions of CO and N_2O from the incineration of waste, and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques as listed in BAT 29 of the BREF.	The following elements have been incorporated into the design of Line 3: • Optimisation of the incineration process via the use of an advanced control system and monitoring of process parameters (refer to the response to BAT 14); • An SNCR system; and • Optimisation of the design and operation of the SNCR system (through CFD modelling to optimise the location and number of injection nozzles, and optimisation of reagent dosing to minimise ammonia slip). The design elements listed above to reduce channelled NOx emissions to air (whilst limiting emissions of CO, N_2O and NH_3) will ensure that Line 3 will comply with the requirements of BAT 29.
30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below to reduce channelled emissions to air of organic compounds: a) Optimisation of the incineration process; b) Control of the waste feed; c) On-line and off-line boiler cleaning;	Line 3 will employ the following techniques to reduce channelled emission to air of organic compounds: • Optimisation of the incineration process – the boilers will be designed to minimise the formation of dioxins and furans as follows: • Minimise residence time in critical cooling section to avoid slow rates of combustion gas cooling, minimising the potential for 'de-novo' formation of dioxins and furans. • Apply CFD modelling to the design where appropriate to ensure gas velocities are in a range that negates the formation of stagnant pockets/low velocities.

#	BAT Conclusion	How met or reference
	d) Rapid flue-gas cooling; e) Dry sorbent injection; f) Fixed-or-moving bed adsorption; g) SCR; h) Catalytic filter bags; and i) Carbon sorbent in a wet scrubber.	• Minimise volume in critical cooling sections. • Prevent boundary layers of slow-moving gas along boiler surfaces via good design and regular maintenance. • Online and offline boiler cleaning through a regular maintenance schedule to reduce dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler. • Dry sorbent injection using activated carbon and lime, in combination with a bag filter. The concentrations of dioxins and furans released from Line 3 will comply with BREF limits. As described above, it can be confirmed that Line 3 will use techniques (a) – (d) and also technique (e), dry sorbent injection, to reduce channelled emissions to air of organic compounds. Line 3will not use catalytic filter bags. Line 3will utilise the injection of ammonia in an SNCR system to abate NOx emissions. This is considered to be a proven method to reduce NOx emissions to below the required ELVs and has been successfully used on a number of plants in the UK and Europe.
31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques as listed in BAT 31 of the BREF.	In accordance with the BREF, dry sorbent injection of activated carbon will be employed at Line 3 in combination with a bag filter.
32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	There will be separate foul/domestic water, process water and surface water drainage systems at the site. Further information on the drainage arrangements is presented within section 2.6. An indicative water flow diagram depicting the segregation of different water streams for Line 3 is presented in Appendix A.
33	In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques as listed in BAT 33 of the BREF.	In accordance with the BREF, the following techniques will be implemented at Line 3 to reduce water usage and prevent wastewater generation: • Use of a flue gas treatment system that does not generate wastewater – by utilising dry sorbent injection of lime and PAC.

#	BAT Conclusion	How met or reference
		• Where practicable process effluents will be re-used within the process. Excess amounts of process effluent (which will rarely be generated) will be tankered off-site for treatment at a suitably licensed waste management facility.
34	In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 34 of the BREF, and to use secondary techniques as close as possible to the source in order to avoid dilution.	There will be no emission to water from FGC. However, it can be confirmed that, in accordance with BAT 34 (a), the incineration process and the FGC process will be optimised to target pollutants such as dioxins and furans, and ammonia – refer to the responses to BAT 29 and 30 above. The risk of emissions to water from the storage and treatment of bottom ash at the site will be minimised. Any overflow from the ash quench will be contained and reused within the process and hence there will not be any release of effluent from the ash quench system.
35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	It can be confirmed that bottom ash and APCr will be handled and disposed of separately at the site.
36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques as listed in BAT 36 of the BREF, based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	There will be no treatment of slags and bottom ashes undertaken at the Facility. Therefore, the requirements of BAT 36 do not apply.
37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques as listed in BAT 37 of the BREF.	In accordance with the requirements of BAT 37, it can be confirmed that the following techniques will be employed at the site to prevent or reduce noise emissions: • Appropriate location of equipment and buildings – in accordance with normal industry practice, the technology provider will implement an efficient layout to result in relatively quiet operational noise levels. • Operational measures – regular inspection and maintenance of equipment will be undertaken. Doors to buildings will remain closed as far as is reasonably practicable. Waste deliveries will take place primarily during daytime hours. • Low-noise equipment – the proposed technology provider will optimise plant selection, where appropriate, to reduce the noise level.

#	BAT Conclusion	How met or reference
		• Noise attenuation – plant rooms will have been acoustically designed for limiting noise emissions to acceptable levels for compliance with relevant workplace regulations. • Noise-control equipment/infrastructure – where appropriate, acoustic cladding will be used on buildings. Refer to the Noise Assessment presented in Appendix G for further details on noise mitigation measures proposed for the site.

3.8 Energy efficiency

3.8.1 General

Line 3 will utilise steam boilers which will generate steam which will be used to supply a steam turbine to generate electricity. Line 3 will supply electricity to the local electricity grid, or private offtaker, via a power transformer which increases the voltage to the appropriate level.

Line 3 also has a provision for heat take-off to be able to export heat off-site in the future.

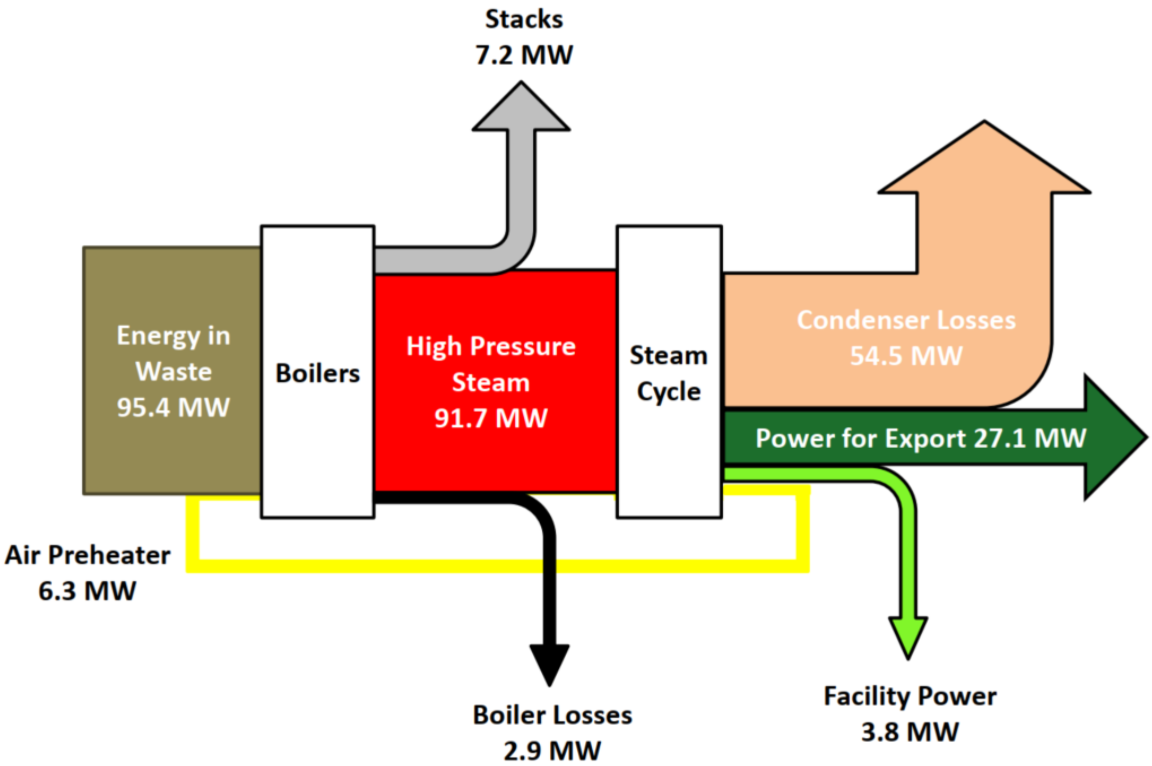
In case of failure of the electricity supply, an emergency diesel generator will be provided to safely shut down Line 3 and to provide an emergency supply to other aspects of the Facility.

In considering the energy efficiency of Line 3, due account has been taken of the requirements of DEFRA and EA guidance titled *'Energy efficiency standards for industrial plants to get environmental permits'*, dated February 2016.

3.8.2 Basic energy requirements

An indicative Sankey Diagram for Line 3 for the 'No heat export' case is presented in Figure 3.

Figure 3: Indicative Sankey Diagram - No Heat Case



Based on the nominal design capacity of Line 3 - No Heat Export

The Facility will have the capacity for the export of heat, subject to technical and economic feasibility. The export of heat would reduce the electrical output of the Facility but increase the overall thermal efficiency.

Assuming electricity-only mode and average ambient temperature, Line 3 will generate approximately 30.9 MWe of electricity in full condensing mode. Line 3 will have a parasitic load of approximately 3.8 MWe. Therefore, the export capacity of Line 3 with average ambient temperature is approximately 27.1 MWe.

Line 3 will process approximately 268,210 tonnes per annum (at the design point of 32.7 tph per line with a design NCV of 10.5 MJ/kg and an availability of 8,200 hours). At the design point, Line 3 will annually generate approximately 253,380 MWh and export approximately 222,220 MWh of electricity.

As presented in Table 5, the design figures compare favourably with the benchmark data for MSW incineration plants, given in the Environment Agency Sector Guidance Note EPR5.01 and in the BREF for Waste Incineration (WI BREF).

Table 5: Facility design parameters comparison table

Parameter	Unit	The Facility	Benchmark
Gross power generation, design point	MWh/t waste	0.94	0.415-0.644
Net power generation, design point	MWh/t waste	0.83	0.279-0.458
Internal power consumption, design point	MWh/t waste	0.12	0.15
Power generation (assumed gross) for 100,000 tpa of waste	MWe	11.5	5-9

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

3.8.2.1 Energy consumption and thermal efficiency

The most significant energy consumers are anticipated to be the following:

- primary and secondary combustion air fans;
- Induced Draft fan;
- boiler feed water pumps;
- ACC fans;
- air compressors;
- fuel loading systems; and
- residue conveying systems.

Line 3 will be designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high efficiency variable speed drives, high standards of cladding and insulation etc.

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

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

- Steady operation will be maintained as required by using auxiliary fuel firing; and
- Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

Due consideration will be given to the recommendations given in the relevant Sector Guidance Notes and the Waste Incineration BREF.

3.8.2.2 Operating and maintenance procedures

An O&M manual will be developed for Line 3. The O&M procedures will include the following aspects.

1. Good maintenance and housekeeping techniques and regimes.
2. As with Line 1 and 2, Plant Condition Monitoring will be carried out on a regular basis. This will ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks.
3. Operators will be trained in energy awareness and will be encouraged to identify opportunities for energy efficiency improvements.

3.8.2.3 Energy efficiency measures

An energy efficiency plan will be built into the operation and maintenance procedures of Line 3, ensuring maximum, practical, sustainable, safe and controllable electricity generation. The plan will be reviewed regularly as part of the environmental management systems.

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

3.8.3 Further energy efficiency requirements

In accordance with Article 44 of the Industrial Emissions Directive, heat should be recovered as far as practicable. In order to demonstrate this, the following points should be noted.

4. Economisers will be installed to recover flue gas heat, compatibly with the temperature requirements of the flue gas treatment system.
5. The boilers will operate with superheated steam.

The Facility will not be subject to a Climate Change Levy agreement.

3.9 Residue recovery and disposal

The main residue streams which will be generated from the operation of the Facility are:

1. IBA; and
2. APCr.

As described in sections 3.9.1 and 3.9.2, the proposed waste recovery and disposal techniques for the residues generated by the Facility, will be in accordance with the indicative BAT requirements.

Prior to the transfer of any residues off-site, where appropriate, the residues will be tested in accordance with the requirements of Technical Guidance WM2: 'Hazardous Waste: Interpretation of the definition and classification of hazardous waste'.

Any materials which are to be transferred to landfill from the Facility will be Waste Acceptance Criteria (WAC) tested – leachability tested – to ensure that they meet the WAC for the landfill that they are to be transferred to.

In accordance with the requirements of Article 4 (Waste Hierarchy) of the Waste Framework Directive, which sets out the priorities for the prevention and management of waste, enfinium will review the options for the recovery and recycling of all residues generated by the Facility.

3.9.1 Incinerator Bottom Ash

Ash which is collected in the boiler (boiler ash) will be mixed with ash which comes off the end of the grate (bottom ash). The mixture of boiler ash and bottom ash, known as IBA, is normally a non-hazardous waste which can be recycled. If the boiler ash were to be mixed with the APCr, the mixture would be defined as hazardous waste and this would restrict the ability of the operator to transfer the boiler ash for recovery.

IBA has been used for at least 20 years in Europe as a substitute for valuable primary aggregate materials in the construction of roads and embankments. Enfinium intends to transfer IBA from the waste incineration plant to an off-site IBA processing facility.

IBA handling will be undertaken in an enclosed building. In addition, any overflow from the ash quench will be contained in the process effluent drainage system, reused and hence will not be released off-site. There is little to no risk of contaminated runoff from the IBA storage area entering nearby watercourses and/or polluting the ground.

The use of an ash quench will limit dust generation within the IBA handling and storage area.

It is not currently proposed to undertake further treatment, including metals recovery, of the IBA on-site. However, an overband magnet is in place over the IBA conveyor to remove some ferrous metals from the IBA. Municipal waste accepted at the Facility will have typically undergone either source segregation (i.e. kerbside recycling) and/or pre-treatment prior to transfer to the Facility. Therefore, the quantities of metals within the waste will be small having been removed prior to delivery to the site. Furthermore, the IBA will be transferred off-site to authorised IBA processing facilities prior to re-use (e.g. as a secondary aggregate). It is intended the adjacent IBA processing facility operated by Blue Phoenix will be the primary recipient of the IBA. Metals recovery will be undertaken at IBA processing facilities.

3.9.2 Air Pollution Control residue

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

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

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

APCr is classified as hazardous (due to its elevated pH) and requires specialist landfill disposal or treatment. Enfinium currently sends APCr to a permitted operator for the production of construction materials, eninfium is investigating further options for the recovery and disposal of APCr. If a suitable option for the recovery of APCr cannot be identified, then it would be sent to a suitably licensed hazardous waste storage facility or landfill for disposal as a hazardous waste. The reuse of APCr is an evolving market and enfinium will continue to explore alternative options for the treatment of APCr throughout the lifetime of the Facility.

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

3.9.3 Summary

The expected quantities and properties of the main residue streams generated from the operation of the Facility are summarised in Table 6.

Table 6: Key residue streams from the Facility

Source/ Material	Properties of Residue	Storage location	Estimated quantity of residue generated (tpa)	Disposal Route and Transport Method	Expected Frequency
IBA	Bottom ash (mixed with boiler ash). This ash is relatively inert, classified as non-hazardous.	IBA bunker	50,440	To be removed from site for processing into a secondary aggregate.	1 – 7 days
APCr	Ash from flue gas treatment, may contain some unreacted lime.	APCR silos	10,140	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.	3 – 7 days

The residues from Line 3 will increase the overall quantity generated at the Facility. However, the residues from Line 3 will be stored and handled as per Line 1 and 2, and there is no proposed change in the storage capacity for this EP variation. The increase in residue generation will therefore not result in additional or increased environmental risk associated with the storage and handling of the residues.

3.10 Management

The documented management systems for Line 1 and 2 will be extended to include for the implementation of Line 3. The management team responsible for the operation of Line 1 and 2 will also be responsible for the operation of Line 3.

A Plans and drawings

B Updated Site Condition Report

C Environmental Risk Assessment

D Dispersion Modelling Assessment

E Dioxin Pathway Intake Assessment

F Abnormal Emissions Assessment

G Noise Assessment

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