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Riverside Resource Recovery Facility EP Variation

Riverside Resource Recovery Limited

Supporting Information – EP Variation

ENGINEERING CONSULTING

Document approval

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Non-technical summary

Riverside Resource Recovery Limited (RRRL) operates the Riverside Resource Recovery Facility (RRRF), a three-stream Energy Recovery Facility (the Facility) at Belvedere in the London Borough of Bexley. An Environmental Permit (EP) for the operation of the Facility was originally granted on 8 September 2003 (Ref: BK0825UI). RRRL have subsequently been granted 6 variations since the EP was granted.

Within this application, RRRL is applying for a number of additional changes to the EP for the Facility, to increase the processing capacity of the ERF from 785,000 to 850,000 tonnes per annum and to request a reduction in Emission Limit Values (ELVs) to the levels required within the Waste Incineration Best Available Techniques Reference document (WI BREF).

Environmental assessments have been undertaken to consider the impact of operating the Facility at the proposed increase in capacity. These have demonstrated that the proposed changes to the capacity and the reduction in ELVs will not result in any significant environmental impacts.

Due to the proposed increase in capacity, RRRL understands that the application will be classed as a Substantial Variation in accordance with the Environmental Permitting (England and Wales) Regulations 2016

Contents

1 Introduction

1.1 Background

Riverside Resource Recovery Limited (RRRL) operates the Riverside Resource Recovery Facility (RRRF), a three-stream Energy Recovery Facility (the Facility) located at Belvedere in the London Borough of Bexley. An Environmental Permit (EP) for the operation of the Facility was granted by the Environment Agency (EA) on 8 September 2003 (Ref: BK0825UI). RRRL has subsequently been granted 6 variations to the EP.

RRRL is proposing a number of changes to the EP which are detailed in section 1.2. This document contains the supporting information for the application for a variation to the EP.

Section 1 of this document provides a brief overview of the applicant/application including the proposed changes and type of variation, whilst section 4 describes the proposed changes in further detail. Section 5 considers the environmental impact associated with the proposed changes, including the potential impact on air quality.

1.2 Proposed changes

Within this application, RRRL is proposing the following changes to the EP:

- Increase the processing capacity of the Facility from 785,000 tonnes per annum to 850,000 tonnes per annum; and
- Reducing the emission limit values within the EP to align with the BAT-AELs for an 'existing facility' as defined within the WI BREF.

RRRL has recently upgraded the Combustion Control System (CCS) for the Facility. The enhanced CCS system improves the stability of combustion within the furnace enabling an increase in the processing capacity without making any changes to the boiler or combustion systems. Therefore, the operating techniques will not change as a result of the proposed increase in capacity. Furthermore, the introduction of the enhanced CCS system will not require any new raw materials or result in any additional waste streams being generated. Further detail on the changes to the combustion control system, from the implementation of the enhanced CCS system, are provided in section 2.

1.3 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.

RRRL 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 explained in section 2 of this document, the proposed increase in plant permitted throughput is equivalent to 65,000 additional tonnes of waste processed per annum.

The threshold for a non-hazardous waste incineration facility within Part 2, Schedule 1, Section 5.1 (b) of the Environmental Permitting Regulations is 3 tonnes per hour. The proposed increase in throughput is more than the threshold in 'Part 2 of Schedule 1 EPRs' and therefore, this application is a 'Substantial Change' to the EP.

RRRL understands that the application will be classed as a Substantial Variation by the Environment Agency (EA).

2 The combustion control system

The enhanced CCS system enables the Facility to operate more efficiently and acts as an optimisation system controller by interacting with the existing combustion control systems and the Distributed Control System (DCS). The enhanced CCS system uses the existing combustion control systems, but with an improved logic. The main changes associated with the CCS upgrade are as follows:

- Improved feed rate control;
- Automated adjustment of the nominal calorific value (NCV) of the waste;
- Improved logic software for burn-out control;
- Improved logic for detection of waste layer thickness;
- Automated adjustment of the O_2 setpoint; and
- Automated adjustment of the primary air distribution.

The parasitic load of the Facility will not change as a result of the implementation of the enhanced CCS system; however, the improved combustion controls, modifications to the steam circuit, and adjustments to the generator and turbine software will result in the Facility being able to export up to 80.5 MWe.

The changes implemented within the CCS upgrade, as explained in sections 2.1 to 2.6, will eliminate most of the manual interventions typically required to ensure stable combustion of the incoming waste.

2.1 Improved feed rate control

The variability in the physical properties of waste is a major source of disturbance for the combustion process. The enhanced CCS system utilises measurements of waste levels, waste resistance coefficient and waste feeding rate to optimise the waste feed control system and optimise the fuel supply to the grate and maintain stable combustion.

The waste feed hopper is fitted with radar level transmitters which continuously measure the level of waste within the feed hopper. Using this information, with the crane weight, the enhanced CCS system calculates the following:

- Waste volume flow;
- Waste volume per ram feeder stroke;
- Waste density; and
- Waste mass flow.

The enhanced CCS system uses this information to vary the waste feed rate by adjusting the ram feeder delivery rate to optimise waste feed into the furnace. This enables the combustion control system to stabilize the quantity of waste and its distribution on the grate. Overall, this improves the stability of the combustion, improves efficiency and enables an increase in the processing throughput.

2.2 Automated adjustment of the NCV

The enhanced CCS system calculates the NCV of the waste within the furnace based on measurements of CO_2 and H_2O in the flue gas. This ability to measure NCV on a real-time basis enables automatic adjustment to be made to the waste feed into the combustion chamber to

maintain a more stable energy flow within the furnace. The stability of the energy flow within the furnace enables a constant steam flow from the boiler; therefore, improving the electrical efficiency from the steam turbine compared to operating with fluctuations in steam output associated with fluctuating energy flow within the furnace.

2.3 Burn-out control

The enhanced CCS system calculates burn-out of the waste within the furnace based on UV pyrometers installed within the furnace. The UV pyrometers monitor the quality of the bottom ash and the location of the principal combustion zone on the grate. This optimises the burn out of the waste on the grate and maximises the energy which is recovered from the combustion process.

2.4 Waste layer thickness

The enhanced CCS system utilises the pressure transmitters which are installed within the furnace to optimise the waste layer thickness on the grate and ensures that the depth of the layer of waste on the grate is consistent, resulting in more stable combustion. This maximises the steam flow output as well as further contributing to burn-out control.

2.5 Automated adjustment of oxygen setpoint

Drawing its experience of installing similar CCS systems on other waste incineration facilities the technology provider has revised the combustion control setpoints to operate with a lower oxygen within the flue gases. This enables the Facility to operate at an increased thermal capacity.

2.6 Automated adjustment of the primary air distribution

A stable fire position on the grate is important to ensure complete burnout of the waste as well as an even temperature distribution in the post combustion chamber. The CCS system uses the combustion intensity signals from the different sections of the grate to determine the fire end position of the corresponding section of the grate. The primary air volume flow to the corresponding section of the grate is automatically adjusted to stabilise the fire end position.

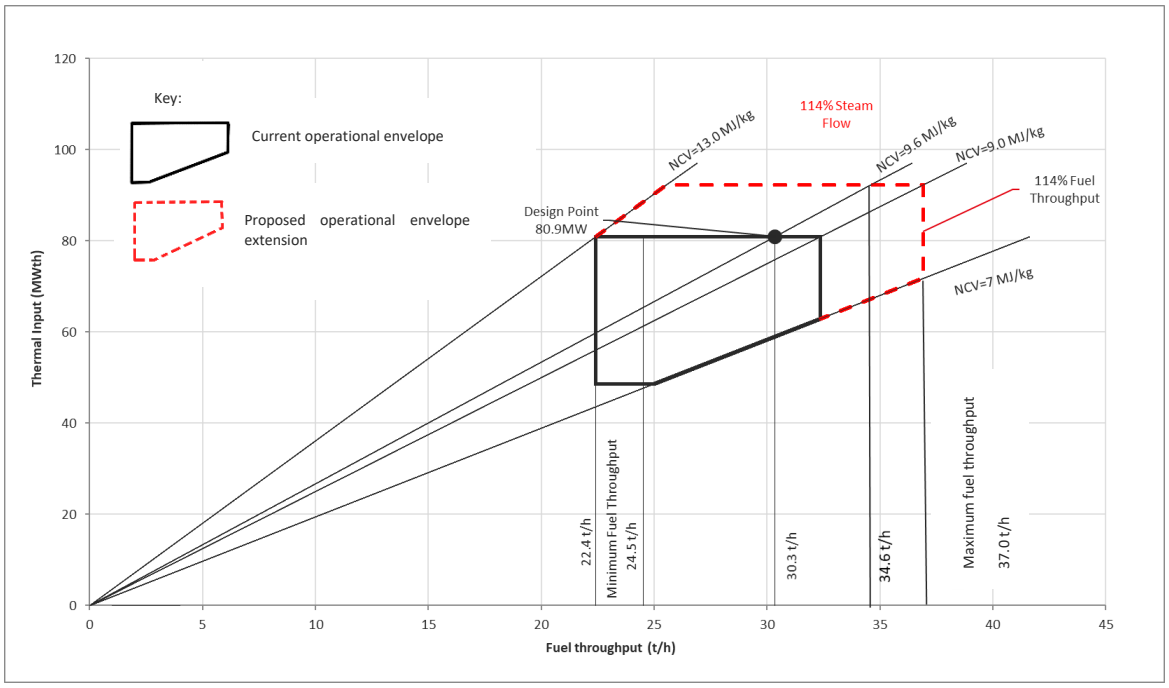
Furthermore, automatic adjustments are made to the movement of the grate to improve combustion. The movement of the grate can be varied in the penultimate grate zone to improve burnout of the waste, and reductions in the speed of the final section of the grate results in greater residence time of the waste on the grate.

3 Processing capacity

3.1 Firing diagram

Due to the proposed changes to the combustion control system, as detailed in section 2, the technology provider has updated the firing diagram for the Facility, refer to Figure 1. A larger copy including labelling is included within Appendix A.

Figure 1: Firing diagram



For reference and comparison purposes, the firing diagram for the Facility, prior to the enhanced CCS system being installed, is presented in Appendix A.

As can be seen from the firing diagram, allowing for the enhanced CCS system, the maximum hourly waste throughput per line will increase from 30.3 tonnes per hour to 34.6 tonnes per hour, at an NCV of approximately 9.6 MJ/kg. It is noted that, at the design minimum NCV, the maximum fuel throughput will be 37.0 tonnes per hour. This will be the maximum hourly processing capacity for each line.

Whilst the Facility will be capable of operating for up to 8,760 hours per annum, allowing for planned and unplanned maintenance, the Facility is expected to have an availability of approximately 8,200 hours per annum, which is consistent with average availability of the Facility in 2018 and 2019. Therefore, allowing for the installation of the enhanced CCS system and the expected availability, the maximum annual capacity at the design NCV can be calculated as follows:

Maximum Annual Plant Capacity = Maximum processing capacity (tph) x Operational Period

= 34.6 tonnes per hour x 8,200 hours

= 283,333 tonnes per annum per line

= 850,000 tonnes per annum

An application for an amendment to the section 36 planning consent for the Facility has been submitted to the Department for Business, Energy & Industrial Strategy (BEIS) for the same

capacity. This application was deemed suitable for publication by the Secretary of State on 29 April 2021. Therefore, if granted, the EP and the planning consent for the Facility will be consistent.

4 EP conditions

4.1 Proposed ELVs

RRRL is aware that the Waste Incineration BAT Reference document (WI BREF) and associated BAT Conclusions were published in December 2019 and compliance will be required from December 2023. The WI BREF introduces revised emission limits (referred to as BAT-AELs). Having installed the enhanced CCS system, RRRL is able to demonstrate compliance with the relevant BAT-AELs and is proposing reduce the emission limit values within the EP to be consistent with those for an 'existing facility' in advance of the implementation of the WI BREF by the EA. The proposed emission limit values are presented in Table 1.

Table 1: Proposed emission limit values

Pollutant	**Emission Concentration at Reference Conditions (mg/Nm³, unless stated) (1)**		
	BAT-AEL / Periodic ELV	**Half-hourly average ELV**	**BAT-AEL / Daily average ELV**
Oxides of nitrogen (as NO_2)		400	180
Sulphur dioxide		200	40
Carbon monoxide		150 (10-minute average)	50
Particulates (PM10)		30	5
Hydrogen chloride		60	8
TOC		20	10
Ammonia			10
Hydrogen fluoride	1		
Mercury	0.02		
Cadmium and thallium	0.02		
Group 3 metals	0.3		
Dioxins and furans	0.06 ng/Nm^3		
Dioxins, furans and dioxin-like PCBs(2)	0.08 ng/Nm^3		

Note:
(1) All emission limits are expressed at 11% oxygen, standard temperature and pressure.
(2) The ELV including dioxin-like PCBs is an alternative to the ELV for dioxins and furans only

4.2 Operating techniques

Apart from the changes to the combustion control systems, as detailed in section 2, no further changes are proposed to the Operating Techniques as listed in Table S1.2 of the EP.

5 Environmental impacts

The environmental impacts associated with the proposed changes to the Facility have been considered in sections 5.1 to 5.8.

5.1 Air quality

The following air quality assessments have been undertaken to consider the impact of the proposed changes to the Facility on air quality:

- Air quality assessment (AQA) (Appendix B);
- Dioxin Pathway Impact Assessment (Appendix C); and
- Abnormal Emissions Assessment (Appendix D).

As demonstrated in the AQA, in relation to human health, the emissions from the operation of the Facility are for a majority of pollutants and averaging periods considered to be 'insignificant' at the location of maximum impact. Where impacts are not classified as 'insignificant' (i.e. Process Contribution (PC) >1% of Environmental Assessment Level (EAL)) the predicted impacts do not lead to any exceedances of EALs and do not constitute 'significant pollution'

Considering the impact on ecologically sensitive sites, the predicted PCs from the Facility are less than 1% of the applicable annual critical level or load and 10% of the applicable weekly and 24-hour critical levels at all national and international protected statutory designated sites, with the exception of impacts at the Inner Thames Marshes SSSI and Ingrebourne Marshes SSSI receptors.

The predicted PCs from the Facility do not exceed 100% of the applied critical levels or loads for any of the pollutants assessed at the locally designated ecological receptor locations. Therefore, the impacts of the Facility are considered 'insignificant' at all designated ecological sites with the exception of the Inner Thames Marshes SSSI and Ingrebourne Marshes SSSI.

Further consideration has been given to the potential impacts of NOx and nitrogen deposition at the Inner Thames Marshes SSSI and Ingrebourne Marshes SSSI as the baseline critical levels and loads are in exceedance and impacts from the Facility are not 'insignificant' (i.e. >1% of the EAL). With regards to the potential impacts of NOx, the predicted annual mean NOx concentration from the Facility following the proposed changes is lower than from the currently permitted and operational Facility. Therefore, it is considered that the NOx impacts are unlikely to damage or affect the integrity of the SSSIs. In relation to nitrogen deposition at the Ingrebourne Marshes SSSI, a review of the unit conditions provided by Natural England does not indicate any adverse effects linked to nitrogen deposition and therefore it is considered that the integrity of the SSSI is not likely to be compromised by the small additional contribution from the Facility.

The abnormal emissions assessment concluded that during periods of abnormal operation, as permissible under the IED (Article 46), the Facility is not predicted to give rise to an unacceptable impact on air quality or the environment.

5.2 Greenhouse gases

A Greenhouse Gas Assessment (Appendix E) has been undertaken which considers the change in greenhouse gases which will be released from the Facility, due to the proposed increase in processing capacity.

The Greenhouse Gas Assessment concludes that there is an additional release of approximately 9,000 tonnes per annum of CO_2 attributable to the increase in waste throughput when taking into account the conventional generation which will be displaced by the Facility.

A carbon assessment has been produced in support of the amendment to the section 36 planning consent for the Facility. This includes a more detailed analysis of the carbon benefits of the development compared to disposal of waste in a landfill and takes into account other indirect carbon emissions (from transport etc). The carbon assessment concludes that, for the base case, operating at the proposed capacity is predicted to lead to a net reduction in greenhouse gas emissions of approximately 29,150 tonnes of CO_2-equivalent (CO_2e) per annum compared to the landfill counterfactual.

5.3 Raw material consumption

The proposed increase in capacity of the Facility will result in the consumption of additional quantities of the raw materials currently consumed. The consumption of the principal raw materials (lime, carbon, and ammonium hydroxide) will increase proportionally to the increase in fuel processed, i.e. an 8% increase in fuel usage will increase raw material usage by 8%.

The proposed increase in plant capacity will not result in any changes to the arrangements for the storage and handling of raw materials or any additional types of raw materials to be consumed at the ERF.

5.4 Residues generation

The proposed increase in capacity of the Facility will result in additional quantities of residues being generated. The estimated quantities of residues generated is presented in Table 2:

Table 2: Estimated residue generation – ERF

Residue	Units	Residue generation – 785,000 tpa	Estimated residue generation – 850,000 tpa
Incinerator Bottom Ash (IBA) [1]	tpa	196,250	212,500
Air Pollution Control residues (APCr) [2]	tpa	19,625	21,250

1. Assuming IBA accounts for 25% of the incoming waste.
1. Assuming APCr generation is equivalent to 2.5% of the incoming waste

5.5 Energy efficiency

As explained in sections 2.2 and 2.4, the installation of the enhanced CCS will result in a more stable energy flow from the boiler. This will enable the Facility to generate additional power. The enhanced CCS system will increase in gross power generation (at the design point) from 72.3 MWe to 83.9 MWe. The parasitic load will not change significantly with the installation of the enhanced CCS system, and it remains at approximately 7 MWe. Therefore, the net generation is expected to be approximately 76.9 MWe, noting that the application for an amendment to the section 36 planning consent for the Facility allows for a net generation of up to 80.5MW to provide flexibility.

The current operation and proposed design of the Facility have been considered against the relevant energy efficiency requirements of the waste incineration sector guidance (EPR5.01) and the Waste Incineration BREF (referred to as the WI BREF).

Table 3: Facility design parameters comparison table

Parameter	Unit	Current Operation	Proposed Capacity	Benchmark
Net power generation (at 8,200 hours)	MWh/t waste	0.719	0.739	0.6-0.9
Internal power consumption (at 8,200 hours)	MWh/t waste	0.07	0.07	0.06-0.19
Power generation (assumed gross) for 100,000 tpa of waste	MWe	9.7	9.9	5-8

As presented in Table 3, the design of the Facility compares favourably with the relevant benchmarks. The proposed design values show an improvement or remain unchanged when compared to the current operation.

5.6 Fire prevention plan

The proposed increase in capacity of the Facility is due to an increase in the thermal load performance. Through the implementation of this variation, there will not be any changes to the quantity or arrangements for the storage of waste. Furthermore, it is understood that:

- there will be no increase in the potential risk of fire at the Facility including the volumes of wastes which will stored within the bunker; and
- there will be no changes to the proposed management techniques to prevent or mitigate fire associated with this variation.

Taking this into consideration, it is understood that an updated Fire Prevention Plan for the Facility is not required to be submitted in support of this application.

5.7 Noise

The proposed changes will not result in any changes to the noise impacts as a result of operations at the Facility. Therefore, it is not considered that it is necessary to provide a 'new' or 'revised' noise assessment associated with the proposed changes to the Facility.

5.8 Odour

It is not considered that the proposed changes will result in an increased risk of odour at the site.

Appendices

A Firing Diagrams

B Air Quality Assessment

C Dioxin Pathway Impact Assessment

D Abnormal Emissions Assessment

E Greenhouse Gas Emissions Assessment

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