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Consulting Engineers Limited

Avonmouth High Temperature Incinerator

Grundon Waste Management Ltd

Non-Technical Summary

ENGINEERING CONSULTING

Document approval

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1 Introduction

An Environmental Permit (EP) was granted by the Environment Agency (EA) to New Earth Energy (West) Operations Limited for the operation of the Avonmouth Energy Facility in January 2013. The EP includes for the operation of a Schedule 1, Section 5.1 (A1) (c) activity:

The incineration of non-hazardous waste in a pyrolysis and gasifier plant with a capacity of 1 tonne or more per hour

The EP was subsequently transferred to Avonmouth Bio Power Limited in October 2015.

Whilst the gasification plant was constructed and commissioned, it did not operate as it was intended. The gasification plant was eventually mothballed by Avonmouth Bio Power Limited in 2016. Grundon Waste Management Limited (Grundon) subsequently acquired the site from Avonmouth Bio Power Limited in February 2021.

Grundon has removed all of the gasification process equipment, including the waste feed and flue gas treatment systems. Grundon is currently installing a new waste incineration combustion technology, and associated waste and flue gas treatment systems to process a mix of non-hazardous, clinical and hazardous wastes which require high temperature incineration, herein referred to as the Facility.

Within this application, Grundon is applying for a Variation to the EP to allow for the high temperature incineration of hazardous and non-hazardous wastes.

1.1 The Applicant

Grundon is one of the UKs leading recycling and waste management companies and is the named Operator of the Facility. Grundon is registered in England (Company Number: 04245965) and has a registered address of Thames House, Oxford Road, Benson, Wallingford, Oxfordshire, OX10 6LX.

Grundon owns and operates multiple industry-leading facilities enabling environmentally friendly methods of recycling and waste disposal. These facilities include Energy from Waste (EfW), High Temperature Incinerator (HTI) and Materials Recovery Facilities (MRFs), treatment plants and transfer stations, among others. Grundon operates the Lakeside HTI facility.

1.2 The Site

The Facility is located on Zinc Road, Avonmouth, BS11 8AZ, and is located within the industrial area of Avonmouth, behind the ASDA Retail Distribution Centre, accessed off Kings Weston Lane in Avonmouth. Junction 18/18A of the M5 motorway is approx. 1 mile to the South. The M4/M5 interchange is approx. 7 miles to the North. Avonmouth Docks are within 1 mile of the site and Bristol City Centre is 10 miles to the East via the A4 Portway.

All of the activities associated with the operation of the Facility will be undertaken within the existing installation boundary, and this application does not propose any changes to the installation boundary.

A revised installation boundary drawing, incorporating the proposed waste incineration technology is provided in Appendix A of the application pack.

1.3 The Activities

The Facility will consist of two Schedule 1 installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities. These include:

- waste incineration plant, including the processing of incoming clinical, hazardous and non-hazardous waste which is delivered to the Facility via road;
- treatment of flue gases generated from the combustion of the waste fuels;
- production of bottom ash material that will be transferred off-site for disposal in landfill;
- generation of an air pollution control residue (APCr) that will be transferred off-site to a suitably licensed hazardous waste facility for disposal; and
- the repackaging of hazardous wastes for transfer off-site to a suitably licenced waste disposal/recovery facility.

The following table lists the Scheduled activities from the Environmental Permitting Regulations, and directly associated activities.

Table 1: Scheduled and directly associated activities

Type of Activity	Schedule 1 Activity	Description of Activity
Installation	Section 5.1, Part A(1) (a)	The incineration of hazardous waste and non-hazardous in a waste incineration plant with a capacity of 2.5 tonnes/hour.
Installation	S5.3 Part A(1) (a) (iv) Repackaging of hazardous waste: **R12** Exchange of waste for submission to any of the operations numbered R1 to R11 (repackaging) **D14** Repackaging prior to submission to any of the operations numbered D1 to D13	Repackaging is limited to: • taking a waste package (for example a bag, jar, drum or box) out of one cart or bulk container (for example a skip) and placing it into another cart or bulk container (for example, a skip) • taking a waste package from a cart or bulk container (for example, skip) and placing it onto a pallet or vehicle • taking a waste package from a pallet and placing it into a cart or bulk container (for example, skip) • transferring, removing or separating waste from its primary packaging (for example container, bags, bins, boxes). Healthcare waste shall not be transferred, removed or separated from its original packaging. Wastes that are combined together during repackaging activities shall have the same EWC code and similar chemical composition. The repackaging of wastes shall not result in: • any incompatible wastes being repackaged together in the same container • a reaction of repackaged wastes with each other

Type of Activity	Schedule 1 Activity	Description of Activity
		• a reaction with the container in which the wastes are being placed. Repackaging shall take place within a building on an impermeable surface with sealed drainage. Fugitive emissions shall be minimised during repackaging. Repackaging of waste shall not change either the maximum storage times for waste on site or the amount that can be stored at any one time.
Directly associated activities		
Directly Associated Activities		The receipt, storage and handling of non-hazardous, hazardous and clinical waste prior to incineration.
Directly Associated Activities		The handling, storage and transfer of residues for transfer off-site.
Directly Associated Activities		Energy recovery via a steam boiler, steam turbine and generator producing electricity.
Directly Associated Activities		Bin washer
Directly Associated Activities		Standby electrical generation to provide electrical power to the plant in the event of an interruption in the supply.

The Stationary Technical Unit (the Facility) includes waste reception and preparation; waste storage; water, fuel oil and air supply systems; a rotary kiln combustion system including steam boiler; facilities for the treatment of exhaust gases; on-site facilities for treatment or storage of residues and wastewater; stack; and devices and systems for controlling the combustion process and monitoring emissions.

The capacity of the Facility will be approximately 60 tonnes per day (2.5 tonnes per hour) of non-hazardous and hazardous wastes, with a net calorific value (NCV) of 26 MJ/kg.

The Facility will have an availability of approximately 8,000 hours per annum. Therefore, the Facility will have a nominal design capacity of approximately 20,000 tonnes per annum (tpa). However, allowing for the Facility operating on a low range NCV (<20 MJ/kg) the Facility could process up to 28,500 tpa. Therefore, the maximum capacity of the Facility is 28,500 tpa.

2 Details of the Facility

The capacity of the Facility will be approximately 60 tonnes per day (2.5 tonnes per hour) of non-hazardous and hazardous wastes, with a net calorific value (NCV) of 26 MJ/kg.

The Facility will have an availability of approximately 8,000 hours per annum. Therefore, the Facility will have a nominal design capacity of approximately 20,000 tonnes per annum (tpa).

The Facility will include the following processes:

1. **Incoming waste**

   The majority of the incoming waste will be delivered to the Facility via road in enclosed packages, including wheeled bins, fibre board, plastic and steel drums, IBCs, boxes, sacks and bulk bags. The Facility will also receive bulk aqueous and organic liquids wastes, for direct injection into the kiln. Compressed gas cylinders will also be accommodated; their contents being directly injected into the kiln, using a dedicated connection and transfer system.

   In addition, the Facility will receive mixed loads of hazardous and non-hazardous wastes. A proportion of the mixed loads are unlikely to be suitable for treatment within the Facility. The materials which are unsuitable for treatment within the Facility will be transferred off-site for disposal or recovery at alternative waste management operations.

   To assist with achieving uniform loading, wastes that are suitable for shredding and hydraulic pumping will be routed to a pre-treatment system - shredding and pumping (S&P) system – to be fed into the kiln. Examples of these wastes include paint, oil, adhesive and resin sludges, contaminated absorbents, and filter cakes which can contain a proportion of free liquid. The S&P system is not designed to manage large packages with over 50% free liquid. For wastes with more than 50% free liquid, most of the liquid will be removed/pumped off prior to pre-treatment in the S&P system. Only chemically compatible wastes will be treated at the same time, avoiding the potential for chemical reactions e.g. polymerisation, which could potentially block the feed pipes.

2. **Combustion system**

   Solid waste will be supplied into the primary combustion section of the process via the elevator or pipeline. High and low calorific liquid wastes will be supplied to the primary or secondary combustion sections, depending upon process demand and waste properties. Liquid and gaseous wastes originating from gas bottles will be supplied directly to the secondary combustion section.

   The combustible gases produced by the partial combustion of the waste in the primary combustion section will be mixed with secondary air introduced at the front of the kiln and burn out completely in the post combustion chambers. High calorific liquid waste can be injected at the inlet side of the post combustion section to raise the flue gas temperature as it exits the stationary zone of the primary combustion.

   In the rotary kiln a nominal temperature will be maintained at around 900 to 1150°C. Flue gas leaving the rotary kiln directly preheats the new waste supplied to the kiln.

   The flue gas generated in the primary combustion chamber will be supplied to a vertical secondary combustion chamber. The minimum operating temperature in the secondary combustion chamber is 1100 °C and will have residence time of at least 2 seconds as the Facility will be processing hazardous wastes.

   A fuel oil fired post combustion burner will ensure that the temperature within the secondary combustion chamber is maintained above 1100 °C.

3. **Energy Recovery**

   The hot flue gases are cooled down in a water tube boiler section, transferring energy to produce saturated steam at 21 bar(a) and 215°C. The saturated steam is supplied to a steam turbine and generator set, to generate electricity. The Facility will generate approximately 1.5 MWe, and will have a parasitic load of up to 0.4 MWe. Therefore, the Facility will export approximately 1.1 MWe of electricity.

4. **Flue gas treatment – NOx abatement**

   A urea based SNCR system will be installed on the radiative section of the boiler.

   The urea will be injected at a minimum of 2 levels, to achieve an optimum NOx reduction also at variable thermal load (and resulting variable flue gas temperatures), with an automated selection of injection location depending upon the actual temperature profile.

   The excess of urea injected in the SNCR process will produce higher concentrations of gaseous ammonia. This acts as an additive, contributing to a further reduction of NOx concentrations in the catalytic filter element-based bag filter, based on SCR NOx reduction.

   In addition, the Facility will utilise catalytic bag filters to provide additional NOx abatement.

5. **Flue gas treatment – Acid gases**

   The Facility will include a primary (dry) and secondary (wet) flue gas treatment system.

   After the energy recovery stage the flue gas passes through a secondary flue gas cooling section, where the temperature is controlled between 160°C and 200°C using ambient air as a cooling media, prior to treatment in the dry flue gas treatment system.

   The dry flue gas treatment systems consist of:

   – dry acid gas scrubbing system, which utilises hydrated lime as a reagent, to remove the majority of the acidic components in the flue gas; and
   – PAC dosing to abate emissions of volatiles, including dioxins & furans, heavy metals and VOC's.

   A bag filter is used to remove fly ash from the flue gas stream, including the above reagents, thus eliminating dust emissions (particulate matter) to the maximum extent. The Facility will include catalytic bag filters.

   The hydrated lime dosing rate is controlled via the plant automation system, monitoring the actual dosing rate of additives (caustic) to the wet scrubber. Recirculation of lime will not be included due to the high acid content of the flue gases. Therefore, lime will be dosed on a once though basis.

   Following the injection of lime and PAC, the flue gas will then pass through the fabric filters, which will remove the particulates and reaction products, collectively known as Air Pollution Control residues (APCr). The APCr will be collected in special bags. The dosing rate for the acid gas reagent will be controlled by the upstream acid gas pollutant concentration measurements and proportioned to the volumetric flow rate of the flue gases. The bag filters will be catalytic bag filters, and will provide additional abatement of emissions of NOx and dioxins and furans.

   Following treatment of the flue gases within the dry flue gas treatment system, the flue gases will pass to the wet flue gas treatment system. The wet flue gas treatment system will be utilised to ensure compliance with the BAT-AELs for acid gases.

   The wet flue gas treatment system consists of a two-stage wet scrubber utilising sodium hydroxide as the reagent. The secondary flue gas treatment system includes a bypass system. The bypass system will only be utilised when combusting wastes which have been identified as being classified as containing radioactive materials.

   The secondary flue gas treatment systems consists of the following:

– a venturi type scrubber, with adjustable removal efficiency
– a column type scrubber, with integrated mist eliminator package

The sodium hydroxide dosing rate will be controlled via a pH measurement in the scrubber liquid circuit to optimise the abatement of the wet scrubber, whilst minimising the consumption of the reagent but optimum amount of additive.

2.1 Raw materials and feedstocks

The Facility will utilise a number of different chemicals and raw materials. The chemicals and raw materials used at the site will include the following:

- lime;
- urea solution (40%);
- powdered activated carbon (PAC);
- sodium hydroxide;
- auxiliary fuel; and,
- other boiler treatment chemicals.

Small quantities of maintenance materials will be kept at the Facility (such as oils, greases, insulants, antifreezes, welding and firefighting gases etc) for the operation and maintenance of plant and equipment.

Raw materials (including maintenance materials) will be supplied to standard specifications offered by different suppliers. All chemicals will be handled in accordance with Control of Substances Hazardous to Health (COSHH) Regulations as part of the quality assurance procedures and full product data sheets will be available.

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.

The Operator will maintain a detailed inventory of raw materials used and will have procedures for the regular review of developments in raw materials used.

2.2 Emissions

2.2.1 Emissions to air

Emissions from the Facility will be released from the stack. Detailed air dispersion modelling of emissions has been undertaken. The emission limits proposed within this application for the Facility are consistent with the upper range of the BAT-AEL's stated in the Waste Incineration BREF for a new plant.

2.2.2 Emissions to water and sewer

The Facility's existing site drainage arrangements are being retained, and surface wate run-off will be discharged into the existing surface water drainage systems.

Process effluents will be collected in a tank/sump to enable re-use within the Facility. Where process effluents cannot be re-used within the process they will be discharged or tankered off-site

to a local wastewater treatment facility. Grundon is engaging with the Sewerage Undertaker to apply for a trade effluent consent for the discharge of process effluent to foul sewer.

Domestic effluents will be discharged to sewer, as per the existing arrangements for the Facility.

2.3 Monitoring

There will be continuous monitoring of emissions to air of the flue gases from the Facility. The monitoring system will include monitoring of oxygen, carbon monoxide, hydrogen chloride, sulphur dioxide, nitrogen oxides, ammonia, VOCs, and particulates. Other pollutants will be monitored by spot measurements at regular intervals. All continuous emissions measurements will be recorded, and operators will be alerted if emissions to air approach the permitted limits. The results of emissions monitoring will be reported to the EA. The Facility will utilise modern control systems, which incorporate the latest advances in control and instrumentation technology. These systems will optimise the operation of the Facility.

Process variables at the Facility will be monitored, including waste throughput, water use and electricity consumption. Regular sampling and analysis of Incinerator Bottom Ash (IBA) will be undertaken to confirm that the Total Organic Carbon (TOC) content is less than 3%, or LOI is less than 5%, and to confirm the non-hazardous status of the IBA.

2.4 Technology selection

The processes have been designed against the background of a detailed assessment of the prevailing environmental conditions at the site, in order that the objectives of the Industrial Emissions Directive (IED) are achieved. Best Available Techniques will be employed at the Facility to minimize its impact upon the local environment.

A quantitative Best Available Techniques (BAT) assessment has been completed for the Facility. This has demonstrated that the proposed techniques to be employed at the Facility will represent BAT in accordance with the relevant BAT guidance notes.

The following techniques are proposed to be employed at the Facility:

- Selective Non-Catalytic Reduction (SNCR) with urea solution for the abatement of oxides of nitrogen;
- a rotary kiln for the combustion of waste;
- a wet and dry systems for the abatement of acid gases;
- lime to be used as a reagent for the abatement of acid gases (dry scrubber); and
- sodium hydroxide to be used as a reagent for the abatement of acid gases (wet scrubber).

2.5 Residues

The main solid residue streams arising from the Facility are:

1. IBA; and
2. APCr.

Due to the nature of the waste being processed at the Facility the IBA generated will be transferred to landfill for disposal.

APCr is classified as hazardous and requires specialist disposal or treatment. It may be possible to send the residue to a waste treatment contractor, to be used to neutralise acids and similar

materials. Using the residues in this way avoids the use of primary materials. If these options are not available, the APCr will be sent to a suitably licensed hazardous waste landfill for disposal as a hazardous waste.

2.6 Management

Grundon has an existing management system which has been accredited to the ISO 14001 Environmental Management System Standard. The existing management systems will be extended to include the operation of the Facility.

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