CORBY ENERGY FROM WASTE FACILITY PERMIT APPLICATION

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BAT Assessment
Encyclis Limited

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1 INTRODUCTION

1.1.1 Encyclis Limited (Encyclis), is applying for an environmental permit for an Energy from Waste Facility (EfW). The EfW will have the capacity to circa 357,408 tonnes of non-hazardous waste fuel annum, generating circa 30.76 MW of electricity. The EfW site is located approximately 2.2 km north-east of Corby Town Centre in a light industrial setting.

1.1.2 Details of the proposal are provided within the supporting information document.

1.1.3 This report addresses the BAT options appraisal requirements as set out in EPR S5.01[1] and provides a comparison of the proposals against the relevant Best Available Techniques (BAT) conclusions set out in the revised Waste Incineration BREF[2] and associated implementing decision[3].

- Section 2 assesses the choice of treatment technology, NOx abatement, acid gas abatement, dioxin and furan abatement and particulate abatement against alternatives, qualitatively and quantitatively using the Environment Agency's H1 tool.
- Section 3 reviews the site processes against each relevant Waste Incineration BAT conclusion.

[1] How to comply with your environmental permit. Additional guidance for the incineration of waste (EPR 5.01). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297004/geho0209bpio-e-e.pdf

[2] Best Available Techniques (BAT) Reference Document for Waste Incineration, JCR Science for Policy Report, 2019 https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

[3] Waste Incineration BAT Conclusions https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D2010&from=EN

2 EFW OPTIONS APPRAISALS

2.1.1 In section 3 of the main application document, a description of the proposed EfW has been provided, detailing those techniques that are considered to represent BAT for the proposed EfW. This section provides a BAT appraisal for the key items of plant as follows:

- Moving grate furnace;
- NOx Abatement
- Acid gas abatement;
- Injection of activated carbon; and
- Bag filters.

2.2 Selection of Treatment Technology

2.2.1 A brief review of available technologies for thermal treatment of the proposed waste material is provided in section 3.4 of the main application document. This review considered a wide range of technologies but concluded that moving grate and fluidised bed systems are the only proven systems for the application to the proposed waste material within the UK. Gasification and pyrolysis systems are recognised as emerging techniques however, their availability and reliability are yet to be proven technologies within the UK at the scale proposed for this facility.

2.2.2 This section provides further discussion on the following alternatives:

- Option 1: Moving Grate;
- Option 2: Fluidised Bed;
- Option 3: Gasification;
- Option 4: Pyrolysis;
- Option 5: Plasma Arc Gasification;
- Option 6: Biological Treatment (Anaerobic Digestion); and
- Option 7: Landfill.

Conventional Thermal Treatment Technologies

2.2.3 Conventional thermal treatment technologies are based upon the complete combustion of the incoming waste material. The application of conventional thermal treatment technologies to the burning of material derived from waste requires the EfW to comply with the Industrial Emissions Directive (IED)[4] and BATC. Fundamental requirements of the IED and BATC include the requirement to achieve a combustion temperature of > 850°C, with a residence time after the last injection of combustion air of at least 2 seconds. A number of variations exist based on the type of combustion plant. Options 1 and 2 in this assessment represent alternative types of conventional thermal treatment.

Common to Conventional Thermal Treatment Technologies

2.2.4 Conventional thermal treatment processes require flue gas treatment to control NO_x emissions, which may give rise as a by-product of the SNCR reaction, to emissions of nitrous oxide, a powerful global warming agent. The nitrous oxide emissions are not a function of the thermal treatment option itself, being related to the selected abatement for NO_x and are consequently not included within this section. A separate assessment of the selected NO_x abatement is provided

[4] Industrial Emissions Directive 2010/75/EU https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0075&from=EN

later in this section and includes consideration of the global warming impacts associated with the available techniques.

2.2.5 Figure 2-1 shows a typical flow diagram for a Conventional Thermal Treatment Process. The thermal treatment of waste is central to the flow diagram, producing electricity and heat, thereby avoiding the combustion of fossil fuels. Similarly, the recovery of materials, such as metals, prior to thermal treatment also avoids the use of fossil fuels. Exhaust gases from the thermal treatment process are emitted to the atmosphere and potentially include both short and long cycle carbon. The bottom ash produced by the thermal process is either sent to landfill or used as an aggregate.

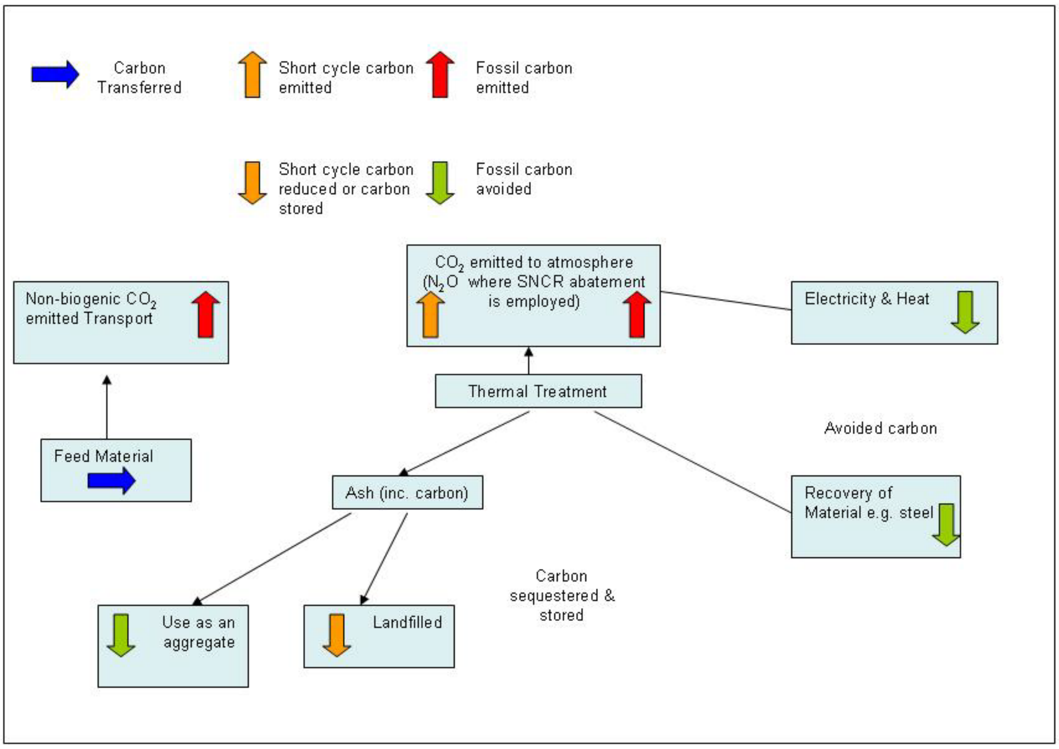

Figure 2-1 Conventional Thermal Treatment Process

2.2.6 Conventional thermal treatment processes offer a proven technique, able to operate flexibly, to cater for a wide range of waste material inputs.

Option 1: Moving Grate

2.2.7 Moving grate technologies are the most widely used system for construction and industrial (C&I) waste, MSW and MSW-derived fuel applications and as such are well proven and reliable. The moving grate system is capable of burning MSW fuel as received as well as processed fuels such as Refuse Derived Fuel (RDF) or Solid Recovered Fuels (SRF). A variety of designs are available, but typically the grate system will include a mechanism for distributing the incoming waste material across the grate and for transporting the combustible material forward, providing mixing as it traverses the length of the grate.

2.2.8 The waste material is burned with an excess of air that is typically drawn from above the storage bunker (as is the case for the proposed facility), providing a source of odour control. Primary air is generally fed through the grate with a secondary air supply above the grate to create turbulence.

2.2.9 Flue gases from the furnace will require treatment to achieve compliance with the emission limit requirements of the IED and BATC.

2.2.10 Moving grate systems will produce two residues, bottom ash (usually combined with boiler ash, but this can be collected separately) and air pollution control (APC) residues. Bottom ash, which is the larger (in quantity) of the two residues, has the potential to be reused as an aggregate. Uses for APC residues are available, subject to testing of the residue.

Option 2: Fluidised Bed Furnace

2.2.11 Fluidised Bed (FB) technology operates by feeding the waste material onto a bed of 'fluidised' sand particles. The fluidised bed technology requires a homogenous feedstock. In this respect fluidised bed would not be suited to all of the types of waste material proposed for the EfW.

2.2.12 FB technology is capable of achieving somewhat lower NOx emissions in the raw gas than are typically achievable in moving grate systems. This is achieved through lower bed temperatures, which reduce thermal NOx formation but may produce higher CO emissions. However, additional abatement using either SCR or SNCR will still be required to guarantee IED and BATC compliance.

2.2.13 Additional raw materials are required in the form of sand within the fluidised bed system.

2.2.14 Solid waste streams from the process typically include bottom ash, cyclone ash (usually mixed with the bottom ash), and APC residues. Although overall a similar total amount of residues will arise in a fluidised bed plant compared with that from a moving grate system, a higher proportion will be classified as hazardous waste. As for moving grate plant the bottom ash can be reused as an aggregate.

2.2.15 FB technology is employed in Europe, including in the UK, where it is operational at Allington in Kent and was previously employed in Scotland at Baldovie (near Dundee). The larger Allington plant has three lines with a combined capacity of approximately 500,000 tpa. UK experience with fluidised bed plant is reported as problematic, with both Dundee and Allington initially experiencing significant downtime, as reported in 2008[5]. In 2014 loss of fluidisation was the single largest cause of downtime, with total unavailability during 2014 of 19%[6] and 16% in 2018[7]. In 2019, FCC Environment launched a consultation on proposals to increase the capacity of the Allington plant to 850,000 tpa, however, the new line would use moving grate technology[8], this was expected to be submitted to the Planning Inspectorate in Spring 2021[9], it is not clear if this happened as no further detail is publicly available. It was anticipated that the end of the operational life of the Dundee facility would be April 2020[10], after which the Dundee facility would be replaced with a moving grate facility. However, MVV have since stated that the FB facility can continue to operate for longer than anticipated and have applied to operate the FB and moving grate facilities in parallel for a period of up to 10 years from April 2020.

[5] letsrecycle.com (2008): Allington Technology Defended as Repairs Near End [online], available: https://www.letsrecycle.com/news/latest-news/allington-technology-defended-as-repairs-near-end

[6] Kent Enviropower Ltd (2015): Annual Report for Allington Energy from Waste Facility, Year: 2014 (pages 10-11) [online], available: https://www.whatdotheyknow.com/request/260104/response/645233/attach/18/Annual%20Report%20for%202014%20Allington.pdf

[7] Kent Enviropower Ltd (2019): Annual Report for Allington Energy from Waste Facility, Year: 2018 [online], available: https://ukwin.org.uk/library/136-AnnualPerformanceReport-2018.pdf

[8] letsrecycle.com (2019): FCC proposes Allington EfW upgrade [online], available: https://www.letsrecycle.com/news/latest-news/fcc-proposes-allington-efw-upgrade/

[9] Planning Inspectorate (2020) Extension to Allington Integrated Waste Management Facility [online] available: https://infrastructure.planninginspectorate.gov.uk/projects/south-east/extension-to-allington-integrated-waste-management-facility/?ipcsection=overview

[10] MVV Environment Baldovie Ltd (2020) Pollution Prevention and Control non-technical summary [online], available: https://www.mvv.de/fileadmin/user_upload/Ueber_uns/de/geschaeftsfelder_1/environment_1/dundee_and_angus_/planning_application/application_to_vary_permit/Pollution_Prevention_and_Control_non-technical_summary_update.pdf

Advanced Thermal Treatment

2.2.16 Gasification and pyrolysis treatment processes have a long history of application to fossil fuels and certain homogeneous waste streams (although these were not historically governed by the requirements of the IED or the former Waste Incineration Directive). Their application to MSW and RDF in the UK is limited at 'commercial scale', and this continued to be the position as described by Defra is 2013[11] with only three operational facilities identified at the time (Table 4 of the Defra document).

2.2.17 It is reported that six ATT projects in England and Wales have been allocated Contracts for Difference in the 2017 auction round[12], however only two signed contracts in 2019 (Round 3)[13].

Option 3: Gasification

2.2.18 Gasification is the partial thermal degradation of a substance in the presence of oxygen but with insufficient oxygen to oxidise the feed material completely. This process produces gaseous fractions known as 'synthesis gas' or 'syngas', primarily a combination of carbon monoxide, hydrogen and methane. The synthesis gas offers the potential to be utilised in a number of ways, including combustion in engines, steam-raising boilers or other energy conversion processes, subject to gas quality and legislative requirements.

2.2.19 Gasification is reported by some as offering the opportunity for higher efficiency electrical generation compared to conventional combustion technologies.

2.2.20 Operationally, a homogeneous incoming waste stream with a high organic content is required to obtain consistent gas quality. Therefore, this technology is better suited to applications where the incoming waste material has been pre-treated.

2.2.21 The process requires energy input from supplementary combustion, likely to be using either natural gas or low sulphur oil, to achieve the temperature required for thermal treatment.

2.2.22 Ash and char are also produced from the gasification process. The ash from some gasification processes is suitable for re-use as an aggregate material. Residues from flue gas cleaning, similar to those from conventional combustion plant would be treated for reuse or disposed of as hazardous waste if a reuse route could not be found.

2.2.23 Combustion of the fuels from the gasification stage will be subject to the requirements of the IED and BATC. These emissions will require treatment and generally similar abatement to that applied to conventional plant to ensure compliance with emission limits[14].

2.2.24 Currently there is limited experience of gasification technology employed for the treatment of waste materials, and there remains a low uptake of this technology in Europe, where experience has proven mixed or is limited.

2.2.25 Where it has been applied, such as the development at Avonmouth by New Earth Solutions (since acquired by Beauparc) to treat RDF, this technology has experienced extensive ongoing

[11] Defra (2013): Advanced Thermal Treatment of Municipal Solid Waste [online], available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/221035/pb13888-thermal-treatment-waste.pdf

[12] ACT and Biomass Schemes Backed in CfD Auction, 11 September 2017 [online], available at: https://www.mrw.co.uk/latest/act-and-biomass-schemes-backed-in-cfd-auction/10023285.article

[13] Low Carbon Contracts Company (2019): Allocation Round three projects sign on the dotted line [online], available: https://www.lowcarboncontracts.uk/sites/default/files/2019-10/LCCC%20press%20notice-signed%20AR3%20contracts-20191018_0.pdf

[14] Energy from Waste: A good practice guide, November 2003, The Chartered Institute of Waste Management

operational difficulties that have led to this plant being closed for long periods[15]. The most recent news found on the Avonmouth plant stated that throughput was to be increased despite continued nuisance issues to neighbours[16].

2.2.26 Viridor's Glasgow facility has suffered construction ongoing delays due to its gasification technology Interserve provider leaving the market, whereas its sister plant at Dunbar based on conventional mass burn technology has reported a more straightforward construction[17]. Four waste wood gasification facilities developed by CoGen (and various partners) are currently operational, which are at a smaller scale than the proposed EfW: Welland Bio Power; Ince Bio Power; Birmingham Bio Power; and Dartmoor Bio Power[18]. CoGen's Hooton Bio Power facility, which is the largest of their facilities at 270,000 tpa of MSW is currently under construction by EPC contractor BWSC. A FB gasification facility with RDF feedstock of smaller scale to the facility (100ktpa throughput), Levenseat Renewable Energy (LREL) in Scotland, was undergoing operational takeover in 2020[19] but no subsequent information has been found regarding operation of the facility and so conclusions on the operational performance of this combination of technology choices cannot be drawn.

2.2.27 Overall, while showing some recent success in certain cases, the technology remains in its infancy with few successful facilities of similar scale to that proposed. So far, no municipal waste gasification plant in the UK has achieved financial takeover, which introduces an issue of commercial viability as gasification projects are experiencing difficulties in securing financing.

Option 4: Pyrolysis

2.2.28 Pyrolysis is the thermal degradation of a substance in the absence of added oxygen. Like gasification, pyrolysis also offers the potential option of more innovative use of the pyrolysis syngas other than immediate combustion to produce heat. The process requires energy input from a combination of waste heat from the process and supplementary combustion, likely to be using either natural gas or low sulphur oil, to achieve the temperature required for thermal treatment.

2.2.29 Typical temperatures for pyrolysis are between 300-800°C[20].

2.2.30 At the scale being considered, similar to gasification combustion of the fuels will be subject to the requirements of the IED and BATC. These emissions will require treatment, generally using similar abatement to that applied to conventional plant to ensure compliance with emission limits.

2.2.31 Solid residues from pyrolysis plant have a high carbon content. Unlike combustion bottom ash or the residue from some gasification plant, this material will require landfilling or further treatment. Residues from flue gas cleaning would require disposal to hazardous landfill.

2.2.32 There is limited experience of the application of pyrolysis technology for the treatment of MSW or RDF, its presence in the market is not well established and its commercial application is limited. A 2015 review of activity in the UK shows continued interest in research and pilot trials for some specific material streams, but no commercial scale or general MSW/RDF treatment facilities in the

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[15] Troubled Gasification Plant to Stay Closed Until 2018, Resource [online], available: https://resource.co/article/troubled-gasification-plant-stay-closed-until-2018-11585

[16] ENDS Report (2021): Waste throughput at EfW plant raised, despite fly infestation objections [online], available: https://www.endsreport.com/article/1726086/waste-throughput-efw-plant-raised-despite-fly-infestation-objections

[17] https://www.endswasteandbioenergy.com/article/1451649/pennon-gives-efw-facilities-update

[18] Cogen UK, Projects [online]. https://www.cogenuk.com/projects

[19] Levenseat Renewable Energy (2018): Commissioning Update: Levenseat Renewable Energy's Power Plant enters Hot Commissioning [online], available: https://levenseat.co.uk/update-power-plant-commissioning/

[20] The Viability of Advanced Thermal Treatment of Municipal Solid Waste in the UK, March 2004, Fitchner Consulting Engineers Limited

UK[21]. It therefore cannot be considered to be fully proven at the current time and particularly not at the scale proposed for the EfW.

Other

2.2.33 In addition to the four technologies outlined above, which are subject to further discussion in the remainder of this section, three further alternatives are considered in brief below.

Option 5: Plasma Arc Gasification

2.2.34 Plasma arc gasification technology transforms waste streams into synthesis gas and a vitrified slag by means of thermal plasma. The plasma (also known as the fourth state of matter) is a mixture of electrons, ions and neutral particles (atoms and molecules).

2.2.35 Plasma technology has been reported by some as achieving a greater level of environmental performance in terms of emissions and residues. To date the process has been used mainly to treat hazardous wastes including organics, metals, polychlorinated biphenyls (PCBs) (including small-scale equipment) and hexachlorobenzene (HCB).

2.2.36 Plasma Arc technology produces very high temperatures (5,000 to 15,000 °C) It involves heating up the syngas after gasification has taken place. Under these conditions, hazardous contaminants, such as tars, PAHs, PCBs, dioxins, furans, pesticides, etc, are broken into their atomic constituents.

2.2.37 The high temperature and oxygen starved environment is used to decompose the feed material into simple molecules as CO, CO_2, H_2, CH_4, etc., and also ash and slag.

2.2.38 Whilst plasma arc gasification is an established technology at small scale for some materials, the process can be very complex, expensive and operator intensive. There would be significant challenge in achieving the very high temperature throughout a solid waste mass at large scale and this is a practical constraint for scaling the application. Plans by Air Products to develop two major plasma arc gasification plants in Teesside eventually failed in 2016[22]. Advanced Plasma Power has reported success with a pilot-scale plant treating MSW to produce biogas[23], albeit at a fairly small 1,000 tpa scale. Following the success of this small pilot plant, a larger 10,000 tpa BioSNG pilot plant was constructed and set to start operating in 2018[24], however no information on its operational performance could be found.

2.2.39 Plasma arc gasification is therefore not considered proven or viable at the scale of the proposed EfW and is therefore discounted from further consideration.

Option 6: Biological Treatment (Anaerobic Digestion)

2.2.40 Anaerobic digestion (AD) involves biological decomposition of waste in air-tight containers to produce a methane-rich biogas. The process requires the control of temperature, pH and moisture to optimise microbe activity and thereby the gas production. Normally, the gas is collected and combusted with energy recovered in the form of heat or electricity. Source separated waste is

[21] Bridgewater, T. and Watkinson, I. (2015): Biomass and Waste Pyrolysis, A Guide to UK Capabilities. Aston University European Bioenergy Research Institute (EBRI). [online], available: http://www.pyne.co.uk/Resources/user/UK%20Biomass%20and%20Waste%20Pyrolysis%20Guide%202015%20081015.pdf

[22] https://waste-management-world.com/a/air-products-to-ditch-plasma-gasification-waste-to-energy-plants-in-teesside

[23] Green gas trial hailed a success as preparations gear up for commercial operations [online] available at: http://blog.advancedplasmapower.com/latest-news/green-gas-trial-hailed-success-preparations-gear-commercial-operations

[24] https://www.theccc.org.uk/wp-content/uploads/2018/12/Biomass-response-to-Call-for-Evidence-Advanced-Plasma-Power.pdf

essential if the solid residue (the digestate) is to have value in agricultural or horticultural application as opposed to disposal in landfill sites.

2.2.41 The incoming waste is screened and then mixed with previously digested material to achieve the correct consistency. This mixture is then pumped into the air-tight digester vessel where it is held for 2-3 weeks. Inside the digester the material is mixed and biogas formed, taken off and burnt for energy (typical methane content 55-65%). The solid waste digestate is extracted, de-watered and disposed of. Control of temperature is very important in the formation of the biogas. Temperatures must be maintained above 30°C for the gas production to occur at reasonable levels. The use of higher temperature systems is possible and increases the production of biogas, however, the process is faster and requires additional energy input.

2.2.42 Further, an AD solution would only be suited to the biodegradable fraction of the proposed waste streams requiring either further processing on site or securing an alternative feed material. On this basis an AD solution has been rejected.

Option 7: Landfill

2.2.43 Whilst landfill would be an alternative option for the proposed waste, landfill presents a number of environmental issues and for some time has been recognised as an unsustainable option for waste management. Consequently, landfill has been discounted as an alternative to the proposed EfW.

Assessment of Technology Options

2.2.44 Based on the above overview, this section provides further discussion of the issues and impacts associated with moving grate; fluidised bed; gasification and pyrolysis techniques and describes the basis for concluding that moving grate represents BAT for this facility.

Emissions

2.2.45 All facilities based on combustion, gasification or pyrolysis technologies where they burn waste materials will be required to comply with the BAT conclusions and, where these aren't applicable, IED. Most technology providers will only provide IED and/or BAT conclusions limit guarantees and will include similar abatement for all technology options to ensure that these levels are met. On this basis, guaranteed emissions performance is considered similar for all options.

2.2.46 Flue gases from all of the options considered (including gasification and pyrolysis) will include trace levels of oxides of nitrogen, acid gases (sulphur oxides, hydrogen chloride, hydrogen fluoride), heavy metals and dioxin and furans.

2.2.47 However, in practice, different unabated emissions performance is achieved by the various technologies[18].

2.2.48 Fluidised bed technology is capable of lower NOx emissions and is capable of achieving levels below IED limits for NOx without abatement, although in practice abatement for NOx would be provided to guarantee compliance. Abated NOx emissions would be expected to be dependent on the selected abatement technology and ultimately would be expected to be similar to that achieved for a moving grate system using the same abatement, although noting that lower reagent consumption would be likely. For other pollutants, emissions performance would be similar to moving grate. Lower NOx levels are reported for some technologies which have the ability to meet IED limits using primary control methods only (i.e. without abatement).

2.2.49 Reported emissions for gasification and pyrolysis are generally accepted to be based on limited data. As a result, reported performance differs. A report from DEFRA indicates that pyrolysis and gasification plant generally achieve lower emissions of pollutants that conventional incineration, (following abatement) to those for moving grate systems[25]. Other reference documents indicate the potential for improved performance including heavy metals and dioxins and furans, albeit at the expense of increased levels of these pollutants in residues[26].

Global Warming Potential

2.2.50 The global warming potential (GWP) is calculated by assessing all direct releases of greenhouse gases from the process (including the main process, associated abatement and energy related emissions) and indirect emissions of greenhouse gases from the primary source of heat or power imported for use in the process.

2.2.51 The purpose of all combustion processes is to fully oxidise a waste material and in an energy recovery process to use the heat energy released through the exothermic reaction of carbon (and hydrogen) with oxygen within a downstream energy conversion stage.

2.2.52 The quantity of CO_2 released from the combustion of the waste material, either directly or indirectly, will be fixed and the plant will not be able to control it. The same carbon in ash requirement applies for gasification and pyrolysis processes subject to the IED and BATC. The products of gasification/pyrolysis processes (a combination of syngas, liquid fuel and solid residue) will contain the chemical energy associated with the same carbon input stream and will be converted by oxidation to CO_2 assuming these are combusted.

2.2.53 It can be noted from the above that the chemistry of the combustion process would be similar for each of the thermal treatment options considered, although the reactions might be optimised under differing conditions, giving rise to the same overall emission of CO_2 associated with a given waste feed material.

2.2.54 In this context, it is necessary to consider the efficiencies related to converting combusted/combustible gases resulting from a process to heat and power, the requirement for supplementary combustion of fuel to maintain the thermal treatment process and those measures to maximise internal energy efficiency of the plant itself (including the 'parasitic' load required to drive supporting equipment and plant).

Energy Conversion Efficiencies

2.2.55 The post combustion energy conversion technology for moving grate and fluidised bed will consist of recovering the energy from the hot combustion gases using a steam turbine unit to generate power, with the option of using a combined heat and power (CHP) unit to generate heat and power simultaneously if needed. In principle, this is independent of the primary combustion process and so it could be considered that the efficiency of this aspect of the EfW should not give rise to any difference between the technologies with respect to overall energy efficiency.

2.2.56 Fuels produced from gasification and pyrolysis (Options 3 and 4) might provide a more flexible option i.e. if treated/refined to an appropriate specification it could be used on site or piped/transported off-site, although in this case, the fuels would need to be used onsite. The fuel is typically either burned in a boiler to raise steam and electricity, with a lower overall efficiency than an EfW facility, or used as a fuel in an engine or turbine. A summary of energy transfers from each process is given in Table 2-1.

[25] Advanced Thermal Treatment of Municipal Solid Waste, DEFRA, 2013.

[26] The Viability of Advanced Thermal Treatment of Municipal Solid Waste in the UK, March 2004, Fitchner Consulting Engineers Limited

Table 2-1: Summary of Technologies and Potential Energy Transfers

Thermal Treatment Process	Output	Transfer of Energy
Conventional thermal treatment (moving grate and fluidised bed)	Hot flue gases	Pass hot gases through a boiler to produce hot water or steam. Steam is used in a turbo-generator to generate electricity. Where steam or hot water are raised for use in an industrial process, efficiency of electrical power generation is reduced but overall energy efficiency can be significantly improved depending on the demand.
Pyrolysis	Syngas Char Bio-oil	Use in steam boiler to drive a steam turbo-generator. Use pyrolysis oil as an engine fuel.
Gasification	Syngas Char	Use in steam boiler to generate process steam only Use as a fuel in a steam turbo-generator Use in a stationary gas engine/turbine to generate electricity at approximately 40% electrical energy conversion efficiency.

Note: Modified from SLR report (2008)[27].

2.2.57 Data for the gross efficiency of ATT technologies using MSW are not available in the public domain on a comparable basis with conventional incineration techniques, due to the limited number of operational plants. Differences in the quoted gross efficiencies of ATT technologies and incineration can arise due to a number of factors, which include:

- differences in the assumed CV of the feedstock (which does not apply in this case);
- net power or gross power output (depending on technique used for conversion);
- whether the parasitic load includes any power consumed in the preparation of the feedstock (which does not apply in this case); and
- size of the steam/gas turbine, which influences conversion efficiencies.

2.2.58 A desire to maximise the efficiency of the conversion process is recognised for any thermal treatment technology. The overall efficiency will be dependent on the efficiencies of the steam turbine and heat exchange/boiler design. The principal difference between the overall energy efficiency of each conventional thermal treatment technology option (i.e. fluidised bed or moving grate) is likely to arise from the parasitic load, although there would be only minor variation in parasitic load (relating to internal material flow transfer, pre-treatment and flue gas treatment).

2.2.59 Each stage of the conversion process combustion/gasification/pyrolysis, energy recovery and secondary energy conversion technologies will reduce the overall conversion efficiency and will have space and layout implications. Specifically, the syngas cleaning stage can affect the overall efficiency of the plant and normally requires cooling of the gas, resulting in the loss of sensible heat from the syngas that cannot be fully recovered.

Indirect Energy

2.2.60 Energy requirements related to the indirect energy input (i.e. fuel for auxiliary/support burners) would be similar for conventional thermal treatment options and therefore a similar quantity of CO_2 would be produced from each option. Unlike gasification or conventional combustion technologies, pyrolysis also requires supplementary combustion to achieve the temperature required for thermal treatment that is likely to be provided by either natural gas or low sulphur oil.

[27] Costs of incineration and non-incineration energy from waste technologies, January 2008, SLR Consulting Limited

Plant Energy Requirements

2.2.61 General energy efficiency techniques for the proposed EfW were considered in Section 2.3 of the main application document. This includes operational, maintenance and housekeeping energy efficiency measures. There is nothing to prevent similar techniques for energy efficiency being applied to any of the four options remaining under consideration. Varying degrees of waste pre-treatment, with associated energy demands, are required for fluidised bed, gasification and pyrolysis technologies. For the proposed EfW, some wastes will be processed using the on-site mechanical pre-treatment but the proposals also include for material to be accepted directly into the EfW.

Residue Generation

2.2.62 The residues generated by moving grate systems are either similar or lower in quantity compared to the alternatives, and compared to those for ATT there is the potential for lower hazards associated with the residues due to lower heavy metals, dioxins and furans[28].

2.2.63 Although moving grate and fluidised bed systems generate similar overall quantities of residues, greater volumes of hazardous waste (APC residues) would be generated from a fluidised bed plant compared to a moving grate plant.

Odour

2.2.64 For all options, odour management is capable of ensuring that odour nuisance is not an issue and therefore for the same waste effects are considered similar.

Raw Materials

2.2.65 Raw material usage of moving grate systems is lower than that required for fluidised bed systems primarily as a result of the requirement for fluidisation sand. ATT options require similar air pollution abatement systems and therefore similar raw materials.

2.2.66 There is the potential for variable usage of raw materials, depending on the raw gas concentrations of pollutants. Given that moving grate systems can present higher raw gas NOx concentrations, the alternatives offer lower reagent usage.

2.2.67 Pyrolysis systems require the addition of supplementary fuel to maintain the treatment process. Whilst all systems will require the use of supplementary fuels during certain operational conditions e.g. start-up/shutdown or occasionally to maintain minimum IED temperatures, their consumption would be much lower than that for pyrolysis.

Noise and Vibration

2.2.68 Noise and vibration emissions from all options are considered similar.

Accidents

2.2.69 All options will handle similar raw materials and reagents and therefore each present similar chemical hazards. ATT systems producing gaseous fuels introduce additional fuel handling hazards.

[28] Advanced Thermal Treatment of Municipal Solid Waste, DEFRA, 2013.

Costs

2.2.70 Reliable data concerning costs for each of the Options is very difficult to obtain – a fact that has been recognised in published reviews. In many instances cost data is only based on estimates and has not been tested commercially at a comparable scale.

2.2.71 In addition to the type of plant proposed, the supply contract type can also have cost implications. For example, a turnkey contract can often attract much higher contract costs compared to a supply and install only contract. Notwithstanding that, it is generally recognised that moving grate represents the most cost-effective option.

2.2.72 For the advanced thermal treatment options, as already recognised, estimated costs are highly variable and range from lower than moving grate to significantly higher, but with a general consensus that the costs would be higher.

Conclusions

2.2.73 The various options for thermal treatment of the proposed combination of waste materials have relative benefits and disadvantages. All four options are capable, subject to appropriate abatement measures being taken, of performing within IED and BATC emissions limits. Whilst moving grate systems generate higher raw gas pollutant concentrations, the application of abatement, which is still required for all options, enables compliance with IED and BATC limits and in many instances performance well below these levels.

2.2.74 The performance of the various options in terms of carbon dioxide releases is recognised as being dependant on the carbon within the waste material which the thermal treatment technology seeks to optimise in the energy conversion process. For the waste materials to be accepted at the EfW, carbon dioxide releases associated with the combustion of the waste material will therefore be limited by the throughput capacity.

2.2.75 Whilst this addresses the potential for carbon dioxide releases directly associated with the waste material, the potential releases of carbon dioxide associated with: the efficiencies of techniques for converting combusted/combustible gases resulting from the process to heat and power; the requirement for supplementary combustion of fuel to maintain the thermal treatment process; and measures to maximise internal energy efficiency of the plant itself (including the ‘parasitic’ load required to drive supporting equipment and plant) are also considered relevant.

2.2.76 The discussions above illustrate that, compared with the other options considered, moving grate systems have similar or improved performance in all three areas.

2.2.77 Moving grate has either a similar or an improved performance compared to the other options in relation to electrical efficiency, residue generation, odour, raw material consumption, noise and potential for accidents.

2.2.78 In this context and alongside in particular the fact that its reliability at a commercial scale is proven and that it provides a cost-effective option, moving grate has been selected as the thermal treatment technology and is considered BAT for the proposed EfW on this basis.

2.3 NOx Abatement Selection

2.3.1 Within the EA Sector Guidance for this sector, there is a requirement for undertaking a site-specific appraisal of the selected abatement plant for NOx control. The following options for NOx abatement have been considered as part of the assessment:

Option 1: Moving grate with Selective Non-Catalytic Reduction (SNCR);

Option 2: Moving grate with Selective Catalytic Reduction (SCR);

2.3.2 For both options, it is assumed that the same primary measures for minimising the formation of NOx are in place (see section 4.1 of the main application document for details).

2.3.3 In terms of comparing the environmental impacts of SNCR and SCR, the key issues are emissions to air, global warming potential and ozone creation potential (associated with energy use and emissions of NOx). Waste production and raw materials usage are also considered relevant issues for comparing the NOx abatement options in terms of their impact on the environment. As both options have been assessed using the same dosing reagent, ammonium hydroxide, the accident risks are considered similar and therefore have not been assessed. Noise and odour potential are also considered similar for both options and therefore are not considered within this assessment.

Flue Gas Recirculation (FGR)

2.3.4 FGR is reported as providing a two-fold benefit:

- Reduced NOx levels.
- Increased energy efficiency.

2.3.5 FGR is often selected where the oxygen content in the flue gases is to be reduced and/or improved mixing of the flue gas in the first boiler pass is required. The recirculated flue gases have a lower oxygen content and when mixed with fresh secondary air the combined larger volume promotes mixing. In practice, good mixing is achieved through appropriate design of the secondary air injection process.

2.3.6 However, despite the reported benefits most energy from waste facilities operate without FGR, and in a number of cases have been reported to retrospectively remove the FGR.

2.3.7 Although FGR can reduce NOx levels, it would still require additional abatement to be installed to achieve the emissions level required by the IED. If the take-off point for the FGR system is installed after the APC plant the ducting will need to be installed with electrical trace heating and would outweigh any energy efficiency benefits in terms of secondary air savings. The requirement for electrical trace heating is primarily to prevent condensation of flue gas constituents in the duct.

2.3.8 The alternative of installing the FGR off-take direct from the boiler is reported as introducing corrosion problems as a result of dew point corrosion due to sulphur oxides in the recirculation ducting and abrasion problems due to the fly ash particles and lower oxygen level in the recirculated gas. The main cause of corrosion in FGR is low O_2 levels of around 6% and below. In practice this leads to operational problems typically requiring replacement of ducting and blower blades after a relatively short time.

2.3.9 Some grate suppliers design their combustion systems to operate with FGR while others reduce NOx through the control of primary and secondary air and the grate design. FGR will not be included at the site.

Air Quality Impacts of NOx Emissions

2.3.10 Table 2-2 provides the long-term emission concentrations used in this assessment. Estimated long-term emission concentrations for SNCR are based on the EA BAT limit for nitrogen dioxide (NO_2), waste incineration BREF level for nitrous oxide (N_2O) and BAT conclusions limit for ammonia[29]. For SCR the long-term concentration for NO_2 is based on a realistic long-term performance concentration whilst that for ammonia (NH_3) is based on BAT conclusions limit.

2.3.11 Short-term emissions performance for both options would be compliance with IED limits for NO_2). As the short-term emission levels used are the same for SNCR and SCR, only long-term concentrations are compared in the table below. Whilst emissions performance data for N_2O is

[29] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D2010&from=EN

provided, N_2O is not an air quality pollutant but does contribute to global warming which is discussed later in this section.

2.3.12 Given the purpose of this assessment is to provide an assessment of the relative performance of the options, the various options have not been modelled and the comparison is made using the H1 default software values which provides a consistent approach for both options. However, it should be noted that for the selected option (option 1) the values given may differ from those reported within other reports supporting this application which are based on dispersion modelling.

Table 2-2. Summary of Air Quality Performance Associated with NOx Abatement

Option	1 SNCR	2 SCR
	Achievable emissions concentrations (in mg/Nm^3) long-term[(1)]	
Nitrogen Dioxide	100	80
Nitrous Oxide	10	0
NH_3	10	10
	Long-term % Process Contribution (PC)/Environmental Assessment Level (EAL)	
%PC/EAL NO_2	14.6	11.7
%PC/EAL NH_3	0.33	0.33
	Long-term % Predicted Environmental Concentration (PEC)/Environmental Assessment Level (EAL)	
%PEC/EAL NO_2	60.6	57.7

Note: PC for N_2O has not been calculated as there is no EAL for N_2O.

2.3.13 In terms of NO_2 performance SCR can achieve lower emission concentrations in the flue gases than SNCR and consequently lower process contributions and predicted environmental concentrations are achieved, albeit not substantially lower.

2.3.14 Deposition of NOx for both options exceeds the insignificance criteria. However, the air quality assessment within Appendix E which includes an assessment of deposition demonstrates that no significant impacts are predicted using SNCR and consequently SCR would similarly not be expected to give rise to significant impacts from deposition.

2.3.15 SCR and SNCR have a similar performance in terms of ammonia releases. The process contributions with the long-term PC for SCR is the same for both options at 0.58 mg/m^3. The short-term PC for SCR and SNCR 31.8 µg/m^3. The long-term PCs for ammonia for both options screen out at less than 1% or 10% respectively of the relevant EAL.

Photochemical Ozone Creation Potential (POCP)

2.3.16 Releases of nitrogen dioxide contributes to ozone creation. The POCP performance is dependent on the NO_2 emissions with SCR achieving a lower POCP than SNCR at approximately 408 compared to approximately 510 respectively.

Global Warming Potential

2.3.17 Global warming potential (GWP) has been considered through the discharge of nitrous oxides and carbon dioxide releases associated with the additional energy requirements to operate the abatement plant.

2.3.18 The energy requirements to operate an SCR system are higher than those for SNCR due to the requirement to reheat the flue gases to between 300-400°C (the range at which the catalytic process operates). SNCR does not require any reheating and therefore energy input is only required to operate associated plant.

2.3.19 The GWP of the two options considered is summarised in Table 2-3 below.

Table 2-3. Summary of GWP Performance

Option	1 SNCR	2 SCR
Global Warming Potential	8,705	11,127

Raw Materials

2.3.20 Both SNCR and SCR require the injection of a reducing reagent (ammonium hydroxide is proposed for this assessment). In addition, SCR requires a catalyst which periodically needs replacing. Annual consumption of raw materials is overall similar, SNCR would require marginally more ammonia but SCR requires a catalyst.

Waste

2.3.21 SNCR produces no wastes requiring disposal whilst SCR uses a catalyst. The catalyst will require periodic disposal, with spent catalyst needing to be replaced approximately every 5 years. This averages out to an annual waste disposal of approximately 45 tpa for the system. The spent catalyst is classified as a hazardous waste and cannot be treated and recovered, therefore the material will require disposal at a hazardous waste landfill.

Summary of environmental performance

2.3.22 To establish BAT for the proposed EfW, the performance of each of the potential options needs to be considered for each of the relevant environmental areas considered. To summarise the assessment above, the performance of SNCR and SCR for each of the relevant issues identified in paragraph 6.4.4 are ranked in Table 2-4 below.

Table 2-4. Summary Ranking

Option	Ranking	
	1	2
	SNCR	SCR
Performance Ranking		
NOx performance	2	1
Ammonia Performance	1	1
GWP performance	1	2
POCP performance	2	1
Sub total	*6*	*5*
Raw Material Consumption: Ammonium hydroxide & Catalyst (SCR only)	1	2
Waste	1	2
Sub total	*2*	*4*
Environmental Performance Total	**8**	**9**

2.3.23 From the table above the overall environmental performance of the SNCR option is marginally better than that for SCR and performance wise it is a trade-off between the marginally better NOx performance of SCR compared to SNCRs lower energy requirements, raw material consumption and waste generation, Although the environmental performance of SNCR is marginally better than that for SCR, it is also worth noting that capital costs for SCR are significantly higher and operating costs marginally higher than for SNCR, see Table 2-5. below.

Table 2-5. Comparison of Costs

Option	Total Capex	Total Opex per annum	Ranking
1	£635,900	£1,252,872	1
2	£ 4,843,900	£1,639,649	2

Summary of NOx Appraisal

2.3.24 The NOx performance of the proposed system SNCR is good, achieving levels well below the IED limits and in accordance with BAT Conclusion BAT AELs. Overall it is concluded that Option 1 is BAT for this installation.

2.4 Acid Gas Abatement Selection

2.4.1 Similar to NOx abatement, the EA sector guidance note requires an options appraisal to be provided for the selected acid gas abatement. The following options have been considered for the proposed EfW:

- Option 1: Dry system;
- Option 2: Semi-dry system; and
- Option 3: Wet scrubber.

2.4.2 The plant has no process emissions to water. A wet system (Option 3), would introduce a process discharge to water. For this reason the wet system has not been considered further in this options appraisal.

2.4.3 For both options, it is assumed that the same primary measures for minimising the formation of acid gases are in place (see section 4.1 of the main application document for details). These options are assessed using the H1 Software tool, full details of this assessment are provided in Appendix H.1.

2.4.4 The options considered for control of acid gases have been assessed on the basis of the following environmental criteria:

- air quality impacts;
- photochemical ozone creation potential (POCP);
- global warming potential (GWP);
- raw material consumption; and
- waste hazard.

2.4.5 Both options are considered to present similar odour, noise, accident hazard and visible plume potential. No releases to water are generated from the dry and semi dry abatement options considered. Consideration of these environmental effects has therefore been excluded from this assessment.

Air Quality Impacts

Table 2-6 provides the long term emission concentrations used in this assessment. Both options would be designed and operated to achieve based on BAT Conclusions limits and therefore the emissions performance of each option would be similar..

Table 2-6. Summary of Air Quality Performance Associated with Releases of Acid Gas Emissions

Option	1	2
	Dry	Semi-dry
Achievable emissions concentrations (in mg/Nm^3)		
SO_2	30	30
HCl	6	6
HF	1	1
Long term % Process Contribution (PC)/Environmental Assessment Level (EAL)		
%PC/EAL SO_2	8.76	8.76
%PC/EAL HCl	-	-
%PC/EAL HF	0.49	0.49
Long-term % Predicted Environmental Concentration (PEC)/Environmental Assessment Level (EAL)		
%PEC/EAL SO_2	19.8	19.8

2.4.6 Given the emissions performance is the same for both options the process contributions for both options are similar. The PC for HF predicted by H1 screens out as insignificant for both options. The PEC for SO_2 and HCl is considered and again screen out for both options. The H1 assessment would therefore conclude that air quality effects from either option would therefore be considered acceptable.

Photochemical Ozone Creation Potential

2.4.7 Emissions of sulphur dioxide to air are also considered under photochemical ozone creation potential (POCP). The POCP for both options is circa 262.

Global Warming Potential

2.4.8 In this assessment for acid gas abatement, global warming potential (GWP) is considered through the energy requirements associated with the selected abatement plant options (in terms of CO_2). Table 2-7 below summarises the GWP for each of the options.

2.4.9 Energy consumption for the semi dry system (option 2) is based on the upper end of the range provided in the Waste Incineration BREF and attributes the energy demand to the pressure drop across the bag filter due to build-up of residues associated with the acid gas abatement. No similar figure is provided in the BREF for a dry system, albeit the BREF notes that energy requirements for the dry system would also be due to the pressure drop across the bag filter. On this basis a similar energy demand is assumed for the dry system.

Table 2-7. Summary of GWP Performance

Option	1	2
	Dry	Semi-dry
GWP	9,288	9,288

2.4.10 Based on the above the GWP performance of both options is similar.

Raw Materials

2.4.11 Both options require the injection of reagent (hydrated lime), whilst a semi-dry system also utilises water. Table 2-8 below summarises the raw material consumption for each of the options.

Table 2-8. Summary of Raw Material Consumption

Option	1	2
	Dry	Semi-dry
Hydrated lime (tpa)	8,935	4,3,520
Water (tpa)	-	107,222

2.4.12 Option 1 consumes more hydrated lime than Option 2, whilst Option 2 has an additional water demand.

Waste

2.4.13 Both options generate waste streams for disposal as a result of excess reagent and reaction products. Residue consumption for both options is based on the upper end of the BREF consumption.

2.4.14 Residues from both options would be hazardous in nature and the disposal route would be the same, for the purpose of this assessment this has been assumed to landfill. Option 1 gives rise to a lower waste hazard and disposal score than option 2, with impact scores of 2,680,500 for option 1 and 5,361,000 for option 2. The assessment has assumed that both options would include control of reagent dosing to minimise wastage.

Summary of environmental performance

2.4.15 To establish BAT for the proposed EfW the environmental performance of each of the potential options needs to be considered for each of the relevant environmental areas considered. To summarise the assessment above, the performance of each abatement option for each relevant issue are ranked in Table 2-9.

Table 2-9. Summary Ranking for Acid Gas Options

	Ranking	
	Dry (Option 1)	Semi-dry (Option 2)
Emissions to Air		
SO_2	1	1
HCl	1	1
HF	1	1
GWP performance	1	1
POCP performance	1	1
Sub total	5	*5*
Raw material usage	1	2
Waste hazard	1	2
Sub total	*2*	*4*
Environmental Performance Total	**7**	**9**

Options 1 and 2 perform equally well for key parameters. However, for raw materials usage Option 1 has much higher reagent usage but does not require water and produces less waste than Option 2. Whilst Option 1 overall score higher than Option 2 the differences in environmental performance are considered marginal.

Summary of Acid Gas Appraisal

2.4.16 The assessment of acid gas abatement has considered the environmental performance of the options.

2.4.17 At this stage a decision on the selected acid gas abatement has not been made but based on the above assessment either option could be considered as BAT in relation to overall environmental performance. It should be noted that there are many examples of EfW plants effectively controlling acid gas emissions using these options demonstrating that either option can perform well. Following the detailed design stage the selected acid gas system will be confirmed and details will be provided to the Environment Agency.

2.5 Dioxin and Furan Abatement Selection

2.5.1 Activated carbon has been selected for control of dioxins and furans, combined with the primary measures detailed within section 3.2 of the main application document. Dioxins and furans can also be controlled by the use of catalytic abatement systems. These have the advantage of destroying the dioxins and furans rather than removal and transfer into the APC residues. However, activated carbon also controls mercury emissions whilst catalytic systems do not and therefore activated carbon would also be required.

2.5.2 Given that activated carbon is effective for the removal of all three pollutants, this is considered to represent BAT and has been selected for the proposed EfW.

2.6 Control of Particulates

2.6.1 There are a range of options available for particulate control including:

- Fabric Filters;
- Ceramic Filters;
- Electro-static Precipitators (ESPs); and
- Wet Scrubbers.

2.6.2 Wet scrubbers and ESPs are not considered to represent BAT on their own as they cannot achieve the emission level performance of other techniques. Ceramic filters can achieve high removal efficiencies of particulates, but applications have generally been limited to small scale uses operating at high temperatures. They are also more susceptible to mechanical failures and blinding than fabric filters.

2.6.3 Fabric filters provide reliable abatement of particulates and are generally accepted as BAT for particulate control. The bag filter system will include multiple compartments which permit isolation of a compartment in the event of bag failure (see section 4.1 of the main application document for further information). The use of trends in particulate emissions and pressure drop measurement will provide a reliable system for detecting bag filter failures and allows investigation to identify and isolate the failed compartment. The proposed system for particulate control at the EfW is therefore considered to be BAT.

3 BAT CONCLUSIONS ASSESSMENT

3.1 Waste Incineration BAT Conclusions 2019

3.1.1 The responses to the relevant waste incineration BAT conclusions for the EfW activity to be undertaken at the Corby EfW site are set out in the tables below.

General BAT conclusions:

Environmental Management Systems

BAT 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates a list of features (as identified in the BAT Conclusions document).
Response/evidence	Encyclis will implement an environmental management system (EMS) in accordance with ISO14001. The EMS will include standard operating procedures and safe working practices that minimise the environmental risks and impacts of the normal operations and include contingency plans to minimise the effect of breakdown, accidents etc. These will include procedures relating to other than normal operating conditions (OTNOC), waste stream management and environmental monitoring. The IMS will include the following sections/procedures: • IMS Policy Manual • Environmental Policy • Operations and Maintenance • Environmental Aspects • Objective and Performance Indicators • Accident Investigation & Reporting Procedure • Legal and Other Requirements • Complaints Procedure • Site Inspection, Audit and Reporting Procedure • Emergency Preparedness and Response Protocols • Energy from Waste Plants Safety • Process Safety Management • Managing Non-Conformance, Corrective & Preventive Action Procedure • Training, Awareness & Competence Procedure • Maintenance Programmes • OTNOC Management Plan • Environmental Monitoring and Measurement • Residues Management Plan

	• Site Closure Plan The EMS will be in place prior to the EfW coming into operation.
Monitoring	
BAT 2	**BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.**
Response/evidence	The EfW gross electrical efficiency will be determined by carrying out a performance test at full load during the commissioning stage. The expected efficiencies and associated management have been set out in Section 2.4 of the main application document and in the Energy Balance provided as Drawing 5 of the main application. Details of this testing will be incorporated within the commissioning plan.
BAT 3	**BAT is to monitor key process parameters relevant for emissions to air and water**
Response/evidence	As set out in Table 4.3 of the main application document, continuous measurement of the following process parameters will be carried out within the EfW, in accordance with BAT 3: • Flow, oxygen content, temperature, pressure and water vapour content of flue gas • Temperature of the combustion chamber Monitoring of flow, pH and temperature of wastewater from wet flue gas cleaning is not applicable as wet flue gas cleaning will not be carried out. Monitoring of flow, pH and conductivity of wastewater is also not applicable as there will be no treatment of bottom ash.
BAT 4	**BAT is to monitor channelled emissions to air with at least the frequency given 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.**
Response/evidence	Table 4.1 of the main application document sets out the proposed monitoring to be undertaken in relation to emissions to air from the EfW as well as the monitoring standards to be used for each pollutant. These comply with the relevant standards and frequencies for each pollutant as set out in BAT 4. Continuous measurement of the following will be carried out: NOx; NH_3; CO; SO_2; HCl; Dust and TVOC (as TOC). As permitted under Annex VI Part 6, continuous measurement of HF will not be undertaken on the basis that the acid gas abatement system will operate to guarantee that the emission limit for HCl will not be exceeded. Periodic measurement of HF will be carried out at the EfW. Periodic measurement of the following will be undertaken HF, N_2O; Metals and metalloids (including Hg); PCDD/F; Dioxin-like PCBs; and Benzo[α]pyrene. Frequencies are provided in Table 4.1 of the main application document.
BAT 5	**BAT is to appropriately monitor channelled emissions to air from the incineration plant during other than normal operating conditions (OTNOC).** **The monitoring can be carried out by direct emission measurements (e.g. for the pollutants that are monitored continuously) or by monitoring of surrogate parameters if this proves to be of equivalent or better scientific quality than direct emission measurements. Emissions during start-up and shutdown while no waste is being incinerated, including emissions of PCDD/F, are estimated based on measurement campaigns, e.g. every three years, carried out during planned start-up/shutdown operations.**
Response/evidence	Monitoring of emissions to air during OTNOC will be set out in the facility OTNOC plan.

	Direct emission measurements will be used for the pollutants that are monitored continuously. Emissions during start up and shutdown while no waste is being incinerated will be estimated for pollutants monitored periodically based on a calculation informed by measurement campaigns carried out every three years during planned start-up/shutdown operations. The plant will follow established start-up and shutdown procedure.
BAT 6	**BAT is to monitor emissions to water from flue gas cleaning (FGC) with at least the frequency given below 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.**
Response/evidence	Not applicable as there will be no process emissions from flue gas cleaning to water. Process water will be reused in the ash quench.

BAT 7	**BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency given below and in accordance with EN standards.** **Monitoring of the following is required at least once every 3 months:** • **Loss on ignition or total organic carbon**
Response/evidence	As set out in Table 4.2 of the main application document, total organic carbon (TOC) in bottom ash will be monitored quarterly.
BAT 8	**For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.**
Response/evidence	Not applicable as the waste to be incinerated will not be hazardous.
General environmental and combustion performance	
BAT 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) given below, and, where relevant, also techniques (d), (e) and (f).** **a) Determination of the types of waste that can be incinerated** **b) Set-up and implementation of waste characterisation and pre-acceptance procedures** **c) Set-up and implementation of waste acceptance procedures** **d) Set-up and implementation of a waste tracking system and inventory** **e) Waste segregation** **f) Verification of waste compatibility prior to the mixing or blending of hazardous wastes**
Response/evidence	The plant will only accept the waste types set out in the list of EWC codes in the main application document (BAT 9a). An overview of the waste pre-acceptance and acceptance procedures is set out in Section 3.1 of the main application (BAT 9b and 9c). The procedure for tracking waste deliveries is also set out in Section 2.1 (BAT 9d). These procedures will be documented within the site's EMS.

	BAT 9e is not applicable as the waste types that will be accepted to the EfW will have similar properties, so there is no need for segregation into different waste types for easier or safer storage and incineration. Mixing or blending of hazardous wastes will not take place at the site and BAT 9f is therefore also not applicable.
BAT 10	**In order to improve the overall environmental performance of the bottom ash treatment plant, BAT is to include output quality management features in the EMS (see BAT 1).** **Output quality management features are included in the EMS, so as to ensure that the output of the bottom ash treatment is in line with expectations, using existing EN standards where available. This also allows the performance of the bottom ash treatment to be monitored and optimised.**
Response/evidence	Not applicable as there is no bottom ash treatment plant at the site. Bottom ash is sent to a third party bottom ash processing plant for recovery.
BAT 11	**In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9(c)) including, depending on the risk posed by the incoming waste, the elements given below:** **For MSW and other non-hazardous waste:** **— Radioactivity detection** **— Weighing of the waste deliveries** **— Visual inspection** **— Periodic sampling of waste deliveries and analysis of key properties/substances (e.g. calorific value, content of halogens and metals/metalloids). For municipal solid waste, this involves separate unloading.**
Response/evidence	Waste deliveries to the EfW will be weighed at the weighbridge. Visual spot checking of waste deliveries will be carried out during unloading and periodic sampling and analysis will be undertaken. The frequency of sampling will be set out in the waste acceptance procedures to be developed prior to the facility accepting any waste. Hazardous waste such as clinical wastes will not be managed at the site. It is accepted that UK radioactive substances regulation is sufficiently robust so as to minimise the risk of radioactive material inadvertently arriving at the site and therefore radioactivity detection will not be provided.
BAT 12	**In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below.** **a) Impermeable surfaces with an adequate drainage infrastructure** **b) Adequate waste storage capacity**
Response/evidence	The surface of the waste reception, handling and storage areas will be impermeable and fitted with an adequate drainage infrastructure. The integrity of this surface will be checked regularly. The bunker is designed to hold circa 5 days' storage of waste. The maximum waste storage capacity of circa 10,500 m^3 will not be exceeded, taking into account the characteristics of the wastes (e.g. regarding the risk of fire) and the treatment capacity. The quantity of waste stored will be regularly monitored against the maximum allowed storage capacity.
BAT 13	**In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given below.**
Response/evidence	Not applicable as clinical waste will not be accepted.
BAT 14	**In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below.**

	a) Waste blending and mixing **b) Advanced control system** **c) Optimisation of the incineration process** **BAT-associated environmental performance levels for unburnt substances in slags and bottom ashes:** **• TOC = 1-3 dry wt-%** **• LOI = 1-5 dry wt-%** ***either TOC or LOI BAT-AEPL applies.**
Response/evidence	Waste blending and mixing will be carried out in the waste bunker using an overhead crane as described in Section 3 of the main application document (BAT 14a). The advanced control system and how the combustion process, waste feed and furnace design will be optimised are set out in Section 3 of the main application document (BAT 14b and BAT 14c). The continuous emissions monitoring system (CEMS) will feed back to the combustion control system so the combustion conditions will be able to be adjusted as required. The plant will be controlled using a suitably designed distributed control system (DCS) following standard practices for this type of facility. The plant will run in automatic mode with minimal interference required by the operators. Settings which require adjustment will be able to be put into manual although this will only be for short term excursions. Typical process parameters such as pressure, flow, temperature, current etc. are all monitored and the DCS will control the process.. The CEMS will run as a separate system with a duty/standby configuration and will communicate with the DCS. There will also be a separate control system for the turbine which will be delivered as part of the turbine supplier package, this will also communicate with the DCS. There will be a separate safety information system to measure and control the required safety interlocks for the plant and will not be able to be accessed by the operators and only by a trained competent person. TOC will be monitored in accordance with the permit requirements to demonstrate that a TOC of <3% is achieved (see BAT 7 response).
BAT 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 (see description in Section 2.1), as and when needed and practicable, based on the characterisation and control of the waste (see BAT 11).**
Response/evidence	The control system to be installed at the EfW will be designed to control the process to ensure operations meet IED and/or BAT-AEL requirements, minimise emissions that can be influenced by operating conditions on the grate (CO, NOx and VOC), achieve a constant level of steam production and maintain operation within the design envelope. The control system will incorporate a combustion control system, described in further detail in Section 3 of the main application document. The system will be an advanced control system as it will involve the use of a computer-based automatic system to control the combustion efficiency and support the prevention and/or reduction of emissions, including the use of high performance monitoring of operating parameters and of emissions.
BAT 16	**In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.**
Response/evidence	The EfW has been designed and will be operated to ensure that start-up and shutdown operations, including emergency shutdown scenarios are carried out safely and without significant environmental impact. The plant has been designed for continuous operation and is expected to operate for 8,000 hours per year. See Section 3 of the main application document. The procedures for start-up and shutdown will be documented, these procedures will be in place prior to commissioning of the EfW.

BAT 17	**In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability.**
Response/evidence	The flue gas cleaning system will be appropriately designed, operated and maintained in order to reduce emissions to air. Details on the proposed techniques are set out in Section 4.1 of the main application document. Waste acceptance and bunker management will assist with controlling the waste feed to the EfW and assisting in ensuring it is well mixed. The advanced control system will regulate the combustion phase to keep within the design range which seeks to minimise pollutant formation. The flue gas cleaning system will also be monitored and automatically controlled to ensure it is operated within the design range set out by the manufacturer and that it is regularly maintained to ensure optimal availability. No wet flue gas cleaning plant is proposed therefore associated wastewater treatment is not carried out.
BAT 18	**In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the environmental management system (see BAT 1) that includes all of the following elements:** **— identification of potential OTNOC (e.g. failure of equipment critical to the protection of the environment ('critical equipment')), of their root causes and of their potential consequences, and regular review and update of the list of identified OTNOC following the periodic assessment below;** **— appropriate design of critical equipment (e.g. compartmentalisation of the bag filter, techniques to heat up the flue-gas and obviate the need to bypass the bag filter during start-up and shutdown, etc.);** **— set-up and implementation of a preventive maintenance plan for critical equipment (see BAT 1(xii));** **— monitoring and recording of emissions during OTNOC and associated circumstances (see BAT 5);** **— periodic assessment of the emissions occurring during OTNOC (e.g. frequency of events, duration, amount of pollutants emitted) and implementation of corrective actions if necessary.**
Response/evidence	OTNOC management will be included within the OTNOC plan, in conjunction with BAT 1, and will cover the elements set out in BAT 18. Review, updating and auditing of the OTNOC procedures will be in accordance with the requirements of the IMS.
Energy efficiency	
BAT 19	**In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.**
Response/evidence	Energy is recovered from the hot flue gases within the steam boiler. The resulting high-pressure steam is directed to the steam turbine, generating electricity which is exported to the grid. The EfW will be designed to be CHP-Ready (see the CHP-Ready assessment in Appendix G to the main application document), but no heat load has been secured at the time of submitting the permit application.
BAT 20	**In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given below.** **a) Drying of sewage sludge** **b) Reduction of flue-gas flow** **c) Minimisation of heat losses** **d) Optimisation of the boiler design** **e) Low-temperature flue-gas heat exchangers**

	f) High steam conditions **g) Cogeneration** **h) Flue-gas condenser** **i) Dry bottom ash handling** **BAT-AEELs for new plant incinerating MSW:** **• Gross electrical efficiency, 25-35%** **• Gross energy efficiency, 72 – 91%**
Response/evidence	The flue gas flow will be reduced through the design of the primary and secondary air distribution. The volume of both primary and secondary air will be regulated by an automatic combustion control system, as set out in Section 3 of the main application (BAT 20b). Heat losses will be minimised where possible, for example through the use of an integral furnace-boiler and insulation of plant as set out in Section 3 of the main application document (BAT 20c). The boiler design will be optimised, as described in Section 3 of the main application document (BAT 20d). The facility has been designed to be CHP ready, as set out in the CHP-Ready assessment in Appendix G to the main application document (BAT 20g). The EfW will be designed initially for electricity export and has therefore been optimised for this mode of generation. Based on electricity only the overall gross efficiency as established using the explanatory and guidance document on IED-based Waste Incineration BREF and BAT conclusion Annex 4[30] for a condensing turbine is 31.6%.

[30] https://www.cewep.eu/wi-bref-guidance/

Emissions to air

BAT 21	**In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions,** **BAT is to:** **— store solid and bulk pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled subatmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion;** **— store liquid wastes in tanks under appropriate controlled pressure and duct the tank vents to the combustion air feed or to another suitable abatement system;** **— control the risk of odour during complete shutdown periods when no incineration capacity is available, e.g. by:** **+ sending the vented or extracted air to an alternative abatement system, e.g. a wet scrubber, a fixed adsorption bed;** **+ minimising the amount of waste in storage, e.g. by interrupting, reducing or transferring waste deliveries, as a part of waste stream management (see BAT 9);** **+ storing waste in properly sealed bales.**
Response/evidence	The incoming waste will be stored in an enclosed building under controlled subatmospheric pressure and the air from the building is extracted for use as combustion air, as described in Section 3 of the main application document. The control measures for fugitive emissions and odour are set out in sections 4.4 and 4.5 respectively of the main application and an odour management plan is included as Appendix L. As the availability of the facility will be high (8,000 hours per year), normal operations with these systems in operation will be happening most of the time. No liquid wastes will be accepted into the site. In the event of a full plant shutdown, the amount of waste in storage will be minimised by stopping/diverting deliveries and/or having run down waste beforehand (if a planned shutdown), as described in Section 3 of the main application document. In the event of an unplanned shutdown waste will be contained within the bunker and the doors to the waste reception building will be kept shut.
BAT 22	**In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to introduce them into the furnace by direct feeding**
Response/evidence	Not applicable as gaseous and liquid wastes will not be accepted at the EfW.
BAT 23	**In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the environmental management system (see BAT 1) the following diffuse dust emissions management features:** **— identification of the most relevant diffuse dust emission sources (e.g. using EN 15445);** **— definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.**
Response/evidence	Not applicable as there is no bottom ash treatment plant at the site. Bottom ash is sent to a third-party bottom ash processing plant for recovery.

BAT 24	**In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below.**
Response/evidence	Not applicable as there is no bottom ash treatment plant at the site. Bottom ash is sent to a third-party bottom ash processing plant for recovery.
BAT 25	**BAT 25: In order to reduce channelled emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given below.** **a) Bag filter** **b) Electrostatic precipitator** **c) Dry sorbent injection** **d) Wet scrubber** **e) Fixed- or moving-bed adsorption** **BAT-AELs to be complied with are:** **- Dust, <2 – 5 mg/Nm^3, daily average** **- Cd+Tl, 0.005 – 0.02 mg/Nm^3, average over the sampling period** **- Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V, 0.01 -0.3 mg/Nm^3, average over the sampling period**
Response/evidence	A bag filter (BAT 25a) and dry injection of activated carbon (BAT 25c) will be used at the EfW, as described in Section 4.1 of the main application document. The EfW will comply with the BAT-AELs for new plant and will perform at or below the limits set out in Table 4.1 of the main application document under normal operating conditions.
BAT 26	**In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24(f)), BAT is to treat the extracted air with a bag filter (see Section 2.2).**
Response/evidence	Not applicable as there is no bottom ash treatment plant at the site. Bottom ash is sent to a third-party bottom ash processing plant for recovery
BAT 27	**In order to reduce channelled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given below.** **a) Wet scrubber** **b) Semi-wet absorber** **c) Dry sorbent injection** **d) Direct desulphurisation** **e) Boiler sorbent injection**
Response/evidence	Dry or semi-wet injection of hydrated lime (BAT 27c) will be injected (BAT 27e) for reduction of acid gases. The BAT case for this approach has been set out in the options appraisal in Section 2.4 of this document.

BAT 28	**In order to reduce channelled peak emissions of HCl, HF and SO_2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given below.** **a) Optimised and automated reagent dosage** **b) Recirculation of reagents** **BAT-AELs** **• HCl, <2-6 mg/Nm^3, daily average** **• HF, <1 mg/Nm^3, daily average or average over the sampling period** **• SO_2 mg/Nm^3, 5-30, daily average**
Response/evidence	Reagent dosage will be optimised and automated as set out in Sections 2.5 and 4.1 of the main application document (BAT 28a). Dosage rates of hydrated lime will be controlled and monitored to ensure usage is optimised and to avoid overdosage resulting in increased quantities of unreacted material within the APC residues. Dosage will be controlled against raw gas concentrations of SO_2 and HCl. Flow of reagent will be monitored and alarmed to indicate a failure.. The EfW will comply with the BAT-AELs for new plant and will perform at or below the limits set out in Table 4.1 of the main application document under normal operating conditions.
BAT 29	**BAT 29: In order to reduce channelled NO_X emissions to air while limiting the emissions of CO and N_2O from the incineration of waste and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given below.** **a) Optimisation of the incineration process** **b) Flue-gas recirculation** **c) SNCR** **d) SCR** **e) Catalytic filter bags** **f) Optimisation of the SNCR/SCR design and operation** **g) Wet scrubber** **BAT-AELs:** **• NO_x, 50-120 mg/Nm^3, daily average** **• CO, 10-50 mg/Nm^3, daily average** **• NH_3, 2-10 mg/Nm^3, daily average**
Response/evidence	The optimisation of the incineration process is described in Section 3 of the main application document (BAT 29a). Selective non catalytic reduction (SNCR) will be in place for NOx reduction (BAT 29c) as described in Section 4.1 of the main application and the options appraisal in section 2.3 of this document. The location of the SNCR reagent injection points will be optimised during the detailed design stage, during commissioning the reagent injection rate will be optimised, and during operation feedback from the emissions monitoring will be used to continually optimise reagent dosing (BAT 29f). The BAT position on flue gas recirculation is set out in Section 2.3 of this document. The EfW will comply with the BAT-AELs for new plant and will perform at or below the limits set out in Table 4.1 of the main application document under normal operating conditions.

BAT 30	**In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below.** **a) Optimisation of the incineration process** **b) Control of the waste feed** **c) Online and offline boiler cleaning** **d) Rapid flue gas cooling** **e) Dry sorbent injection** **f) Fixed- or moving-bed adsorption** **g) SCR** **h) Catalytic filter bags** **i) Carbon sorbent in a wet scrubber** **BAT-AELs:** • **TVOC, <3-10 mg/Nm^3, daily average** • **PCDD/F, <0.01-0.04 ng I-TEQ/Nm^3 average over the sampling period <0.01-0.06 ng I-TEQ/Nm^3 long-term sampling period** • **PCDD/F + dioxin-like PCBs, <0.01-0.06 ng WHO-TEQ/Nm^3 average over the sampling period <0.01-0.08 ng WHO-TEQ/Nm^3 long-term sampling period** **Either PCDD/F or PCDD/F + dioxin-like PCBs BAT-AEL applies.**
Response/evidence	As set out in the response to BAT 29, the optimisation of the incineration process is described in Section 3 of the main application document (BAT 30a). Both online and offline boiler cleaning will be carried out at the EfW (BAT 30c). Flue gas is cooled rapidly as set out in the description of the boiler design in Section 3 of the main application document (BAT 30d). Dry injection of activated carbon (BAT 30e) will be used at the EfW, as described in Section 4.1 of the main application document. The waste feed is controlled through only accepting permitted waste codes and mixing in the bunker (BAT 30b). The EfW will comply with the BAT-AELs for new plant and will perform at or below the limits set out in Table 4.1 of the main application document under normal operating conditions.
BAT 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 given below.** **a) Wet scrubber (low pH)** **b) Dry sorbent injection** **c) Injection of special, highly reactive activated carbon** **d) Boiler bromine addition** **e) Fixed- or moving-bed adsorption** **BAT-AELs:** • **Hg, <5-20 µg/Nm^3 daily average or average over the sampling period, 1-10 µg/Nm^3 long term sampling period** **Either of the above BAT-AELs applies.**
Response/evidence	Dry sorbent injection of activated carbon (BAT 31b) will be used at the EfW, as described in Section 4.1 of the main application document.

	The EfW will comply with the BAT-AELs for new plant and will perform at or below the limit set out in Table 4.1 of the main application document under normal operating conditions.
Emissions to water	
BAT 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.**
Response/evidence	Not applicable as there will be no process water discharge.
BAT 33	**In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given below.** **a) Waste-water-free FGC techniques** **b) Injection of waste water from FGC** **c) Water reuse/recycling** **d) Dry bottom ash handling**
Response/evidence	Dry injection of activated carbon and injection of hydrated lime (BAT 33a) will be used at the EfW therefore no waste waters are generated from flue gas cleaning (see Section 4.1 of the main application document). Process waste waters (i.e. from boiler blowdown, boiler water regeneration and process area cleaning) and rainwater will be collected for re-use where possible, as described in Section 2.5 of the main application document (BAT 33c). Excess water from the bottom ash quench will be directed back into the quench bath for reuse (BAT 33 c).
BAT 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 given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.** **Primary** **a) Optimisation of the incineration process and/or of the FGC system** **Secondary** **b) Equalisation** **c) Neutralisation** **d) Physical separation** **e) Adsorption on activated carbon** **f) Precipitation** **g) Oxidation** **h) Ion exchange** **i) Stripping** **j) Reverse osmosis** **k) Coagulation and flocculation** **l) Sedimentation**

	m)	Filtration
	n)	Flotation
Response/evidence	Not applicable as there will be no aqueous process emissions from flue gas cleaning or from the storage of Bottom Ash.	

Material efficiency

BAT 35	**In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.**
Response/evidence	Bottom Ash and APC residues will be collected separately at the EfW. Bottom ash will be collected in the bottom ash bunker whilst APC residues will be contained within a silo.
BAT 36	**In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.** a) Screening and sieving b) Crushing c) Aeraulic separation d) Recovery of ferrous and non-ferrous metals e) Ageing f) Washing
Response/evidence	Not applicable as there is no bottom ash treatment plant at the site. Bottom ash is sent to a third-party bottom ash processing plant for recovery

Noise

BAT 37	**In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.** a) Appropriate location of equipment and buildings b) Operational measures c) Low-noise equipment d) Noise attenuation e) Noise-control equipment/infrastructure
Response/evidence	Operational measures (BAT 37b) will include inspection and maintenance of equipment; closing of doors and windows of enclosed areas, if possible; operation of equipment by experienced staff; and provisions for noise control during maintenance activities. Low-noise equipment such

	as low-noise compressors, pumps and fans will be installed at the EfW (BAT 37c). Noisy plant and equipment will be contained within enclosed buildings (BAT 37d) and noise control equipment/infrastructure will include silencers including the ID fan and equipment insulation (BAT 37e). See the Noise Assessment in Appendix J for more detail.

Summary

3.1.2 Based on a review of all the available information that has been assessed, the site/operator will be compliant with all of the relevant requirements of the above applicable BAT conclusions before becoming operational.

Drawing 1 Name of Drawing

Drawing 2 Name of Drawing

Drawing 3 Name of Drawing

Drawing 4 Name of Drawing

Drawing 5 Name of Drawing

Appendix A
H1 TOOL

CORBY ENERGY FROM WASTE FACILITY PERMIT APPLICATION

EPR/FP3502BB/A001
BAT Assessment
Client

2023-02-09

JER9793

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