Bridgwater Resource Recovery Facility

Best Available Techniques

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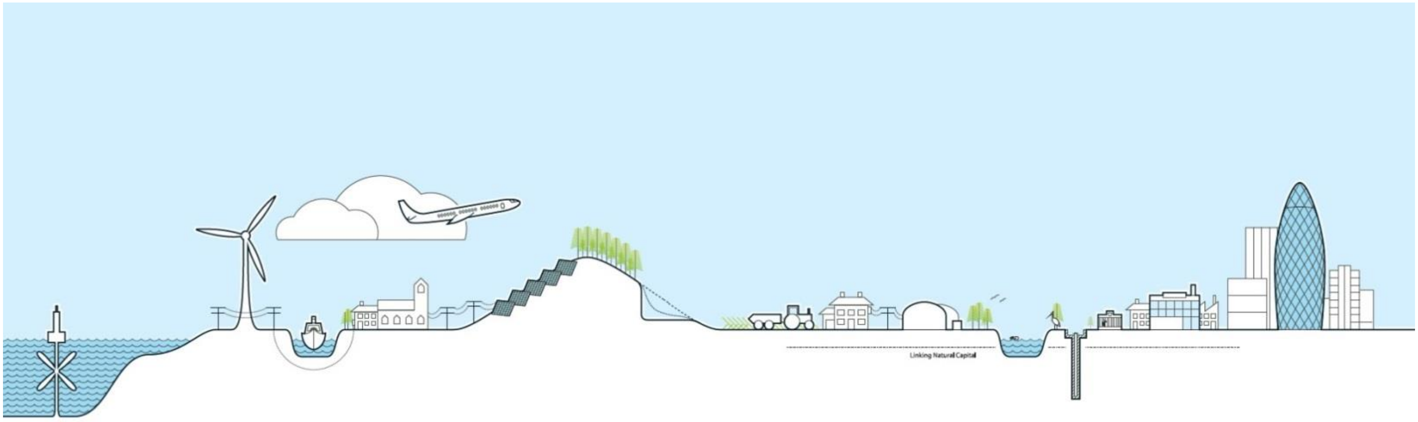

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1 Introduction

The Bridgwater Resource Recovery Facility (BRRF) comprises of an Energy Recovery facility (ERF) which generated electricity from the energy harnessed in the incineration of Refuse Derived Fuel (RDF). The facility is to be located on land located off Showground Road, south-west side of Bridgwater in Somerset. The post code for the site is TA6 6AJ and the grid coordinates for the centre of the site are ST 30970 35064. The facility is designed to accept up to 130,000 tonnes of RDF per annum, and will generate approximately 9.58MW of electricity. A maximum output of 7.75MW will be exported to the local electricity distribution network, operated by Western Power Distribution (WPD).

This activity is listed under the relevant schedule of the Environmental Permitting (England and Wales) Regulations 2016 and in addition to the Industrial Emissions Directive requires to be operate in accordance with "best available techniques" (BAT) for preventing pollution in order to ensure a high level of protection of the environment as a whole. The Environment Agency has produced guidance on what constitutes BAT for the incineration of waste (EPR 5.01[1]) and this is therefore is the key reference document for this assessment. The tables within the Appendix to this report provide specific answers to the questions asked within the guidance.

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

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

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

2 Combustion Process

2.1 Technology choice

A range of combustion technologies are available for the incineration of Refuse Derived Fuel (RDF) and Municipal Solid Waste (MSW) derived feedstocks in the UK, with the most commonly used technology being a moving grate - which is the technology proposed for BRRF.

Reference is made to alternative technologies within the guidance including fixed stepped hearths, pulsed hearth which are not appropriate at the scale proposed for the facility. In addition, whilst gasification and pyrolysis technology do show considerable potential, applications utilising RDF or mixed waste at the scale proposed at BRRF have proved problematical due to issues with the scalability of the technology leading to poor records on reliability.

The table below summarises the options considered:

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

Table 1. Technology choice

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

The viable alternative to moving grate technology is the fluidised bed technology. Whilst applications of this type have been utilised within the UK, it does not have an established track record equivalent to moving grate technology and imposes limitations on operation that may not be appropriate to the variability of wastes that may be processed by the facility.

Therefore, moving grate technology has been selected as the Best Available Technique in this circumstance as it is a proven and robust technology which includes a number of mechanisms to ensure complete combustion.

2.2 Proposed Process

The incineration process incorporates a single incineration line, incorporated a reciprocating (moving grate) technology. Maximum design capacities are expressed as the Maximum Continuous Rating. This is approximately 13 tonnes per hour of non-hazardous RDF (EWC 19 12 10) (with a calorific value of 11MJ/kg). The moving grate moves the waste through different phases of combustion, ensuring that complete oxidation is achieved and that emissions are minimised. In the first part of the process wastes are gasified, ignited and combusted on the surface of the grate. This is followed by a second stage of combustion, where further oxidation occurs and complete burn-out of the wastes is achieved. Both primary and secondary airflow are utilised with air being introduced in a controlled manner. Additional air is introduced in the boiler as a means of ensuring that the off-gases remain at a temperature within the range 850°C - 1,050°C for more than 2 seconds and that compounds such as carbon monoxide are oxidised. As these temperatures are in the range that may allow the formation of NO_x, measures for the control of these compounds are included and detailed in Section 3.1.

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

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

Furthermore, feeding of waste will cease if the temperature in the combustion chamber falls below 850°C.

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

3 Abatement of point source emissions to air

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

The selected technology choice(s) is highlighted in bold in each of the tables.

3.1 Nitrogen Oxides (NO_x)

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

3.1.1 BAT assessment for NO_x

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

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

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

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

SNCR (with urea) + SCR	**Combination of SNCR (with urea) and SCR system to achieve BAT-AELs specified in the Waste Incineration BREF. Urea solution is used also in SCR system in order to avoid storage and handling of the dangerous ammonia solution**

Each technique has different levels of performance and associated costs. These are summarised in the table below.

	Unit	Treatment Technique		
		SNCR	SNCR + FGR	SNCR + FGR + SCR
Impact of options				
Assumed unabated NO_x emissions	mg/m^3 t/yr	500 278	500 278	500 278
Estimated abated emissions NO_x	mg/m^3 t/yr	200 111	200 111	120 67
NO_x Saved	t/yr	167	167	211
Environmental Performance (long term)				
Process contribution (PC)	µg/m^3	2.0	1.9	1.1
Background concentrations	µg/m^3	16.1	16.1	16.1
Predicted Environmental Contribution (PEC)	µg/m^3	18.1	18.0	17.2
Environmental Assessment Level	µg/m^3	40	40	40
PC as proportion of EAL	%	5.1	4.7	2.8
PEC as proportion of EAL	%	45.4	44.9	43.0
Costs				
Capital Cost Estimate	£k	257	552	6,652
Annualised capital costs	£k	23	54	648
Maintenance, water and reagents	£k	194	156	222
Loss of exported power	£k	53	73	196
Total annualised costs	£k	270	283	1,066
Cost per tonne NO_x Abated	**£/t**	**1,617**	**1,694**	**5,052**

The combined use of SNCR and SCR system with Flue Gas Recirculation (FGR) is proposed to meet the NO_x emission concentrations required by the Waste Incineration BREF. Whilst the use of an SCR system on its own can provide effective control, the combination of the two reduction techniques along with continuous emission monitoring can provide an additional level of flexibility to optimise the process by adjustment of control points.

3.1.2 Process Proposed for NO_x abatement

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

- Prevention of air oversupply (preventing the supply of additional nitrogen);

- Optimising the combustion with well distributed primary and secondary air in order to avoid unnecessary high temperatures in the combustion chamber
- Control of the temperature and oxygen content in the upper stage of the combustion chamber.

The last measure can be achieved by recirculating a percentage of flue gases taken directly from the stack (FGR).

Further NOx abatement will be carried out in the facility with the following secondary techniques:

- SNCR system acting as a first stage within which a 40% urea solution will be dosed directly into the combustion chamber
- SCR as a second step of the secondary abatement technique, within which the urea will be disassociated into ammonia before entering via the flue duct.

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

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

3.1.3 NO_x emission concentration from selected abatement

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

The impact of NO_x emissions at this concentration are assessed in the Air Quality Assessment report submitted with this application (document reference H171P-G9-00-0033).

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

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

- *"The impacts of the facility on concentration of all pollutants relevant to human health have been screened out as insignificant. It can thus be assumed that the proposed development will have an insignificant impact on air quality for local residents."*

With regard to the impact upon ecological designated sites the report concludes that:-

- "*All of the process contributions within the Severn Estuary (SAC, SPA and Ramsar site) and the Somerset Levels and Moors (SPA, SSSI and Ramsar) are less than 1% of the long-term EALs and less than 10% of the short-term EALs and can thus be discounted as insignificant according to the Environment Agency guidance*.
- *All of the process contributions within the LWS and LNR sites are less than 100% of the EALs and can also be discounted as insignificant. Process Contributions to acid deposition are considered at no risk of exceeding critical loads."*

The selected abatement technology and the corresponding NO_x emission concentration that is it designed to achieve, has been specified to ensure that the modelled impacts are comprehensively demonstrated to be insignificant when measured against statutory objectives and guidance on risk assessment for air quality. Accordingly, a reduction in the NO_x emission concentration will not result in betterment in qualitative assessment, as set out in the concluding section of the air quality assessment. An assessment of the selected stack height is included as Appendix 2.

3.2 Carbon Monoxide

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

3.2.1 BAT for Carbon Monoxide Abatement

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

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

3.2.2 Proposed method for CO control

Within the BRRF facility continuous monitoring for CO will be undertaken and the data interrogated by the plants DCS. In addition to adjusting process parameters (such as secondary air rates to maintain excess oxygen level to around 6%) to ensure emissions are minimised, CO formation would be an indicator of incomplete combustion and therefore inefficient operation. CO is monitored at the stack by the CEMS (see Appendix 3 for further details).

3.3 Acid Gases

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

3.3.1 BAT for Acidic Gases

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

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

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

Technique	Comparative Observations
Wet system with sodium hydroxide	+ High removal rates and low solid waste production

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

3.3.2 Proposed method for acid gas control

Acidic gases on the exhausts (typically HCl, SO_2 and HF) will be neutralised by adding alkaline reagents into the flue stream. The facility will have a two-step dry acidic gases reduction process. In the first step, magnesium lime (a mixture of dolime and lime) will be dosed into the combustion chamber. The second step will consist of the dosing of lime into the flue stream after the boiler.

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

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

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

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

3.4 VOCs, Dioxins and Furans

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

3.4.1 BAT for abatement of VOC, Dioxins and Furans

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

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

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

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

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

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

Any dioxins or furans adsorbed by PAC shall be removed by the use of filtration. A secondary effect of the SCR it to oxidise further possible traces of VOCs, dioxins and furans.

3.4.2 Proposed method for VOC, Dioxins and Furans control

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

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

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

- Activated carbon injection where dioxins, furans and other organic compounds may be adsorbed;
- SCR where the above listed compounds are oxidised by the deNOx catalyst as a secondary effect of this technique.

3.5 Metals and Mercury

3.5.1 BAT for abatement of Mercury

The main methods from the abatement of metals and Mercury are provided in BAT Conclusion 31 of the Waste Incineration BREF. Separate techniques are provided for the reduction of mercury to other metals, and can be further categorised into primary and secondary techniques.

3.5.2 Proposed method for Mercury control

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

3.5.3 BAT for the abatement of Metals

The main methods from the abatement of metals are provided in BAT Conclusion 31 of the Waste Incineration BREF. Separate techniques are provide for the reduction of mercury to other metals, and can be further categorised into primary and secondary techniques.

3.5.4 Proposed method for metals control

Differently from Mercury, other metals will be mainly converted by the incineration process into non-volatile oxides. The primary technique of abatement of metals from the flue gases is the same used for dust removal. The facility will be equipped with a fly ash collecting tray and with a bag filter and metal compound particle will be trapped by it.

3.6 Incinerator Bottom Ash

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

3.7 Fly Ash

Fly ash that is precipitated by gravity in boiler hoppers will be routed to the boiler and economiser Fly Ash silo. If fly ash cannot be reprocessed it will be taken off-site for disposal at an appropriate licensed site. It is proposed that, following plant commissioning, a period of ash monitoring for 6 months is undertaken to determine if the ash contains any hazardous properties.

3.8 Particulates

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

3.8.1 BAT for particulate abatement

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

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

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

3.8.2 Proposed technique for particulate abatement

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

4 BAT Specific Questions

Guidance EPR 5.01 asks a number of specific questions with regards to the manner in which the plant would intend to demonstrate that it meets the required BAT standard. These questions and relevant commentary is included in Appendix 1 to this report.

The topic covered within the BAT specific questions include:

- Facility overview
- Hazardous Waste Incineration
- Emissions to surface water and sewer
- Waste recovery and disposal
- Continuous emission monitoring

- Recovery and beneficial use of heat
- Minimising the amount and harmfulness of residues

5 APPENDIX 1 – BAT SPECIFIC QUESTIONS/ANSWERS

5.1 EPR 5.01

Describe how the plant is designed, equipped and will be operated to ensure that the requirements of Council Directive 2000/76/EC on the incineration of waste are met, taking into account the categories of waste to be incinerated		
Ref	**Question**	**Response**
Facility Overview		
1	Does the installation contain more than one incineration line? Identify with a brief reference (e.g. L1, L2 etc) and provide a brief description (e.g. fixed hearth, chain grate) of each line.	The facility is to contain a single incineration line of mobile inclined reciprocating grate.
2	State the maximum design capacity (in tonnes/hour) for waste incineration for each line, and the maximum total incineration capacity (in tonnes/hour) of the plant.	The facility has a single incineration line with a maximum continuous rating capacity of approximately 13 t/hr
3	Are any of the wastes you treat hazardous waste for WID purposes?	The facility will only accept non-hazardous wastes for incineration
4	For each line, provide the following information: a. Is the operating temperature of the plant, after the last injection of combustion air, 1,100°C for hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, or 850°C for all other wastes? b. If the operating temperature is below 1,100°C for incineration of hazardous waste with greater than 1% halogenated hydrocarbons expressed as chlorine, or below 850°C for all other wastes, you must request a derogation under WID Article 6(4) with a justification that the operation will not lead to the production of more residues or residues with a higher content of organic pollutants than could be expected if operation was according to WID conditions. c. State the residence time of gas at the operating temperature given above. Is it less than 2 seconds? d. Where the residence time is less than 2 seconds, you must request a derogation under WID Article 6(4) with a justification that the operation will not lead to the production of more residues or residues with a higher content of organic pollutants than could be expected if operation was according to WID conditions. e. Describe the technique that will be used to verify the gas residence time and the minimum operating temperature given, both under normal operation and under the most unfavourable operating conditions anticipated, in accordance with WID Article 6 (4).	a. After the last injection of combustion air, the temperatures will be controlled within the range 850°C - 1,050°C. The facility will not accept any hazardous wastes. Temperature will be measured with suction pyrometer thermocouples. b. Not applicable, as the temperature will be above 850°C. c. The residence time of the gas at the normal operating temperature (>850°C) will be in excess of two seconds. d. Not applicable e. The plant will be designed to provide a minimum exhaust gas residence time after the last injection of combustion air of at least two seconds at a temperature of at least 850°C. This criterion has been using Computational Fluid Dynamic (CFD) modelling during the design stage. Gas temperatures measured at various points within the boiler during commissioning will be used to confirm the minimum two seconds gas residence time at minimum 850°C requirement. It will also be demonstrated during commissioning that the Plant can achieve complete combustion by measuring concentrations of carbon monoxide, volatile organic compounds and dioxins in the flue gases and analysis of the bottom ash. During the operational phase, the temperature at the two seconds residence time point will be monitored to ensure that it remains above 850°C. The location of the temperature probes will be selected using the results of the CFD model and commissioning tests.

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

	d. Maximum and minimum annual disposal in tonnes e. State whether it is hazardous waste for the purposes of WID	d. Maximum disposal is 130,000 t/yr e. Hazardous waste is not to be accepted for incineration
13	Is any fraction of the hazardous waste generated by the installation of which the incinerator is a part? For hazardous wastes which fall into this category, you may request a derogation from the requirement to comply with the requirements in sections 14) - 16) below by virtue of Article 5(5) of the Directive.	Not applicable - hazardous waste is not to be accepted for incineration
	Describe how you ensure that information about the mass of waste (as categorised by the European Waste Catalogue (EWC)) to be delivered, is available before it is received? (WID Article 5 (2))	Not applicable - hazardous waste is not to be accepted for incineration
	How do you ensure that the requirements of WID Article 5(3) as listed below are satisfied before the hazardous waste streams identified are delivered? • hazardous waste consignment notes have been provided • the physical and chemical characterisation of the waste show that the waste is suitable for treatment at the plant • the hazardous characteristics of the waste are sufficiently known to enable safe handling and safe blending/mixing where appropriate	Not applicable - hazardous waste is not to be accepted for incineration
Hazardous waste incineration		
13	Is any fraction of the hazardous waste generated by the installation of which the incinerator is a part? For hazardous wastes which fall into this category, you may request a derogation from the requirement to comply with the requirements in sections 14) - 16) below by virtue of Article 5(5) of the Directive.	Not applicable - hazardous waste is not to be accepted for incineration
14	Describe how you ensure that information about the mass of waste (as categorised by the European Waste Catalogue (EWC)) to be delivered, is available before it is received? (WID Article 5 (2))	Not applicable - hazardous waste is not to be accepted for incineration
15	How do you ensure that the requirements of WID Article 5(3) as listed below are satisfied before the hazardous waste streams identified are delivered? • hazardous waste consignment notes have been provided • the physical and chemical characterisation of the waste show that the waste is suitable for treatment at the plant • the hazardous characteristics of the waste are sufficiently known to enable safe handling and safe blending/mixing where appropriate	Not applicable - hazardous waste is not to be accepted for incineration
16	Do you take representative samples from the hazardous waste streams? If not, provide justification or alternatives (e.g. for clinical waste safety hazards may limit access to the waste stream however the waste acceptance/pre-acceptance procedures from EPR SGN S5.07 on Clinical Waste Management provide robust alternatives). (WID Article 5(4) (b))	Not applicable - hazardous waste is not to be accepted for incineration
17	What is the retention period of samples after incineration of the batch has been completed? Minimum is 1 month. (WID Article 5(4) (b))	Not applicable - hazardous waste is not to be accepted for incineration
18	Do you incinerate H9 (as defined in Annex III of the Hazardous Waste Directive) infectious clinical waste?	Not applicable - hazardous waste is not to be accepted for incineration
19	If you incinerate H9 infectious clinical waste, will the material go straight from storage into the furnace without being mixed with other categories of waste and	Not applicable - hazardous waste is not to be accepted for incineration

	without direct handling during loading of the furnace as required by WID (Article 6 (7))?	
Emissions to surface water and sewer		
20	If the technique by which you clean the exhaust gas from the incinerator generates waste water, you must give details of the waste water treatment process and demonstrate that you comply with the requirements of WID Annex IV and Articles 8(4) and 8(5). In particular, if you mix waste waters from your exhaust gas treatment with other waste waters prior to treatment, monitoring or discharge, you must demonstrate how you apply the mass balance requirements referred to in Articles 8(4) and 8(5) to ensure that you derive a valid measurement of the emission in the waste water.	A two-step dry air control system based on magnesium lime, lime and activated carbon, followed by the use of bag filters, is proposed for the facility. These techniques do not generate a liquid effluent for disposal.
21	Describe your storage arrangements for contaminated rainwater run-off, water contaminated through spillages and water arising from fire-fighting operations. Demonstrate that the storage capacity is adequate to ensure that such waters can be tested and, if necessary, treated before discharge. (WID Article 8 (7)).	Manual penstock valves are to be provided prior to connection to Wessex Water sewage network to be closed in the event of any drainage be contaminated. The engineered containment system on site will prevent the release of potentially polluting liquids (including firewater) to surface water and groundwater taking advantage of available storage volume from: • RDF bunker within the main building; • Drainage pipework and manholes; • Attenuation tank on the western side of the building, and • Bunded ground on the northern side of the building. Testing of the water within the drainage network can be undertaken at the designated sampling chamber located at the penstock. See Fire prevention Plan (doc. Nr. H171P-G9-00-0025) submitted with the application for further details.
22	For each emission point, give benchmark data for the main chemical constituents of the emissions under both normal operating conditions and the effect of possible emergency conditions. In this section we require further information on how you monitor the pollutants in these emissions. You must provide information for flow rate, pH, and temperature. Article 8 of WID requires that wastewater from the cleaning of exhaust gases from incineration plant shall meet the ELVs for the metals and dioxins and furans referred to in Annex IV of WID. Where the waste water from the cleaning of exhaust gases in mixed with other waters either on or offsite the ELVs in Annex IV must be applied to the waste water from the cleaning of exhaust gases proportion of the total flow by carrying out a mass balance. Monitoring for other pollutants is dependent on the process and the pollutants you have identified in response to the question.	It is expected that a permit condition will regulate the discharge of surface water from the site. It is anticipated that the permit condition will impose limits on suspended solids, oil and grease. A surface water monitoring point will be in place within the Permit boundary. It is anticipated that the relevant consent will require that discharge of surface is water is free of visual oil and grease. The exact nature of the discharge of process water will be determined following commissioning and a Trade Effluent Discharge Consent will be sought with the relevant sewage undertaker. Until such a time when consent is in place any process water for discharge will be removed from the site via tanker to a suitably licensed facility following suitable characterisation. An application to Wessex Water for a discharge of up to 120m^3 per day is pending determination. The parameters of the discharge that has been applied for are:- pH Range - 6-10 Suspended Solids Range – 20mg/l COD range – 50mg/l Temperature Range – 20 – 40°C.
23	For each parameter you must define: • emission point • monitoring frequency • monitoring method • whether the equipment/sampling/lab is MCERTS certified	The drainage strategy within the facility Environmental Management System will define these parameters for each potential discharge point. All monitoring equipment, testing and sampling Labs will be to MCERTS standard.

	measurement uncertainty of the proposed methods and the resultant overall uncertainty • procedures in place to monitor drift correction • calibration intervals and methods • accreditation held by samplers or details of the people used and their training/competencies	
24	Describe any different monitoring that you will carry out during Commissioning of new plant.	Additional inspections will be undertaken to ensure drainage connections have been appropriately made
25	Describe any different arrangements during start-up and shut-down.	None
26	Provide any additional information on monitoring and reporting of emissions to water or sewer.	None
Waste recovery/disposal		
27	How do you deal with the residue from the incineration plant? Explain how you minimise, recover, recycle and dispose of it.	Incinerator bottom ash will be transported to, and stored within, an enclosed room. It shall then be loaded into appropriate covered bulk vehicles for transport to a suitably licensed recycling and recovery facility. Boiler, fly ashes, and APC residues will be collected and separately stored to await collection. The APC residues are classified as hazardous waste (on the basis of irritancy (H4) and ecotoxicity (H14)) and will be transported off-site for disposal at a suitably permitted landfill facility.
Continuous emission monitoring performance		
28	How do you intend to manage the continuous measurement system to satisfy WID Article 11 (11)? WID Article 11 allows a valid daily average to be obtained only if no more than: • 5 half-hourly averages, and • 10 daily averages per calendar year during the day are discarded due to malfunction or maintenance of the continuous measurement system. Give details of how calibration, maintenance and failure of the continuous measurement system will be managed in order to satisfy these limitations. If necessary distinguish between different incineration lines.	WID requirements for process operation will be written into the operational process control software for the facility. This ensures the plant operates in accordance with the requirements specified under WID and will provide a detailed record of how calibration, maintenance and failure of the continuous measurement system (CMS) is managed. A standby CEMS system is provided as a separate redundant system. This is included as Appendix 2 to this document.
29	Give details of how you define when start-up ends and shut- down begins. Describe any different arrangements for monitoring during start up or shut down. Note that the emission limit values specified for compliance with WID do not apply during start-up or shut-down when no waste is being burned. Explain how you will integrate these periods into the emissions monitoring system in such a way that the reportable averages are calculated between these times, but the raw monitoring data remains available for inspection. (WID Article 11(11)). If necessary distinguish between different incineration lines.	The end of the start-up period is defined when the combustion chamber has reached 850 °C. At this point waste feeding will commence. Shut down begins when waste feeding stops, when the auxiliary burners will be used until all waste has been combusted and is empty. CEMS will commence monitoring emissions as soon as waste is fed into the grate. During shut down when there is no waste remaining on the grate CEMS monitoring will cease. The control of this process is to be integrated into the plant operating software.

30	Describe each type of unavoidable stoppage, disturbance or failure of the abatement plant or continuous emission monitoring system during which plant operation will continue. State the maximum time anticipated before shut-down is initiated for each of these types of unavoidable stoppage.	The plant will not continue to operate normally in the event of a failure of a stoppage or failure of the emissions abatement plant. Should the CEMS fail at any time, the backup CEMS will commence measurement automatically; if this unit has also failed an automatic plant shutdown will be initiated.
31	Will the values of the 95% confidence intervals of a single measured value of the daily emission limit value, exceed the percentages of the emission limit values required by WID Article and Annex III point 3, as tabulated below? (We will accept that MCERTS certified instruments satisfy these quality requirements)	MCERTS instruments will be used for all measurements
32	Describe the monitoring of process variables, using the format tabulated below. For emissions to air, include at least the arrangements for monitoring oxygen content, temperature, pressure and water vapour content at the points where emissions to air will be monitored (WID Article 11 (7)). For emissions of waste water from the cleaning of exhaust gases include at least the arrangements for monitoring pH, temperature and flow rate (WID Article 8 (6)).	For process monitoring arrangements, please refer to the Operating Techniques document submitted with the application. There are no emissions of waste water from the cleaning of fuel gases.
Describe how the heat generated during the incineration and co-incineration process is recovered as far as practicable		
33	You must assess the potential for heat recovery from each line, using the guidance in this Sector Guidance Note. You must justify any failure to recover the maximum amount of heat.	Refer to report ref. H171P-G9-00-0024-02 (Appendix 1) for Heat Opportunities Report.
Describe how you will minimise the amount and harmfulness of residues and describe how they will be recycled where this is appropriate		
34	Describe how you will minimise the amount and harmfulness of residues and describe how they will be recycled where this is appropriate.	Non-hazardous incinerator bottom ash will be collected and sent to disposal / recycling centres. for recovery of metals and further processing and recycling into an aggregate where possible. Efficient operation of the plant through close process control will be the primary method to control the quantities air pollution control residues (APCR) generated by the process. Whilst disposal of these wastes to approved contractors is currently the most practicable option, the plant operator will regularly review the disposal options and will consider sending APC wastes for further use / recycling should practical options become available.
35	For each significant waste that you dispose of, provide the following information: • Incineration line identifier • Residue type reference (e.g. RT1, RT2 etc) • Source of the residue • Description of the residue • Details of transport and intermediate storage of dry residues in the form of dust (e.g. boiler ash or dry residues from the treatment of combustion gases from the incineration of waste). Article 9 of WID requires operators of incineration plant to prevent dispersal in the environment in the form of dust.	• L1 (only one incineration line) • RT1 – Incinerator Bottom Ash. Incinerator bottom ash developed in the combustion chamber will primarily be extracted from the bottom of the grate and quenched with water. The incinerator bottom ash is then discharged via a wet conveyor system to a dedicated storage room, from which it is discharged by wheeled loader into appropriate covered skips or bulk vehicles for transport to reprocessing into secondary products and/or disposal. • RT2 – Fly ash. Fly ash with magnesium lime residues coming from conductive and radiant surface of the boiler are collected from boiler bottom hoppers and conveyed to an enclosed silo. This material is subsequently discharged into tankers through enclosed unloading systems (screw conveyor and flexible hose to tanker ports) for onward transport to reprocessing and/or disposal • RT3 – Air Pollution Control Residues. APCR from the bag filter are conveyed to enclosed silos. This material is subsequently discharged into tankers through enclosed unloading systems

	• Details of total soluble fraction and soluble heavy metal fraction of residues. Article 9 of WID requires operators of incineration plant to establish physical and chemical characteristics and polluting potential of incineration residues. • Route by which the residue will leave the installation – e.g. recycling, recovery, disposal to landfill, other.	(screw conveyor and flexible hose to tanker ports) for onward transport to reprocessing and/or disposal. • Handling and transport of IBA, Fly Ash and APC within the facility is undertaken using fully enclosed systems, based on a combination of belt/chain/screw conveying systems, depending on the material to be handled. Intermediate storage is provided by silos for fly ashes whilst intermediate storage for IBA will be within a dedicated enclosed room from where it is discharged by wheeled loader into appropriate covered bulk vehicles for transport to reprocessing into secondary products and/or disposal. Other residues are discharged into tankers through enclosed unloading systems (screw conveyor and flexible hose to tanker ports for off-site transport to prevent fugitive dust emissions. • The composition of the IBA and APC will be established during the commissioning phases of the project. • Route for disposal or reprocessing will be established during the operational phase and may be modified during the life of the plant within the conditions of the permit.
36	Article 6(1) of WID requires incinerators to be operated in order to achieve a level of incineration such that the slag and bottom ashes have a total organic carbon (TOC) content of less than 3%, or their loss on ignition (LOI) is less than 5% of the dry weight of the material. Where the incinerator includes a pyrolysis stage or other stage in which part of the organic content is converted to elemental carbon, the portion of TOC which is elemental carbon may be subtracted from the measured TOC value before comparison with the 3% maximum, as specified in the Defra Guidance on the Waste Incineration Directive. Note that WID Article 6(1) requirements are complied with if either TOC or the LOI measurement referred to below is achieved. TOC: for waste incinerators, 3% as maximum as specified by WID Article 6(1). LOI: for waste incinerators, 5% maximum as specified by WID Article 6(1). Specify whether you intend to use total organic carbon (TOC) or loss on ignition (LOI) monitoring of your bottom ash or slag.	Total Organic Carbon (TOC)

5.2 Waste Incineration Best Available Techniques

5.2.1 Environmental Management System

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the following features:-		
(i)	Commitment of the management, including senior management;	✓	To be included in EMS documentation
(ii)	Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	✓	Environmental policy to be a part of the EMS
(iii)	Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;	✓	To be included in EMS documentation
(iv)	Implementation of procedures paying particular attention to: (a) Structure and responsibility (b) Recruitment, training, awareness and competence (c) Communication (d) Employee involvement (e) Documentation (f) Effective process control (g) Planned regular maintenance programmes	✓	To be included in EMS documentation

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

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

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
(xiii)	A systematic method to identify and deal with potential uncontrolled and or/unplanned emissions to the environment, in particular: a.) Emissions to soil and groundwater from the handling and storage of fuels, additives, by products and waste b.) Emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities	✓	Part a.) Will be dealt with by way of Standard Operating Procedure to be incorporated into the EMS. Part b.) is not relevant to this operation.
(xiv)	A dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues and additives;	*N/A*	Not required due to very low risk of dust emissions from any of the activities associated with the operation of the site.
(xv)	A noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including: a.) A protocol for conducting noise monitoring at the plant boundary b.) A noise reduction programme c.) A protocol for response to noise incidents containing appropriate actions and timelines d.) A review of historic noise incidents, corrective action and dissemination of noise incident knowledge to the affected parties;	*N/A*	It is not envisaged that a Noise Management Plan will be required based on the findings of the Noise Impact Assessment. However this requirement will be reviewed should any contrary evidence be received, such as the receipt of substantiated noise complaints and/or at the request of the Environment Agency.
(xvi)	For the combustion, gasification or co-incineration of malodorous substances, and odour management plan including:	✓	Odour Management Plan is provided.

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	a.) A protocol for conducting odour management b.) Where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions c.) A protocol to record odour incidents and the appropriate actions and timelines d.) A review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties.		

5.2.2 Monitoring

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or all of the relevant parts of the incineration plant.	✓	The expected gross electricity efficiency is calculated to be 25.3%, in accordance with the calculation specified for this condition.
BAT 3	BAT is to monitor key process parameters relevant for emissions to air and water including those given below:-		
	Flue-gas from the incineration of waste	✓	Included in monitoring programme
	Combustion chamber	✓	Included in monitoring programme
	Waste water from wet FGC	***N/A***	
	Waste water from bottom ash treatment plants	***N/A***	
BAT 4	BAT is to monitor channelled emissions to air with at least the frequency given 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 provisions of data of an equivalent scientific quality.	✓	Ref. CEMS document “H171P-GR-06-0010”. The minimum requirements of BAT 4 are met.
BAT 5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during OTNOC (other than normal operating conditions)	✓	The CEMS system will continue to monitor emission during OTNOC periods. The CEMS system is supplied with redundancy to ensure that it can operate in other than normal operating conditions (OTNOC), including a failure of power supply.

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

5.2.3 Environmental Combustion and Performance

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is the use all of the techniques (a) to (c) given below, and where relevant, also techniques (d), (e) and (f)		
(a)	Determination of the type of waste that can be incinerated	✓	The plant will operate with pre-processed waste fuel subject to classification checks undertaken by the third party supplier to ensure all waste is non-hazardous. Two visual inspections will be undertaken when the waste arrives on-site. The first will be at the weighbridge and latter during the unloading activities in the bunker or in the storage area in the waste reception hall. A conceptual flow diagram illustrating the fuel acceptance procedures is attached. The fuel will also be sampled on a bi-weekly basis. A gross sample of approx. 42kg will be collected on the days on which fuel delivery occurs (4 samples of approx. 2kg each per day). A 5kg representative sample will be extracted from the 42kg gross pile following the guidelines of applicable BS standards. The representative sample will be sent to an accredited laboratory for chemical and physical analysis.
(b)	Set-up and implementation of waste characterisation and pre-acceptance procedures.	✓	
(c)	Set-up and implementation of waste acceptance procedures	✓	
(d)	Set-up and implementation of a waste tracking system and inventory	✓	
(e)	Waste segregation	***N/a***	
(f)	Verification of waste compatibility prior to the mixing or blending of hazardous waste	***N/a***	
BAT 10	In order to improve overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system	***N/a***	No IBA treatment is to be undertaken on the site. All IBA treatment will be undertaken off-site by a third party.
BAT 11	In order to improve the overall environmental performance of the incineration plant BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9c) including, depending on the risk proposed by the incoming waste, the elements given below.	✓	All RDF received by the facility is subject to waste acceptance protocols established with the RDF provider (refer to the compliance measures for BAT 9 above).

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	Municipal solid waste and other non-hazardous waste		
BAT 12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below:- a.) Impermeable surface with adequate drainage infrastructure b.) Adequate waste storage capacity	✓	All areas where waste is handled and stored is supplied with a sealed drainage system, and is located on impermeable hard standing. Sufficient storage capacity is provided for 3.5 days of RDF combustion
BAT 13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given below:-	***N/a***	Applicable to facilities accepting clinical waste only
BAT 14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use a combination of the techniques given below:- a.) Waste blending and mixing b.) Advanced control system c.) Optimisation of the incineration process.	✓	Waste homogenisation to be undertaken by suitably trained and experienced operative utilising the loading polyp. See BAT 15 for information pertaining to the advanced system control, and optimisation of the incineration process.
BAT 15	In order to improve the overall environmental performance of the incineration of waste, to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings e.g. through the advanced control system, as and when needed and practicable, based upon the characterisation and control of the waste.	✓	The plant will be equipped with a microprocessor-based distributed control system (DCS) (with full redundancy) which will manage and supervise the complete operation of the plant. For the purpose of optimising environmental parameters, the control system will act on: - fuel supply

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			- supply and balancing of primary, secondary air, and recirculation fumes, - Temperature control in the combustion chamber - Feeding of sorbents (dolime and lime) to optimise the reduction acidic gases - Feeding of activated carbons - Urea supply for SNCR and SCR. The plant will be equipped with pressure, temperature, flow and analysis sensors directly connected to the control system which will act on the final acting elements with feedback and feedforward algorithms. The plant operators will have man-machine interfaces in which it will be possible to display all of the operating parameters of the plant and act on a real-time basis to adjust the behaviour of the plant. The various parameters will be recorded continuously and it will be possible to view current and historical trends. An alarm system will be implemented with recording of events. Finally, the DCS system will also manage the plant automatic shutdowns. Automatic plant shutdowns cannot be overridden by operators.
BAT 16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as is practicable shutdown and start-up operations.	✓	The plant has been designed to operate continuously for approximately 8,000 hours a year. The foreseen scheduled stops are 2 per year during which the system maintenance activities will be carried out. Many of the system components are redundant to ensure continuity of operation. For non-redundant components, procedures for the preventive maintenance of critical components will be implemented to avoid unexpected breakages.

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			To guarantee the supply of fuel, framework agreements will be stipulated with various suppliers which will therefore guarantee the full operability of the plant.
BAT 17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability.	***N/a***	
BAT 18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the Environmental Management System that includes all of the following elements.	✓	At OTNOC management plan will be prepared during the commissioning phase of the plant.

5.2.4 Energy Efficiency

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 19	In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	✓	Refer to CHP-R Report (ref. H171G9-00-024 Appendix 2).
BAT 20	In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given below:- a. Drying of sewage sludge b. Reduction of the flue-gas flow c. Minimisation of heat losses d. Optimisation of the boiler design e. Low temperature flue-gas exchanges f. High steam conditions g. Cogeneration h. Flue-gas condenser i. Dry bottom ash handling	✓	Refer to CHP-R Report (ref. H171G9-00-024 Appendix 2).

5.2.5 Emissions to air

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

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

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	a. Bag filter b. Electrostatic precipitator c. Dry sorbent injection d. Wet scrubber e. Fixed or moving bed adsorption		to alert the operator if the flue gas temperature will approach the design value. A further higher threshold will be implemented to shut-down the boiler.
BAT 26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 (f), BAT is to treat the extracted air with a bag filter.	***N/a***	No treatment of slags or bottom ashes is proposed.
BAT 27	In order to reduce channelled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given below:- a.) Wet scrubber b.) Semi-wet scrubber c.) Dry sorbent injection d.) Direct desulphurisation e.) Boiler sorbent injection	✓	BAT is achieved through the combination of dry sorbent injection in the combustion chamber and boiler. The facility will have a two-step dry acidic gases reduction process. In the first step, magnesium lime (a mixture of dolime and lime) will be dosed into the combustion chamber. The second step will consist of the dosing of lime into the flue stream after the boiler.
BAT 28	In order to reduce channelled peak emission of HCl, HF and SO_2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given below:- a.) Optimised and automated reagent dosage b.) Recirculation of reagents	✓	A NO_x, SO_2 and HCl analyser will be installed after the boiler and before the lime injection. The SO_2 and the HCl concentration will be used as feedback signal to optimise the storage of magnesium lime (1st step of acidic gas abatement) and as feedforward signal for the lime injection (2nd step of acidic gases abatement). The lime injection rate will be further optimised by using the concentration of SO_2 and HCl read at stack by CEMS.

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

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			The selection, as a secondary technique, of the combination of the SNCR and SCR system allows a reduction of NO_x in compliance with the upper limit of the new BREF indications. With the two systems working together, the NO_x concentration in the stack will be 120mg/Nm^3. This value was also assessed in terms of the ground and impact on human health as insignificant.
BAT 30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d) and one or a combination of techniques (e) to (i) given below. (a), (b), (c) and (d) and one or a combination of techniques (e) to (i). a. Optimisation of the incineration process b. Control of the waste feed c. Online and offline boiler cleaning d. Rapid flue-gas cooling e. Dry sorbent injection f. Fixed or moving bed adsorption g. SCR h. Catalytic filter bag i. Carbon sorbent in a wet scrubber	✓	The primary techniques to control the formation of dioxins, furan and other organic compounds that will be implemented are:- - The plant will operate with pre-processed waste fuel and further mixing will be implemented at site, if needed, to guarantee fuel homogeneity in order to have optimal and, as far is possible, homogenous and stable incineration condition. - Design and operation of the combustion chamber to achieve a good burnout of the combustion gases by ensuring that the combustion gases are maintained at a minimum of 850°C for a minimum residence time of two seconds at a minimum oxygen level of 6%. - Installation of auxiliary burners to always avoid the temperature of the combustion chamber from falling below 850°C.; and - Design of the boiler in order to have a rapid flue gas cooling and limit the residence time of the fumes within the temperature range 200 - 400°C. - Boiler bundles will be equipped with in-line compressed air cleaning system to reduce the dust residence time and accumulation in the boiler. Off-line boiler bundles cleaning

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			activities will be carried out during the maintenance periods. The facility will be equipped with the following secondary techniques:- - Powdered Activated Carbon (PAC) injection where dioxins, furans and other organic compounds may be adsorbed; - SCR where the above listed compounds are oxidised by the deNOx catalyst as a secondary effect of this technique.
31	Mercury Emission	✓	The facility will use, as a primary technique for the control of mercury emissions, the use of fuel with a low content of mercury. As a secondary technique, activated carbons are injected into the gas flow. The activated carbon adsorbs, with high efficiency, the volatile mercury compounds. The carbon is filtered in the bag filter.

5.2.6 Emissions to water

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 32	In order to prevent the contamination of uncontaminated water, to reduce emission to water and to increase resource efficiency, BAT is to segregate waste water stream and to treat them separately, depending on their characteristics.	✓	All waste water streams will be collected within the facility and disposed to public sewer. The following are the waste waters produced in the plant: Surface Water Surface Water discharge includes all roof water and other sources of clean water from the site. This is discharged by the site's drainage system to the Wessex Water surface water drainage network. All external areas are surfaced with suitable impermeable hardstanding. Surplus attenuation is provided by the existing pond located on the opposite side of Showground Road to the proposed facility. A new hydrobrake will be installed to control to rate of outflow so not to exceed the existing discharge rate. The surface water pond would only be used in the event that the amount of surface water generated from the installation exceeded the nominal capacity of the connection to the Wessex Water storm water system. Foulwater The effluent from the RDF power plant consists of two flows; the waste water from the WC's located in the RDF building, and waste water generated from the process. Foulwater from the WC's will be transferred into the Wessex Water foulwater drainage network. This includes connection to the toilet blocks located in the main building, and the weighbridge office.

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			Process waste water mainly consists of RO reject water and boiler blow down. Process waste water will be collected into a neutralisation basin where, Ph, conductivity and temperature will be conditioned. The pH of the process waste water will be balanced by the addition of a hydrogen chloride (HCl) or Sodium hydroxide (NaOH) solution. Temperature will be adjusted by adding both RO reject water and/or fresh water. Conductivity will be adjusted by adding freshwater. When the discharge parameters are acceptable, the treatment process effluent will be discharged into the foulwater network. The treatment plant will recirculate the waste water if these parameters do not comply with the limits set by the Wessex Water discharge consent. Treated wastewater is directed into the foulwater drainage network from the neutralisation tank, along with any potentially oily waters. The process will generate waste water for a total amount of approximately 2.5m^3 per hour, with a peak generation of 13m^3 per hour. Oily Water The collection of water from any areas which could be contaminated with oily water has a separate drainage network which passes through a buried full retention oil separator, prior to connection into the foulwater network. RDF Water

BAT Ref.	**BAT Standard**	**BAT Status**	**Compliance Measure**
			Water collected from inside the reception hall and bunker which will be in contact with the RDF is collected in a separate drainage network to a sealed sump from which it may be pumped. All internal areas are fitted with an impermeable surface. A non-return overflow valve is fitted to the surface water drainage network in the event of an exceedance of this system.
BAT 33	In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given below: a.) Waste water free FGC techniques b.) Injection of waste water from FGC c.) Water reuse recycling d.) Dry bottom ash handling	✓	The plant has been designed with the aim to reduce as much as feasible the water consumption. The following criteria have been followed: - Utilisation of dry FGC techniques - Utilisation of air-cooled steam condenser - Utilisation of air-cooled radiators for plant's auxiliary cooling services - Maximisation, as far as possible of water reuse in the process. With reference to this last point, the following reuse have been foreseen: - Utilisation of RO reject water for IBA quenching - Reuse of wet IBA drained water back to IBA quenching system - Utilisation of RO reject water to cool down the waste water coming from boiler blow down tank prior to dispose the water to the Wessex Water network. Considering the above, the site requires a raw water supply of an average of 7.2m^3 per hour with a peak demand of 12.3m^3 per hour. This will provided by mains water under a contract with a water supply company.

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			More details can be found in the document H171P-TH-00-0000 “Raw and Waste water balance scheme.”
34	Reduction of emissions to water	✓	The BAT 34 applies to waste water generated in slag / IBA treatment system and in wet flue gas systems. The facility will use dry FGC system with no waste water production. The wet IBAs will be drained as much as possible and the recovered water will be sent back to the quenching system through closed impermeable collecting pit and sump pump. Produced IBAs will be temporarily stored in a closed room and loaded with a wheeled loader into appropriate covered bulk vehicles for transport to reprocessing into secondary products and/or disposal.

5.2.7 Material Efficiency

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

5.2.8 Noise

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the technique given below:- a.) Appropriate location of equipment and buildings b.) Operational measures c.) Low-noise equipment d.) Noise attenuation e.) Noise-control equipment infrastructure.	✓	Ref. the noise impact assessment (ref. H171P-G9-00-0710) and the Noise and Vibration Management Plan (H171P-G9-00-0711) for further details regarding point a - e

6 Appendix 2 - Stack height

The Bridgwater Resource Recovery Facility has a proposed stack height of 40m above the finished ground level of the facility. This equivalent to c.46m AOD.

The stack height of 40m was determined during the preparation of the planning application in which it was demonstrated that, at this height, the impact upon ambient air quality in the local area were within the limit established by the Air Quality Standards Regulations 2010, and acceptable parameters for ecological receptors. This was verified through the preparation of an air quality assessment, supported by dispersion modelling.

With regards to demonstrating the principal of BAT, the extant EPR 5.01 guidance stipulates that "*You must demonstrate that an appropriate assessment of vent and chimney heights has been made… You should recognise that the chimney or vent may also be an emergency emission point under certain circumstances. Process upsets or equipment failure giving rise to abnormally high emission levels over short periods should be assessed. Even if you can demonstrate a very low probability of occurrence, the height of the chimney or vent should nevertheless be set to avoid any significant risk to health*."

In this permit application, an assessment of the proposed stack height with respect to air quality impacts is included with the following documents:-

- Air Quality Assessment (H171P-G9-00-0033);
- Abnormal Operations Assessment (H171P-G9-00-0712); and
- Human Health Risk Assessment (H171P-G9-00-0713)

All of which indicate acceptable impacts upon human and ecological receptors, and satisfy the requirement set out in EPR 5.01.

There is no definitive reference as to the height an exhaust stack should be in the published Waste Incineration BAT Reference document. With regards to establishing what the Best Available Techniques should be, where no definitive conclusion is provided, reference is made to the provisions made within the Annex III of the Industrial Emissions Directive (IED). Of the criteria for determining best available techniques, the three below are of particular relevance to the demonstration that the selected stack height represents BAT.

> "4. Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale."
>
> "6. Nature, effects and volume of the emissions concerned."
>
> "10. The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it".

With respect the first point listed above, the UK has experienced a notable growth in the number of EfW facilities over the last couple of years. There are many examples of other EfW facilities that have been granted with an environmental permit. The proposed installation represents a comparatively small scale waste incineration project relative to other permitted operation in England, many of which have considerably higher annual throughput than proposed here.

Whilst there is no direct correlation between stack height and annual throughput, it is expected that facilities with higher annual throughput will have a higher annual mass emission rate, and therefore require a higher stack to achieve comparable Process Contributions. Therefore, rather than relying on a direct comparison with the stack heights at other EfW schemes, it is appropriate to consider this as one of a number of criteria, including the throughput/capacity of the plant, the calculated process contribution and sensitivity of the impact, and the emissions abatement techniques proposed.

Where modelling work indicates that the Process Contributions of particular substance exceed 1% of the applicable Environmental Quality Standard, further information to demonstrate that the stack represents BAT may be requested as part of the determination of the permit application.

In this case the annual mean Process Contributions are provided in Table 13 of the Air Quality Assessment. Those with in which the Process Contribution exceeds 1% of the long-term EAL, or 10% of the short-term EAL are shown in the table below:-

Pollutant	**Averaging Period**	**Maximum PC in Cartesian Grid**		**EAL**
		PC	**% of EAL**	
NO_2	Annual mean	1.03	2.6	40
	99.79th %ile of 1-hour means	20.97	10.5	200
SO_2	99.0th %ile of 15-minute means	32.22	12.1	266
VOCs (as Benzene)	Annual mean	0.12	2.5	5
VOCs (as 1,3-butadiene)	Annual mean	0.12	5.5	2.25
Cd	Annual mean	0.00025	4.9	0.005
As	Annual mean	0.0037	123	0.003
Pb	Annual mean	0.0037	1.5	0.25
Total group 3 metals (as Cr VI)	Annual mean	0.0037	1845	0.0002
Mn	Annual mean	0.0037	2.5	0.15
Ni	Annual mean	0.0037	18.4	0.02
V	Max hourly mean	0.11	11.0	1

Table 1: Emission above 1% Process Contribution

Subsequent stages of the air quality assessment establish that the risk from each of the above listed emission is within acceptable statutory limits. In particular the high calculated PCs of Arsenic and Total Group III metals are qualified, with an explanation of the assumptions used the in model for these parameters.

However, in order to establish the principal of BAT, measures to minimise the impacts, as measured by the Process Contributions from the facility, must be demonstrated. In the case of this proposal, the abatement system design has already been modified from that initially proposed to meet the more stringent emission standards of the Waste Incineration Best Available Techniques Reference Document (WI-BREF). This provides an opportunity for a comparison of the impact on surrounding ambient air conditions between two separate emission scenarios.

Table 2 below compares the maximum Process Contributions of NO_2 between a NO_x stack emission concentration of 200mg/Nm^3 and 120mg/Nm^3.

	NO_x @ 200mg/Nm^3		**NO_x @ 120mg/Nm^3**	
	PC (ug/Nm^3)	% of EAL	PC (ug/Nm^3)	% of EAL
Annual Mean	1.86	4.6	1.03	2.6
99.79th%ile of 1 hour mean	25.86	12.9	20.97	10.5

Table 2: Maximum Process Contributions

The table above illustrated the effect of the lower and the maximum NO_2 impact upon the study area due to meeting the lower daily average emission limit prescribed by the Waste Incineration BREF.

As illustrated in the Air Quality Assessment (ref. H171P-G9-00-0033) the extent of the area in which the 1% PC threshold will be exceeded is limited to isolated areas mainly to the north-east of the stack.

This can be compared to the similar figure, shown within the previously prepared air quality model in which NO_x emissions were measured at 200mg/Nm^3. This illustrates a far greater level of spatial coverage area in which the Process Contribution will exceed 1% of the applicable air quality standard. The modelling demonstrates that the impact upon any identified sensitive receptors is acceptable, with the conclusion being that the impacts would be negligible. Therefore, it is not clearly demonstrated that by increasing the stack the impact upon sensitive receptors could be significantly improved.

The reduction of the concentration of the pollutant can therefore be seen as preferable to increasing the stack height as this will aid dispersion only and not reduce the mass of pollutant emitted.

Figure 1: NOx dispersal at 120mg/Nm^3 daily average

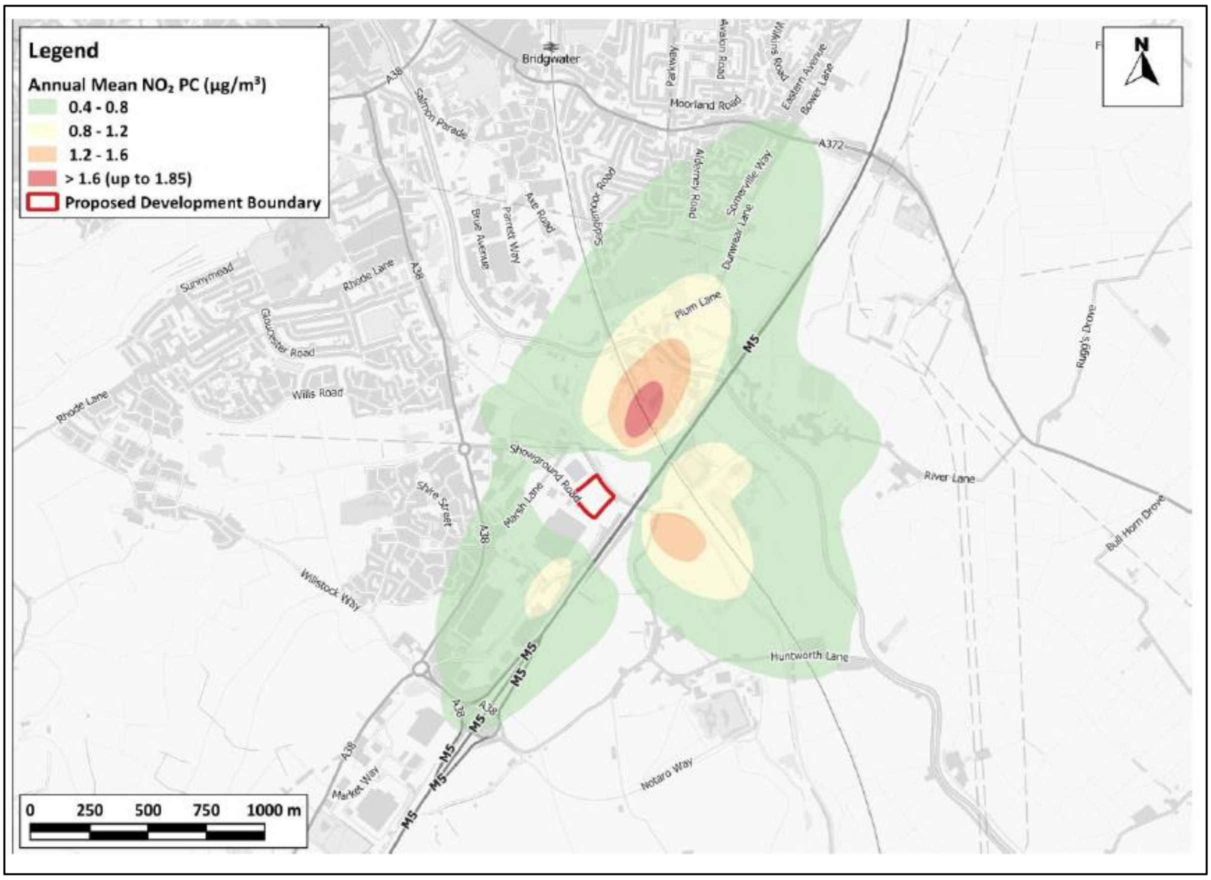


Figure 2: NOx dispersal at 200mg/Nm³ daily average

As a final point, any options appraisal of alternative stack heights would need to take into account the impact on emission parameters (temperature and pressure) and how these would impact upon the dispersion achieved. Consideration would also need to be given to the impact upon the energy demands of the exhaust fan with a higher exhaust stack requiring additional energy use to achieve the efflux required. Therefore the impact of a different stack height than that proposed would need to consider the holistic environmental impact of the proposal, and in addition to the dispersion that may be achieved.

7 Appendix 3 – CEMS Summary

BRIDGWATER RESOURCE RECOVERY LTD

BRIDGWATER WTE PLANT

- THE SHOWGROUND, BRIDGWATER -

CONTINUOUS AND PERIODIC EMISSION TO AIR SUMMARY

02							
01	26/02/2020	REVISED WHERE INDICATED			TGV	BL	BGV
00	26/11/2018	FIRST ISSUE			TGV	US	BGV
REV. *REV.*	DATA *DATE*	DESCRIZIONE *DESCRIPTION*			EMESSO *ISSUED*	CONTROLLATO *CONTROLLED*	APPROVATO *APPROVED*
DOC N. *DOC NR.*	*Project ID* ***H171P***	*Discipline* ***G***	*Doc. Type* ***R***	*System* ***06***	*Serial Number* ***0010***	*Typical Doc. Template* ***H171P-GR-06-0010-00***	

TABLE OF CONTENT

1 FOREWORD

Rev. 0 – First Issue.

Rev. 1 – Revision to adapt the CEMS to new BAT prescriptions.

2 SCOPE

STC Power has awarded the design, construction and start-up of a Waste-to-Energy power plant to be erected in Bridgwater, Somerset, UK.

The power plant will be composed of the following subsystems:

- RDF handling system
- Biomass-fired boiler
- Exhaust filtration and pollutant abatement system
- Ash and slags handling system
- Steam turbine and air condenser
- Demineralized water system
- Compressed air system
- Electrical power plant
- Distributed control system
- Continuous Monitoring Emission System

Scope of this document is to specify the arrangement of the installed CEMS and its main features and, in brief, describes the following hints:

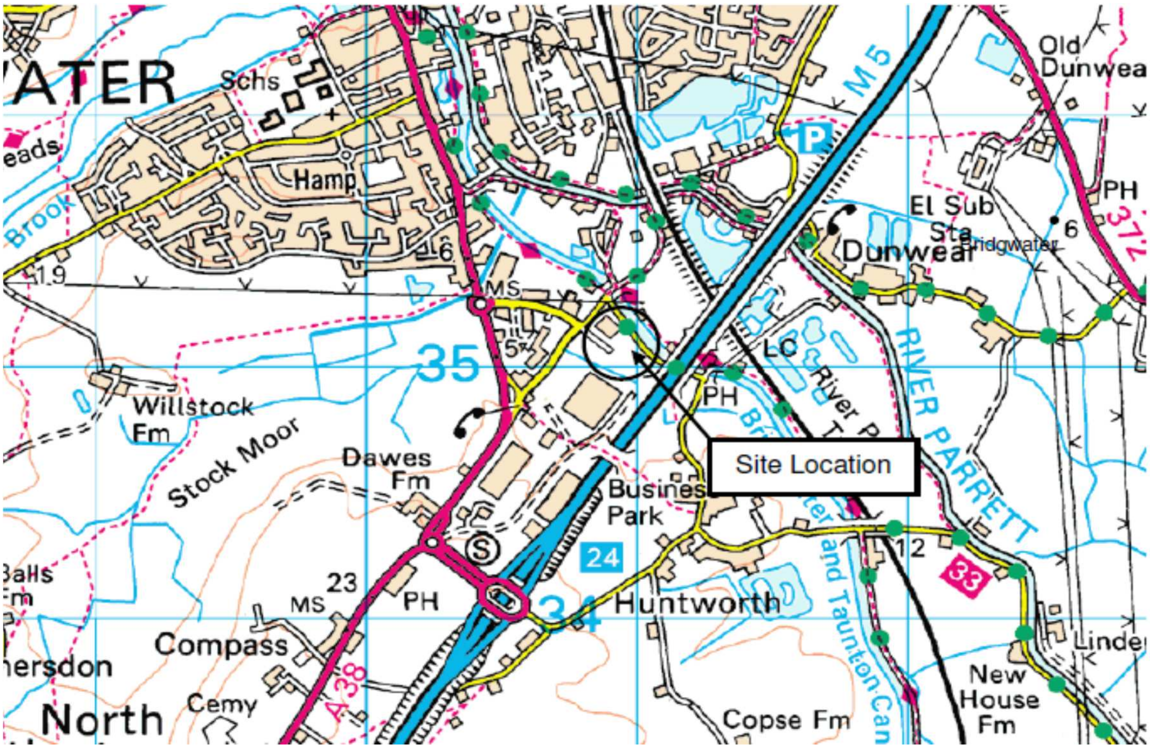
- Plant and equipment details, including accreditation to MCERTS;
- Methods and standards for sampling and analysis;
- The compliance of the system with the new BAT prescriptions;
- The compliance of the system with the Environment Agency Technical Guidance Note "M1 sampling requirements for stack emission monitoring";
- The compliance of the system with the Environment Agency Technical Guidance Note "M2 monitoring of stack emissions to air";
- Details of monitoring locations, access and working patterns; and
- Accreditation of the system to MCERTs.

3 DEFINITIONS

3.1 Definitions

The following terms used in this report have the meanings as listed here below:

Operator	Bridgewater Resource Recovery Ltd Incorporated under the law of England and Wales Company No: 8932414 120 Aldersgate Street London, EC1A 4JQ, England.
Facility, Plant	WTE Power Plant to be erected in Showground Road, Bridgwater, TA6 6AJ, Somerset (UK);
Site	Showground road, Bridgwater, TA6 6AJ, UK;



3.2 Acronyms

CEMS	Continuous Emissions Monitor System
EA	Environment Agency
FID	Flame Ionisation Detector
FTIR	Fourier transform infrared spectroscopy
IED	Industrial Emission Directive
POP	Persistent Organic Pollutant
RDF	Refuse-Derived Fuel
SCU	System Control Unit
TOC	Total Organic Carbon
VOC	Volatile Organic Compound
WTE	Waste to Energy

In this report the symbols:

"." (point)	is the decimal separator;
"," (comma)	is the thousands separator.

4 REFERENCE DOCUMENTS

- Best Available Techniques (BAT) Reference Document for Waste Incineration
- Environment Agency Technical Guidance Note M1 sampling requirements for stack emission monitoring.
- Environment Agency Technical Guidance Note M2 monitoring of stack emissions to air

5 PLANT DESCRIPTION

The Bridgwater Resource Recovery Facility (BRRF) is an energy from waste plant utilising Refuse Derived Fuel (RDF) to produce electricity and heat. RDF will be delivered to a reception hall by means of tipping trailers and trucks equipped with walking floors. The fuel will be deposited into a storage area within the hall or directly into a fuel bunker. Material deposited within the storage area will be transferred by wheeled loader.

The facility is equipped with:

- Fuel reception pit/ bunker – 5,200m3; and
- A Fuel reception area of approximately 1,650m3

The capacity fuel reception pit and fuel reception area combined is approx. 6,850m^3, equivalent to 3.5 days of operation (assuming Nominal Continuous Rate (NCR) load@ 175kg/m^3, LHV = 11,000kJ/kg).

The fuel in the pit is handled by an overhead crane that automatically spreads out the fuel, optimising the pit replenishment, and feeds a boiler hopper. From there, it passes to the feeding grate section in accordance with the demand of the boiler.

The incineration grate will have the following functions:-

- Transport of materials to be incinerated through the combustion chamber;
- Distribution of the materials to be incinerated; and
- Distribution of primary combustion.

The fuel will be dosed by an integrated hydraulic pusher on the inclined mobile grate inside the combustion chamber, which will adjust the height and distribution of fuel on the grate and is cooled by air

Electric air fans, equipped with variable frequency drives, provides the primary and secondary air in the various sections of the combustion grate and furnace.

The combustion chamber has been designed to achieve a good burnout of the combustion gases by ensuring that these are maintained at a minimum 850°C for a minimum residence time of 2 seconds at a minimum oxygen level of 6%. The correct design of the combustion chamber, combined with the control temperature and residence time, will be the primary technique for the control of dioxins and furans formation. This technique will ensure also the control of carbon monoxide formation.

At start-up, auxiliary gas-oil fed burners will be used to heat up the combustion chamber to at least 850°C before any waste is introduced. During operation, the burners will also be switched on automatically if the temperature falls below this 850°C and, during shutdown, the burners are to be used until to maintain this temperature until there is no more unburnt waste in the combustion chamber.

Incineration of bottom ash developed in the combustion chamber will primarily be extracted from the bottom of the grate and quenched with water. A suitable transport system will then remove the quenched bottom ash, which will be temporarily stored within the building, before being collected for off-site disposal.

In order to abate the NO_x content in the exhaust, the facility is equipped with a Selective Non-Catalytic Reduction (SNCR) process, which removes nitrogen oxides by injecting the reducing agent (urea) into the combustion chamber. The reactions occur at temperatures between 850°C and 1,000°C.

Typical SNCR removal efficiency is in the range of 50 – 60%. To further reduce the concentration of NO_x in the exhaust gases a Selective Catalytic Reduction (SCR) system will be installed as second stage of NO_x reduction process.

Acidic gases from the exhaust (typically HCl, SO_2 and HF) will be neutralised by adding alkaline reagent into the flue stream. The facility will have a two-step acidic gases reduction process. In the first step, magnesium lime (a mixture of dolime and lime) will be dosed into the combustion chamber. The second step will consist of the dosing of lime into the flue stream after the boiler.

Exiting the combustion chamber, gases will enter the boiler where they transfer the heat to the fluid which is evaporating water. After being superheated by means of an appropriate exchanger, the resultant steam is then sent to the power generation steam turbine-generator.

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

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

Following the reaction tower, exhaust gases are passed through a bag filter dust suppression system to retain the reacted products. The Air Pollution Control Residues (APCR) so collected with be directed into a silo and sent to authorised facilities for proper disposal.

Immediately after the bag filter, the exhaust gases are passed into SCR reactor for the second step of secondary technique of NO_x abatement.

Following the SCR, exhaust gases are expelled in the atmosphere through the stack.

A Continuous Emissions Monitoring System (CEMS) is installed on the stack to continuously monitor the pollutants.

The super-heated steam coming from the boiler at 50 bar(a) and 395°C is delivered at the steam turbine for electrical power production.

The exhaust steam is sent from the turbine to an air-cooled condenser for final condensation in order to optimise power production.

The process condensate returned to the deaerator to be recycled to the steam boiler for a new cycle.

The electricity generated, net of the parasitic consumption of the plant, is dispatched to the national grid through an electrical substation.

6 CONTINUOUS EMISSION MONITORING

6.1 CEMS description

The plant will be equipped with a Continuous Emission Monitoring System.

It will be based on several different subsystems:

- Fourier transform infrared-spectrometer to monitor the following pollutants:
  - Hydrogen Chloride
  - Carbon Monoxide
  - Sulphur Dioxide
  - Oxides of Nitrogen (NO and NO_2 expressed as NO_2)
  - Ammonia
- Flame Ionisation Detector for TOC analysis;
- Zirconium Dioxide Sensor for oxygen measurement;
- Scattered light sensor for Particulate matter measurement;
- Atomic absorption spectroscope for Mercury monitoring;
- VOC sampler for long-term sampling of dioxins (PCDD), furans (PCDF), dioxinlike PCBs and other Persistant Organic Pollutants (POPs).

The CEMS will be based on a redundant architecture composed by a Master Unit and a Slave Unit with the exception of Mercury analyser and VOC sampler which will be not redundant.

Both Master and Slave Units include FTIR, Oxygen, VOC and Dust analysers.

In case of fail of any of above-mentioned analyzers, Slave Unit takes place without analysis interruption.

After recovery of Master Unit, the Slave one may be switched over in the same way.

A sequence to switch Master/Slave manually or to exchange roles (Master become Slave and Slave become Master) is provided.

All components, including the acquisition software will MCERTs certificated.

The following parameters will be continuously monitored:

- Particulate Matter
- Total Organic Carbon
- Hydrogen Chloride
- Carbon Monoxide
- Sulphur Dioxide
- Oxides of Nitrogen (NO and NO_2 expressed as NO_2)
- Ammonia
- Mercury

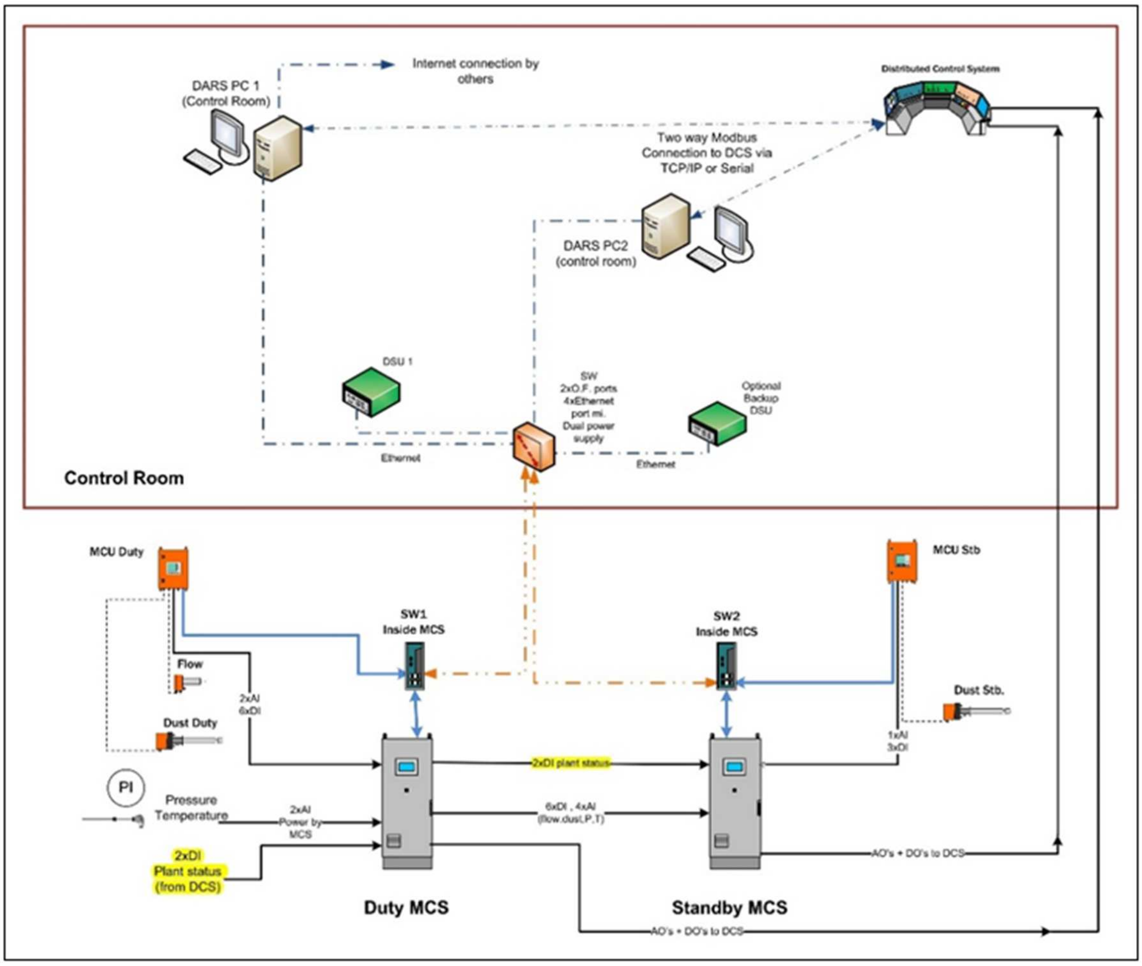
To adjust the raw values to the reference conditions, the following parameter will be also continuously monitored:

- Oxygen
- Water content (moisture)
- Flow rate
- Temperature

The VOC sampler will permanent sample the exhaust over a period of up to 6 weeks allowing periodic analysis of dioxin/furan emissions ensuring that fluctuations in plant operation and in the composition of the fuel are well recorded.

6.2 CEMS architecture

The CEMS architecture with all main components is highlighted in the following drawing.

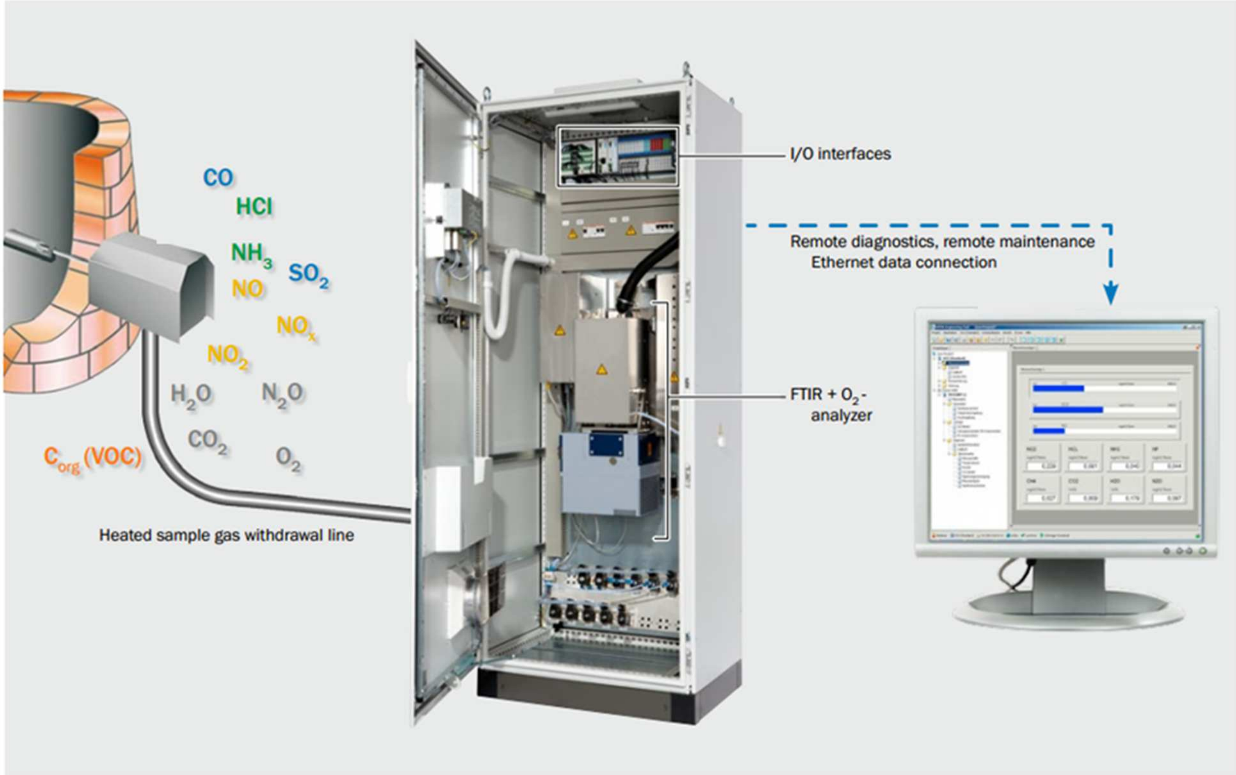


6.3 CEMS Components

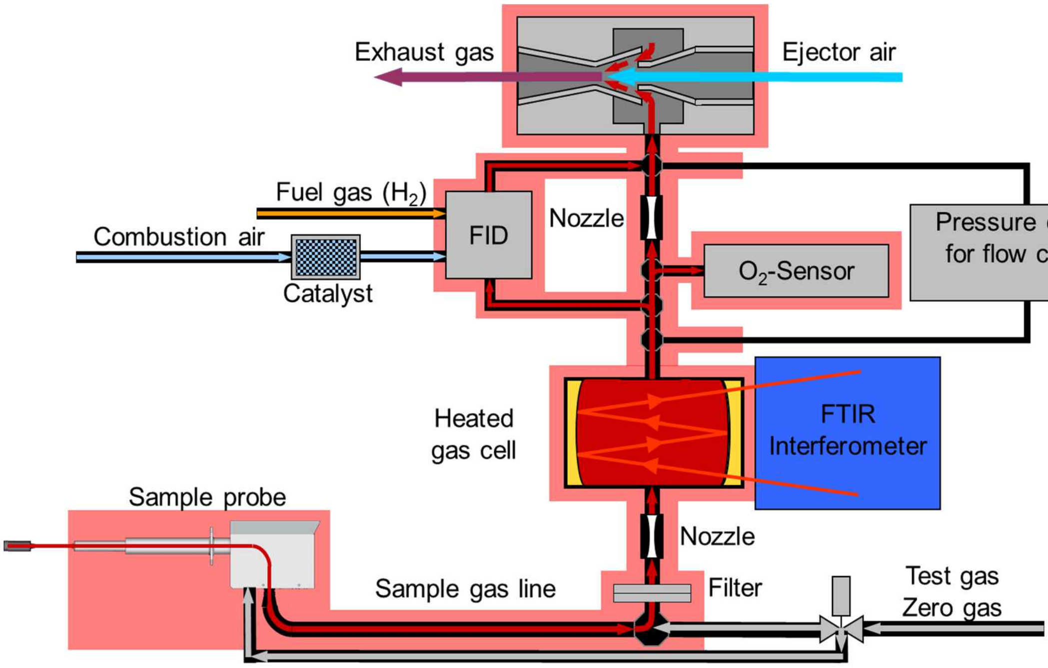
6.3.1 FTIR Analyser

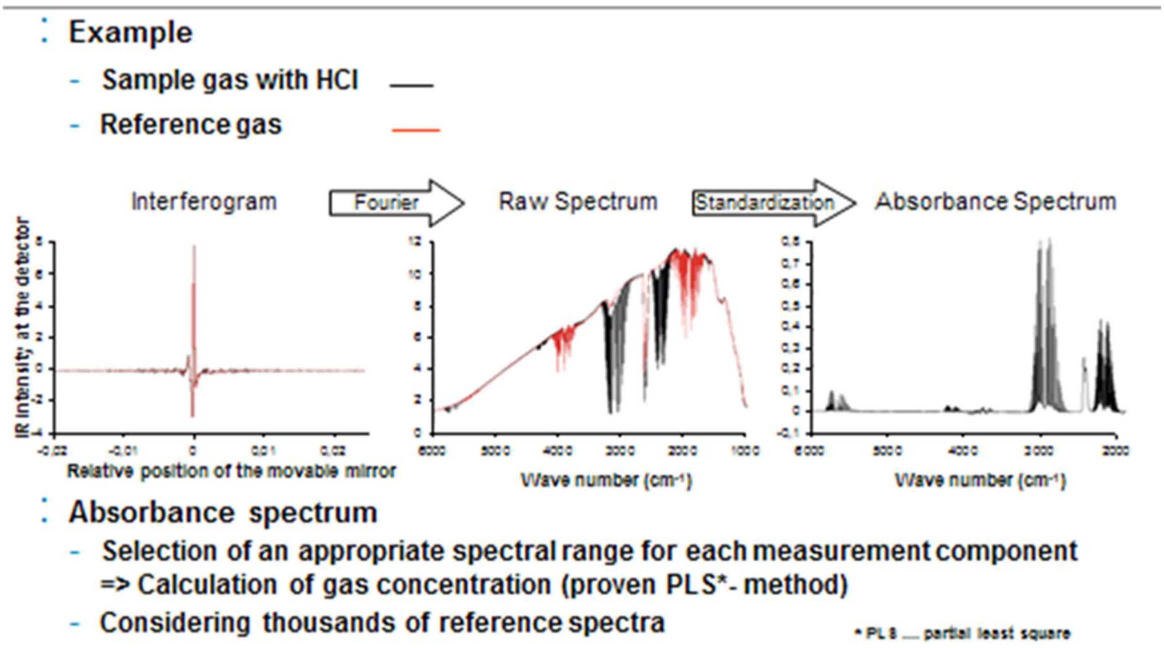
It will be installed a multi component FTIR analyser system.

The gas to be measured is taken by means of a sample gas probe from the flue gas. To provide the analyser system with the sample gas from the probe a heated sample gas line is used. A Fourier transform infrared-spectrometer (FTIR-spectrometer) serves for the spectral analysis of the gas concentrations.



The sample gas is delivered by an ejector pump. The sample gas probe will be capable of automatic zero gas provision, automatic back-flush with zero adjustment and filter cleaning. The system will have an independent temperature control system for all heated parts in order to prevent any condensation of flue gas within the system.





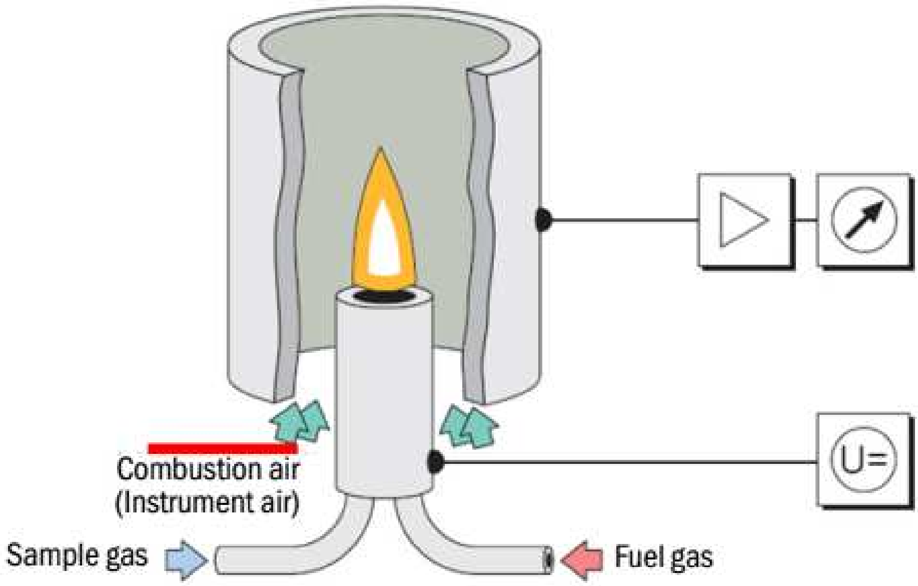
6.3.2 Oxygen Analyser

Oxygen measurement is performed with a zirconium dioxide (ZrO2) sensor (in short: O2 sensor). The O_2 sensor is located within the FTIR cell enclosure. The elaboration of the signals of the O_2 sensor will be performed by FTIR signal processing.

6.3.3 TOC Analyser

The above mentioned FTIR will be equipped with a FID (Flame Ionization Detector) to measure the organically bound total carbon (TOC). The FID is located in the cell enclosure.

Measuring principle



A hydrogen flame supplied by fuel gas and combustion air burns in the FID. The sample gas is routed into this flame. The hydrocarbons contained in the sample gas are split; the produced hydrocarbon fragments are ionized. A stream of ions forms in the electric field and this electrical stream is measured. The measuring signal is proportional to the number of the listed, non-oxidized hydrocarbon atoms. Hydrocarbon atoms that are already oxidized are only partially detected.

The signals of the FID are elaborated by FTIR signal processing. The measured values are displayed on the operator panel.

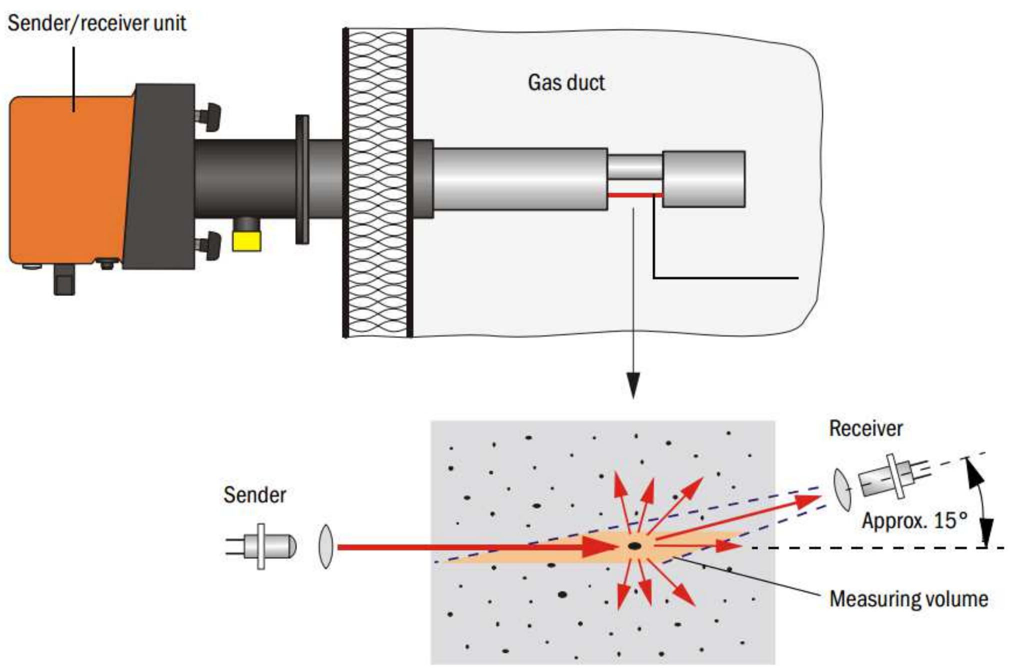
The control and evaluation system SCU (System Control Unit) is designed and adjusted to satisfy the requirements of emission control purposes as well as the requests of process measurement technology. An Ethernet interface for the remote control of the entire measuring system facilitates the data transfer via internal and external TCP/IP networks. In this way remote control and remote service of the measuring system are also possible using the software package

6.3.4 Particulate Matter Analyser

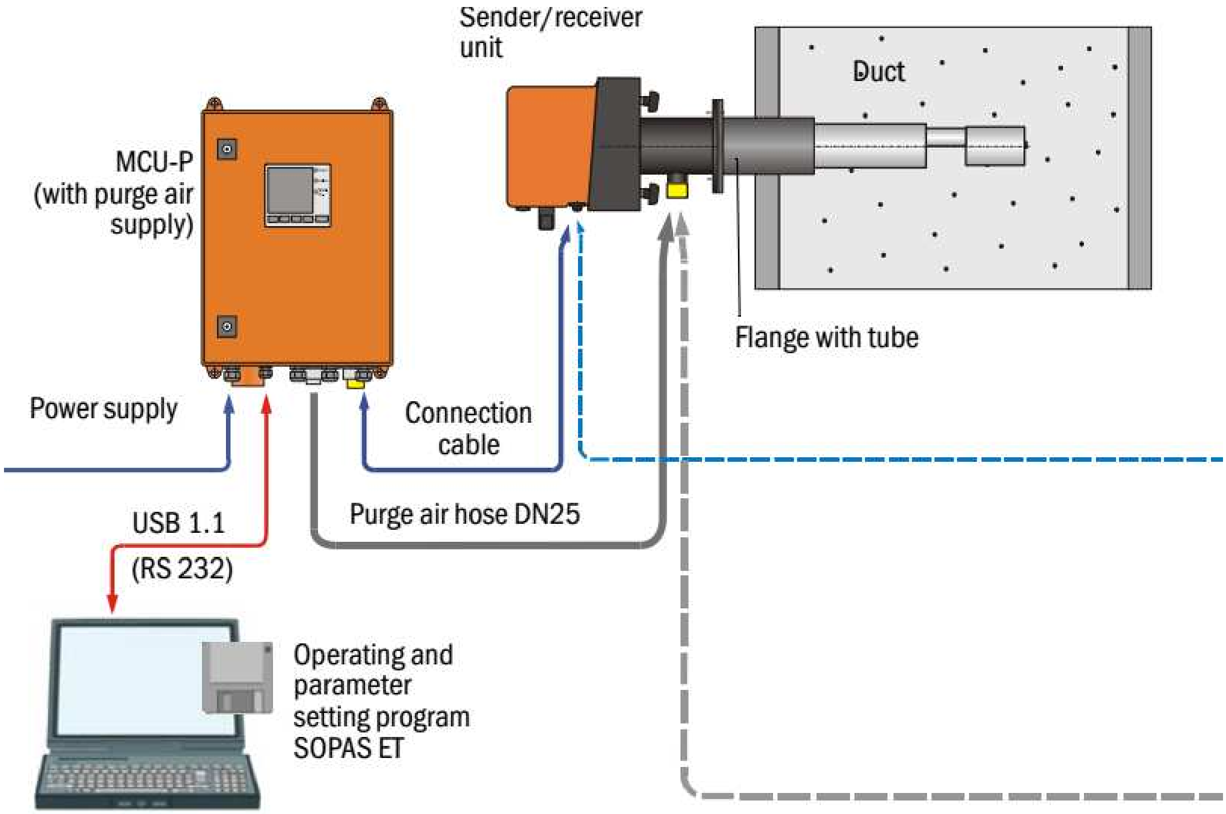
The measuring system that will be installed will work according to the scattered light measurement principle (forward dispersion). A laser diode beams the dust particles in the gas flow with modulated light in the visual range (wavelength approx. 650 nm). A highly sensitive detector registers the light scattered by the particles, amplifies the light electrically and feeds it to the measuring channel of a microprocessor as central part of the measuring, control and evaluation electronics. The measuring volume in the gas duct is defined through the intersection of the sender beam sent and the receive aperture.

Continuous monitoring of the sender output registers the smallest changes in brightness of the light beam sent which then serves to determine the measurement signal.

Figure 1 Measuring principle

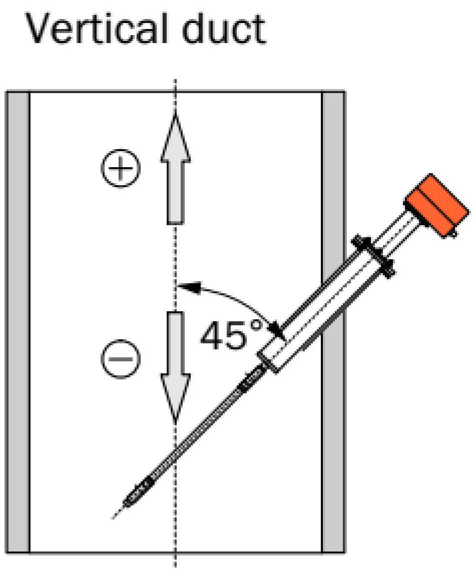


Measured scattered light intensity (SL) is proportional to dust concentration (c). Scattered light intensity not only depends on the number and size of particles but also on the optical characteristics of the particles and therefore the measuring system must be calibrated using a gravimetric comparison measurement for exact dust concentration measurement. The calibration coefficients determined can be entered directly in the measuring system.

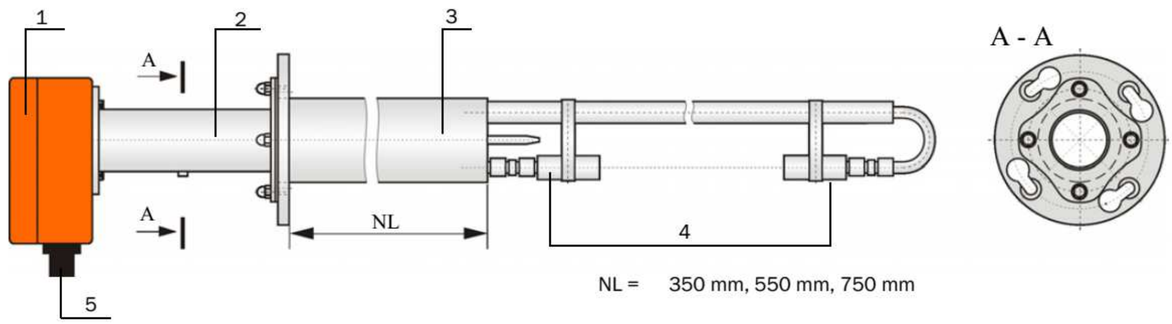


6.3.5 Flow Rate Measuerment

It will be installed a gas flow rate measuring devices operate according to the principle of ultrasonic transit time difference measurement. These sender/receiver units contain piezoelectric ultrasonic transducers that function alternately as senders and receivers. The sound pulses are emitted at an angle α to the flow direction of the gas. Depending on the angle α and the gas flow rate v, the transit time of the respective sound direction varies as a result of certain "acceleration and braking effects". The higher the gas flow rate and the



smaller the angle to the flow direction are, the higher the difference in the transit times of the sound pulses. Gas flow rate v is calculated from the difference between both transit times, independent of the sound velocity value. Therefore changes in the sound velocity caused by pressure or temperature fluctuations do not affect the calculated gas flow rate with this method of measurement.



6.3.6 Mercury analyser

The mercury analyser which will be installed at site will work according to Zeeman atomic absorption spectroscopy (Zeeman AAS).

according to the principle involved, mercury can be measured in its elemental state. Therefore, it is essential to convert all mercury compounds to their elemental states before actually determining the Hg concentration. The conversion is carried out heating the exhaust stream at about 1,000 °C.

The photometric determination of the mercury content occurs directly in the hot converter. This makes the process fast and continuous, and ensures that the conversion rate is steady.

An Hg discharge lamp emits light in the element-specific wavelength. A strong magnetic field generated around the lamp splits the spectral line into several components which form the measuring and reference wavelengths simultaneously (Zeeman effect).

6.3.7 POPs sampler

The plant will be equipped with an automatic sampler, QAL 1 certified, long-term sampling of dioxins (PCDD), furans (PCDF), dioxinlike PCBs and other Persistant Organic Pollutants (POPs).

By permanent sampling over a period of up to 6 weeks, the sampler ensures continuous documentation of dioxin/furan emissions for each single sample, thus ensuring that fluctuations in plant operation and in the composition of the fuel are well recorded.

The used principle complies the cooled probe method which is described in CEN/TS 1948-5:

A cooled probe (<50°C) is used to extract a part of the flue gas isokinetically from the stack. Dioxins and furans which are bounded in the gas, the dust and the condensate of the flue gas are adsorbed in a specific cartridge filled with a hydrophobic copolymer of styrene-divinylbenzene resin (XAD-2) and a dust filter.

An automatic leakage test is performed before and after the sampling cycle to validate the non-contamination of the adsorption cartridge.

After adsorption, the measured gas is pumped through a flexible tube to the control cabinet, where the gas is cooled down (<5°C) to completely remove the condensate. The isokinetic extraction is controlled continuously as a function of the flue gas velocity, temperature and pressure, by use of a thermal mass flowmeter and a frequency controlled pump.

The dried measured gas flow is determined twice by means of a calibrated gas meter and a thermal mass flowmeter.

The sampler operates fully automatically and all necessary data is stored internally. The data can be transferred after the sampling an USB flash drive. Both the XAD-2 cartridge and the USB flash drive are then send to a specialized laboratory for further analysis of collected POPs.

7 COMPLIANCE WITH EA TECHNICAL GUIDANCE NOTE M1

Here below is attached the Annex 1 of Environment Agency Technical Guidance Note “M1 sampling requirements for stack emission monitoring”. The Check List has been duly compiled with reference to Widmerpool Plant actual configuration.

Characteristic	Requirement	✓
Sample plane location	As far downstream or upstream from any disturbance, which could produce a change in direction of flow (e.g. bends, fans)	✓
	In a section of duct with constant shape and cross sectional area	✓
	Recommend five hydraulic diameters* upstream and two hydraulic diameters downstream (or five hydraulic diameters from the top of the stack)	✓
Sample plane orientation	Installation of sample plane in vertical stacks is preferred to horizontal ducts**	✓
Exploratory survey	It is advised that an exploratory velocity traverse is carried out before committing to installation	✓
Flow criteria	Angle of gas flow less than 15° to duct axis	✓
	No local negative flow	✓
	Minimum velocity (a differential pressure of 5Pa, which equates to 3 m/s)	✓
	Ratio of the highest to lowest gas velocity less than 3:1	✓
Measurement ports	Planned at design stage because retrofitting can be expensive (for example ducts may have protective linings)	✓
	Allows access to sample points	✓
	It is recommended that access ports have a minimum diameter of 125mm. For small stacks (less than 0.7m diameter) a smaller socket (for example 75mm may be necessary)	✓
	The port socket must not project into the gas stream	✓
	Additional ports may be required to allow access for measurement of other quantities (for example velocity and water vapour)	✓
	Additional ports may be required for CEMs	✓
	For large ducts four ports may be necessary	✓
	For rectangular ducts the ports should be installed on the longer side	✓
	The operator must maintain the ports in good condition and free them up prior to work being undertaken	✓

Characteristic	Requirement	✓
Identification	Clearly identified and labelled measurement section	✓
Load bearing capacity	Permanent and temporary work platforms must have a load bearing capacity sufficient to fulfil the measurement objective	✓
	Some measurement objectives may require platforms that support up to six people plus up to 300 kg weight of equipment	✓
Position and work area	Sufficient work area to manipulate probe and operate the measuring instruments, without equipment overhanging guardrails	✓
	A sufficient depth of work area is given by the internal diameter or depth of the duct and the wall thickness plus 1.5 m	✓
	If two opposite measurement ports are installed for one measurement line, a correspondingly smaller work area is required	✓
	It is recommended that ports in vertical ducts are 1.2 to 1.5m above the floor of the platform	✓
	Provision of dual level platform. These are necessary if the selected sample plane is located in a horizontal section of a large rectangular duct, and some of the sample points are positioned above a convenient and safe working height (nominally 1.5m maximum for sample probe handling)	✓
	Removable chains or self-closing gates at the platform to prevent workers falling through access hatches or ladders	✓
	Prevent accumulation of free-standing water and, if necessary, provide drainage	✓
Fall prevention	Upper hand rails at a minimum of 950mm (910mm allowed for old handrails). Gaps in rail no bigger than 470mm. Toe boards required	✓
	Consider installing personal protection systems on vertical ladders	✓
Access	Easy and safe access available	✓
	Consider installing work restraint systems on vertical ladders	✓
Power supply	Single phase 110V electrical power of a suitable current provided by a suitable number of outdoor waterproof sockets at the platform	✓

Characteristic	Requirement	✓
Lifting equipment	Lifting systems for raising and lowering of equipment, where access to the sampling platform is by vertical, or steeply inclined, ladders or stairs	✓
	Lifting systems (for example, hoists) and attachments (for example, eyes) must be inspected and maintained by a competent person	✓
	Installation of a support structure for securing portable lifting systems (handrails are not usually suitable for supporting lifting systems)	✓
Monorails	Consider sampling monorails above the sampling ports to enable certain designs of sampling train to be suspended	✓
Exposure to gas	Avoid areas of sources which emit unexpectedly, for example rupture discs, overpressure valves and steam discharges	✓
Exposure to stack gas	Avoid areas of significant positive pressure	✓
Awareness	Consider how stack emission monitoring personnel are informed of operating faults that may endanger them?	✓
Indoor location	Consider locating working platform within a building	✓
Ventilation	Well ventilated	✓
Heat and dust	Protection of the working area from heat and dust	✓
Weather protection	Protective measures (for example, weather protection and heating to ensure conditions are appropriate for personnel and equipment)	✓
Lighting	Artificial lighting or facilities for temporary lighting	✓

8 DETAILS OF MONITORING LOCATIONS, ACCESS AND WORKING PATTERNS

Bridwater plant emit exhaust gas from the stack with following specs:

Parameter	Common Stack
Stack Height	40 m above ground
Stack Ext. Diameter	1.80 m
Stack Inner Dia.	1.50 m
Efflux temperature	180 -190 °C
Efflux velocity	> 16 m/s

Selected CEMS, is connected to the Stack Ports with heated cables that allows sampled gas to be carried to analysers simultaneously from the various probes.

A platform structure is positioned in the stack at elevation 13.40 m above ground to allow safe operations during manual sampling activities. The platform will be designed to withstand more than 300 kg /m^2 of distributed load and is made of < 20 mm spaced carbon steel grid.

Platform is shaped to leave sufficient workspace to access the sampling ports.

Four ports DN125 are positioned on same level with a 90 ° array to allow both continuous and periodical sampling. The port level will be installed at a height that will allow more than 5 hydraulic diameters upstream and more than 5 hydraulic diameters downstream the ports to assure an even and flat flow velocity profile.

Other sampling ports will be installed at different levels and they have the purpose to accommodate in-situ analyser probes;

- Pressure Transmitter
- Temperature Transmitter
- Dust Probe (Master)

- Dust Probe (Slave)
- Ultrasonic flowmeter
- Spare nozzle

Working platform is provided with a lifting system with its own support, independent from handrail.

Convenience outlets and lighting is provided too.

Details of the stack are highlighted in the drawing H171P-MD-06-0193 attached to this document.

9 ACCREDITATION OF THE SYSTEM TO MCERT

The CEMS will compliant to the applicable European Standard and the compliance will be been assessed by MCERT.

10 PERIODIC MEASUREMENTS

Several parameters, that are not continuously measured, will be periodically sampled and analysed.

The parameters will be sampled and analised by a specialized company with robust quality assurance and quality control methods and record keeping. The sampling and the analisys will be carried out according to applicable EN standards.

Several parameters, that are not continuously measured, will be periodically sampled and analysed.

The parameters will be sampled and analysed by a specialized company with robust quality assurance and quality control methods and record keeping. The sampling and the analysis will be carried out according to applicable EN standards.

Parameter	Monitoring Frequency
Cd, Tl and their compounds	Quarterly in first year. Then biannual.
Sb, As, Pb, Co, Cu, Cr, Mn, Ni, V	Quarterly in first year. Then biannual.
Nitrous Oxide (N_2O)	Quarterly in first year. Then biannual.
Dioxins, Furans	Quarterly in first year. Then biannual.
Dioxin-like PCBs	Quarterly in first year. Then biannual.
Polycyclic Aromatic Hydrocarbons (PCA)	Quarterly in first year. Then biannual.

11 REPORTING AND NOTIFICATIONS TO EA

11.1 Reporting

The Operator will send to EA all reports related to the continuous and periodic emission to air monitoring on quarterly basis (monthly during the first year of operations).

11.2 Notifications

In the event:

- that the operation of the activities gives rise to an incident or accident which significantly affects or may significantly affect the environment; or
- of a breach of any permit condition.

the Operator will inform immediately the Environment Agency