Determination of an Application for an Environmental Permit under the Environmental Permitting (England & Wales) Regulations 2010

Decision document recording our decision-making process

The Permit Number is:	EPR/RP3236CR
The Applicant / Operator is:	Helius Energy Gamma Limited
The Installation is located at:	Avonmouth Biomass Power Plant, Avonmouth Docks, Bristol Port, Avonmouth

What this document is about

This is a decision document, which accompanies a permit.

It explains how we have considered the Applicant's Application, and why we have included the specific conditions in the permit we are issuing to the Applicant. It is our record of our decision-making process, to show how we have taken into account all relevant factors in reaching our position. Unless the document explains otherwise, we have accepted the Applicant's proposals.

We try to explain our decision as accurately, comprehensively and plainly as possible. Achieving all three objectives is not always easy, and we would welcome any feedback as to how we might improve our decision documents in future. A lot of technical terms and acronyms are inevitable in a document of this nature: we provide a glossary of acronyms near the front of the document, for ease of reference.

Preliminary information and use of terms

We gave the application the reference number EPR/RP3236CR. We refer to the application as "the **Application**" in this document in order to be consistent.

The number we have given to the permit is EA/EPR/RP3236CR/A001. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 19/07/2013.

The Applicant is Helius Energy Gamma Limited. We refer to Helius Energy Gamma Limited as "the **Applicant**" in this document. Where we are talking about what would happen after the Permit is granted, we call Helius Energy Gamma Limited "the **Operator**".

Helius Energy Gamma Limited's proposed facility is located at Avonmouth Docks, Bristol Port, Avonmouth. We refer to this as "the **Installation**" in this document.

How this document is structured

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Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

APC	Air Pollution Control	I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
AQS	Air Quality Standard	LCPD	Large Combustion Plant Directive (2001/80/EC)
BAT	Best Available Technique(s)	LCV	Lower calorific value – also termed net calorific value
BAT-AEL	BAT Associated Emission Level	LfD	Landfill Directive (1999/31/EC)
BREF	BAT Reference Note	LHB	Local Health Board
CCW	Countryside Council for Wales	NR	Local Nature Reserve
CEM	Continuous Emissions Monitor	LOI	Loss on Ignition
CFD	Computerised fluid dynamics	LWS	Local Wildlife Site
CHP	Combined heat and power	MSW	Municipal Solid Waste
COMEAP	Committee on the Medical Effects of Air Pollutants	MWI/CWI	Municipal/Clinical waste incinerator
CROW	Countryside and rights of way Act 2000	Opra	Operator Performance Risk Appraisal
CV	Calorific value	PC	Process Contribution
CW	Commercial waste	PHE	Public Health England
DAA	Directly associated activity	PEC	Predicted Environmental Concentration (i.e. PC plus background)
DD	Decision document	PPS	Public participation statement
EAL	Environmental Assessment Level	PR	Public register
EfW	Energy from Waste	RDF	Refuse derived fuel
EIAD	Environmental Impact Assessment Directive (85/337/EEC)	RGS	Regulatory Guidance Series
ELV	Emission limit value	SAC	Special Area of Conservation
EMS	Environmental Management System	SED	Solvent Emissions Directive (1999/13/EC)
EMAS	EU Eco Management and Audit Scheme	SCR	Selective catalytic reduction
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended	SGN	Sector guidance note
EQS	Environmental quality standard	SHPI(s)	Site(s) of High Public Interest
EU-EQS	European Union Environmental Quality Standard	SNCR	Selective non-catalytic reduction
EWC	European waste catalogue	SPA	Special Protection Area
FSA	Food Standards Agency	SS	Sewage sludge

GWP	Global Warming Potential	SSSI	Site of Special Scientific Interest
HHRAP	Human Health Risk Assessment Protocol	SWMA	Specified waste management activity
HMIP	Her Majesty's Inspectorate of Pollution	TDI	Tolerable daily intake
HPA	Health Protection Agency	TEF	Toxic Equivalent Factors
HRA	Human Rights Act 1998	TGN	Technical guidance note
HW	Hazardous waste	UHV	Upper heating value – also termed gross calorific value
HWI	Hazardous waste incinerator	UN-ECE	United Nations Environmental Commission for Europe
IBA	Incinerator Bottom Ash	US EPA	United States Environmental Protection Agency
IED	Industrial Emissions Directive (2010/75/EU)	WFD	Waste Framework Directive (2008/98/EC)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC)	WHO	World Health Organisation
I-TEF	Toxic Equivalent Factors set out in Annex VI of IED	WID	Waste Incineration Directive (2000/76/EC)

Chemical substances/types			
Cd, Tl	Group 1 metals: cadmium, thallium respectively	POP(s)	Persistent organic pollutant(s)
Hg	Group 2 metal: mercury	PAH	Polycyclic aromatic hydrocarbons
As, Co, Cr, Cu, Mn, Pb, Ni, Sb, V	Group 3 metals: arsenic, cobalt, chromium, copper, manganese, lead, nickel, antimony, vanadium, respectively	PCB PXDD PXB PXDF	Polychlorinated biphenyls Poly-halogenated di-benzo-p-dioxins Poly-halogenated biphenyls Poly-halogenated di-benzo furans respectively
CrVI	Chromium VI,	NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
TOC	Total Organic Carbon	N_2O	Nitrous oxide
HF	Hydrogen fluoride	NH3	Ammonia
HCl	Hydrogen chloride	SO_2	Sulphur dioxide
CO_2	Carbon dioxide	CO	Carbon monoxide
BaP	Benzo[a]pyrene *(a PAH)*		

1 Our decision

We have decided to grant the Permit to the Applicant. This will allow it to operate the Installation, subject to the conditions in the Permit.

We consider that, in reaching that decision, we have taken into account all relevant considerations and legal requirements and that the permit will ensure that a high level of protection is provided for the environment and human health.

This Application is to operate an installation which is subject principally to the Industrial Emissions Directive (IED).

The Permit contains many conditions taken from our standard Environmental Permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations and other relevant legislation. This document does not therefore include an explanation for these standard conditions. Where they are included in the permit, we have considered the Application and accepted the details are sufficient and satisfactory to make the standard condition appropriate. This document does, however, provide an explanation of our use of "tailor-made" or installation-specific conditions, or where our Permit template provides two or more options.

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 19/07/2013. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

The Applicant made no claim for commercial confidentiality. We have not received any information in relation to the Application that appears to be confidential in relation to any party.

2.2 Consultation on the Application

We carried out consultation on the Application in accordance with the EPR, our statutory PPS and our own RGS Note 6 for Determinations involving Sites of High Public Interest. We consider that this process satisfies, and frequently goes beyond the requirements of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, which are directly incorporated into the IED, which applies to the Installation and the Application. We have also taken into account our obligations under the Local Democracy, Economic Development and Construction Act 2009 (particularly Section 23). This requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of representatives of interested persons in the exercise of our functions, by providing them with information, consulting them or involving them in any other way. In this case, our consultation already satisfies the Act's requirements.

We advertised the Application by a notice placed on our website, which contained all the information required by the IED, including telling people where and when they could see a copy of the Application.

We placed a paper copy of the Application and all other documents relevant to our determination (see below) on our Public Register at Horizon House in Bristol and also sent a copy to Bristol City Council for its own Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made.

We sent copies of the Application to the following bodies, which includes those with whom we have "Working Together Agreements":

- Natural England
- Director of Public Health (Bristol City Council)
- Public Health England
- Avon Fire & Rescue Service
- Bristol Port Authority
- Wessex Water
- National Grid
- Health & Safety Executive
- Food Standards Agency
- Bristol City Council (Environmental Health Department)
- Devon and Severn Inshore Fisheries and Conservation Authority

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly. Note under our Working Together Agreement with Natural England, we only inform Natural England of the results of our assessment of the impact of the installation on designated Habitats sites.

Further details along with a summary of consultation comments and our response to the representations we received can be found in Annex 4. We have taken all relevant representations into consideration in reaching our determination.

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it and issued an information notice on 26/09/2013. A copy of the information notice was placed on our public register and sent to Bristol local authority for inclusion on its register, as was the response when received.

In addition to our information notices, we received additional information during the determination from the Applicant:

- information concerning calculation of the site's carbon emissions – received 7 August 2014
- confirmation of nominal site design calculations – received 8 August 2014
- information concerning validation of site baseline reference data – received 13 August 2014

3 The legal framework

The Permit will be granted under Regulation 13 of the EPR. The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* for the purposes of the IED;
- a waste *co-incineration* plant as described by the IED;
- an *operation* covered by the WFD, and
- subject to aspects of other relevant legislation which also have to be addressed.

We address some of the major legal requirements directly where relevant in the body of this document. Other requirements are covered in a section towards the end of this document.

We consider that, in granting the Permit, it will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

The Installation is subject to the EPR because it carries out an activity listed in Part 1 of Schedule 1 to the EPR:

- Section 5.1 Part A(1)(b) – incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.

The IED definition of "waste incineration plants" and "waste co-incineration plants" says that it includes:

> *"all incineration lines or co-incineration lines, waste reception, storage, on site pre-treatment facilities, waste, fuel and air supply systems, boilers, facilities for the treatment of waste gases, on-site facilities for treatment or storage of residues and waste water, stacks, devices for controlling incineration or co-incineration operations, recording and monitoring incineration or co-incineration conditions."*

Many activities which would normally be categorised as "directly associated activities" for EPR purposes (see below), such as air pollution control plant, and the ash storage bunker, are therefore included in the listed activity description.

There is no on-site treatment of incinerator bottom ash (IBA) associated with this installation.

An installation may also comprise "directly associated activities", which at this Installation includes the generation of electricity using a steam turbine, a back-up electricity generator and firewater pumps for emergencies. These activities comprise one installation, because the incineration plant and the steam turbine are successive steps in an integrated activity.

Together, these listed and directly associated activities comprise the Installation.

4.1.2 The Site

The installation is sited at Avonmouth Docks within the operational area of the Port of Bristol. It is bounded to the south by an open area used for temporary storage incidental to Avonmouth dock and a cement storage and despatch operation. To the east, the site is bounded by an active Network Rail railway line; to the north by an open bulk storage area and beyond to oil storage tanks. To the west of the site is an open area currently used for car storage and beyond, the Severn Estuary.

The nearest residential settlement is Avonmouth village, 1 km from the site's southern boundary.

There are a number of ecologically sensitive sites within the distance criteria including the Severn Estuary SAC/SPA/Ramsar/SSSI and the Avon Gorge Woodland SAC/SSSI.

The Severn Estuary is the closest internationally designated site to the proposal and is located approximately 150m west of the facility. It is designated for its passage, overwintering and assemblage of bird populations. The Avon Gorge Woodland SAC is cited for being representative of Tilio-Acerion Forest habitat.

The Applicant submitted a plan which we consider is satisfactory, showing the site of the Installation and its extent. A plan is included in Schedule 7 to the Permit, and the Operator is required to carry on the permitted activities within the site boundary.

Further information on the site is addressed below at 4.3.

4.1.3 What the Installation does

The Applicant has described the facility as a Biomass power station. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the installation is a waste co-incineration plant because notwithstanding the fact that waste will be thermally treated by the process; the process is 'co-incineration' because it is considered that main purpose of this plant is the generation of energy. The objective of the installation is to convert a variety of biomass fuels into electricity using conventional steam cycle technology.

The facility can accept 850,000 tonnes per annum (tpa) of non-hazardous mixed virgin and waste wood which produces approximately 113 MWe of electricity from a steam turbine.

The biomass fuel comprises wood fuel in the form of virgin wood in both chip and pellet form together with a proportion of recycled wood fuel derived from waste sources. The majority of the biomass fuel imported as woodchip or pellets is delivered by sea through the Bristol port companies' infrastructure. The remainder, chiefly recycled wood waste, is delivered either by road or by ship. The fuel is stored under cover or in a silo. The biomass fuel streams are blended on site and fed into a circulating fluidised bed boiler. The heat from the combustion process is used to produce steam and the combustion products are treated by a conventional flue gas treatment process.

The wood delivered by sea is unloaded by grab and crane into a hopper and thence onto a conveyor which discharges onto a second belt conveyor within a fuel screening enclosure where removal of ferrous metals, size screening and weighing operations take place.

Wood delivered by road is unloaded into ground level reception hoppers inside a building and thence to the recycled wood fuel storage silo.

The biomass fuel is combusted in the furnace of the boiler which consists of a fluidised bed. This is a mass of particulate solids (sand, fuel ash and combustion materials) through which an upwardly flowing gas is passed at a velocity sufficient to cause the particles to behave like a liquid. The turbulence in the bed helps to ensure complete combustion and better heat transfer rates. Flue gas and bed material then pass to the cyclones where the larger particles are separated from the flue gas stream. The separated solids are then returned to the furnace.

The boiler is equipped with start-up and support burners fuelled by light fuel oil and are used to generate the temperatures in the system prior to the

introduction of the biomass fuel and to maintain the furnace conditions which may fluctuate according to variations in the calorific content of the biomass fuel.

The heat generated from the combustion is used to produce superheated steam. The steam produced will be supplied to the steam turbine and used to generate electricity.

The flue gas is cleaned using a number of technologies:-

- Selective Non-catalytic Reduction (SNCR) for nitrogen oxide reduction;
- Dry adsorbent injection, for acid gas removal;
- Activated carbon injection for removal of heavy metals;
- Bag filters, for particulate removal.

The SNCR system involves the injection of an aqueous ammonia solution into the furnace: the ammonia reacts with nitrogen oxide and reduces it to nitrogen and water. The ammonia solution is stored in a dedicated tank located in a bund.

Levels of sulphur dioxide, hydrogen chloride and hydrogen fluoride are reduced by the injection of hydrated lime into the flue gas upstream of the bag filter. The hydrated lime is contained in a storage silo prior to use in the injection system.

Activated carbon is injected to control emissions of gaseous heavy metals, dioxins and furans.

A multi-compartment, pulse jet cleaned bag filter system is used for particulate removal.

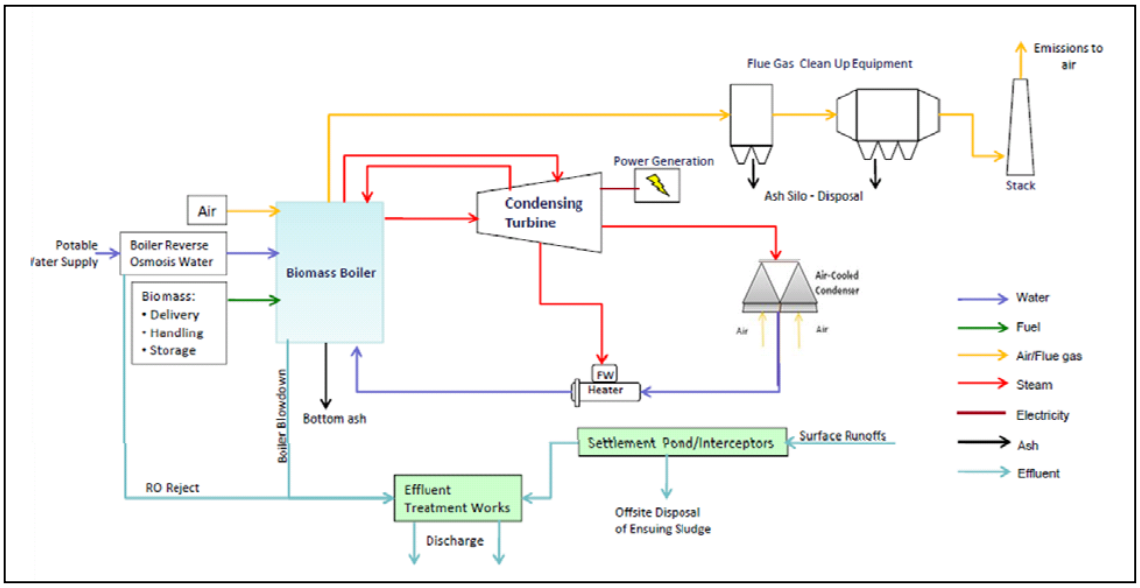
Two types of ash will be generated, one from the combustion process as bottom ash, the other as fly ash – mainly collected from the flue gas bag filters. These ashes will be collected for disposal or recycling, the bottom ash will be collected in skips, the fly ash is collected in a dedicated silo prior to being taken offsite.

The exhaust steam from the turbine is condensed in an air cooled condenser.

Excess uncontaminated roof and surface water is collected and discharged at a controlled rate to the Kingsweston Rhine. Spent reverse osmosis water from the water treatment plant is also discharged to the Kingsweston Rhine. All process effluent drainage including boiler blowdown liquids, reverse osmosis cleaning effluent and general washing and cleaning effluents are piped to the on-site effluent treatment plant for pH neutralisation prior to discharge as trade effluent to Wessex Water Bristol Sewage Treatment Works.

Process Flow Diagram

The process is illustrated in the following simplified flow diagram:



The key features of the Installation can be summarised in the table below.

Key Features		
Parameter	**Detail**	
Material throughput,	850,000 tpa virgin + waste wood	60 – 115 tph virgin + waste wood depending on moisture content and calorific value of biomass fuel
Number of lines	1	
Typical operating hours	8000 – 8760 hours/annum	
Material processed	Virgin woodchips (about 10-20% of the total), recycled woodchips (30-35%), virgin wood pellets (50-75%).	
Calorific value of waste (dry)	Virgin woodchips (17-25 GJ/t), recycled woodchips (17-23 GJ/t), virgin wood pellets (17-25 GJ/t)	
IBA produced	Approximately 1000 – 2000 tpa	
APCR produced	Approximately 7000 – 18000 tpa	
Metals recovered	No estimate given	
Furnace technology	Fluidised bed combustion (FBC)	
Auxiliary Fuel	Gas oil	
Acid gas abatement	Dry	Hydrated lime
NOx abatement	SNCR	Ammonia
Dioxin abatement	Activated carbon	
Reagent consumption (typical values)	Auxiliary Fuel (Gas oil)) Ammonia Hydrated lime Activated carbon Process water	304 tpa 300 tpa 400 tpa 200 tpa 71, 900 tpa
Flue gas recirculation	Yes	
Stack	Height 100 m	Diameter 3.4 m
Flue gas	Flow, 104 Nm^3/s	Velocity, 18 m/s
Electricity generated	113 MWe	904,000 – 989,880 MWh/a total (based on 8,000 to 8760 hours)

Key Features		
Parameter	**Detail**	
Electricity exported	99.9 MWe	799,200 – 875,124 MWh/a (based on 8,000 to 8760 hours)
Steam exported	0 tonnes/hour	0 MWh
Steam conditions	Temperature, 540°C	Pressure 93.2 barg
Waste heat use	None presently proposed	

4.1.4 Key Issues in the Determination

The key issues arising during this determination were emissions to air and the possible effect on the habitat sites and we therefore describe how we determined these issues in most detail in this document.

4.2 The site and its protection

4.2.1 Site setting, layout and history

The installation site is a brownfield site comprising two plots of land separated by an internal port railway line within the operational area of the Port of Bristol. The western plot forms the main fuel storage area and the eastern plot is the location of the electricity generation equipment and ancillary buildings. Previous uses of the site by the Bristol Port company were for the bulk storage of various materials transiting the Port for export or import. The installation also includes a quayside conveyor corridor.

The site is immediately adjacent to the eastern arm of the Avonmouth Dock near the unloading berth and existing bulk cargo handling equipment.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

Physical prevention measures	
Substance or scenario	**Prevention measures**
Fugitive dust emissions	Dust extraction and suppression units will be installed in the fuel handling systems to reduce dust emissions. Fuel store roof structural steelwork will be designed to shed dust. The boiler house will have a central dust extraction system which is separate from that of the fuel transfer system. Trucks bringing recycled wood fuel will be off-loaded within an enclosed building fitted with a water mist system to reduce fugitive emissions of dust. Ash handling systems and storage will be enclosed.
Water run off	Surface water is collected from all hardstanding and road areas and diverted via oil and silt interceptors to swales or attenuation ponds prior to discharge into the Kingsweston Rhine. One attenuation pond is located on the eastern site; and the second attenuation pond is located on the western site. An existing soakaway is located to the south east of the site.
Flood risk	The site is located within the Environment Agency designated Flood Zone 3a, which indicates a high probability of flooding. The plant has been designed to be operational as long as possible in a flood situation, subject to the safety of personnel and availability of

Physical prevention measures	
Substance or scenario	**Prevention measures**
	external services. The major potential cause of flooding is tidal and up to the end of the plant life (2055) a maximum surge level of 9.41m AOD is predicted. All critical equipment is installed above this level and buildings are flood resilient.
Storm waters	Flooding from rainfall sources is predicted not to be as severe as the tidal floods, so the measures in place for tidal protection are protective of rainfall floods.
Firewater	The facility will have a fire main hydrant, water mist and sprinkler system and will use potable water for fire protection. It will have diesel-driven fire water pumps and an on-site firewater storage volume of up to 1,600 m^3 of potable water in two tanks. In the event of a fire, the surface water system is isolated and flow diverted to a FW pump station and tank. Retained water is discharged to the site drainage system if its quality is acceptable or removed by tanker if not.
Spills and leaks; loss of containment; transfer of substances; overfilling of vessels	All storage areas will be bunded and constructed from materials resistant or impervious to the substances contained. Bund capacity will be constructed to contain 110% capacity of the largest tank and 25% of the combined capacity of all the tanks in the bund whichever is the larger. In the event of a large spill the facility's drainage system divert spillage to interceptors which can be isolated. The contents of the spill will be collected and removed by tanker. Vessels containing hazardous substances have level measurement displays, high level alarms and overfill protection devices.
Management controls	
The operator intends to operate the site in accordance with ISO14001, incorporating staff competence training, management and operational procedures including an accident management plan and incident response. Competent trained staff is used for handling, storage and transfer of materials. Materials are handled in contained areas to contain any spillages. Routine inspection of tanks, bunds and container vessels to check for damage and/or deterioration. Water arisings are harvested for use elsewhere in the plant. Spill kits are available to contain and collect small spillage. Condition 1.1.1 of the Permit requires that the scope of the management system shall include measures to minimise the risk of accidents and incidents using competent persons and resources. This includes an emergency action management plan which includes the handling of flood water arisings.	

Article 22(2) of the IED requires the Applicant to provide a baseline report containing at least the information set out in paragraphs (a) and (b) of the Article before starting operation.

The Applicant has submitted a site condition report which includes a report on the baseline conditions as required by Article 22. We have reviewed that report and consider that it adequately describes the condition of the soil and groundwater prior to the start of operations. It is understood that further site investigation data and validation of the site prior to the development is proposed and a validation report to be submitted following this work. We

consider that the validation report would provide a better assessment of the baseline conditions at the site. We have therefore set a pre-operational condition (PO6) requiring the Operator to provide this information prior to the commencement of operations. The baseline report is an important reference document in the assessment of contamination that might arise during the operational lifetime of the installation and at cessation of activities at the installation.

In respect of the protection of the soil and groundwater and the monitoring regime to demonstrate continued protection, pre-operational condition PO7 has been included in the Permit requiring the Operator to submit a written protocol to the Agency that demonstrates how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The protocol shall be implemented in accordance with the written agreement from the Agency.

4.2.3 Closure and decommissioning

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place for the closure and decommissioning of the Installation, as referred to in Section 16 of the supporting information document (AVON-R-009) of the Application. Pre-operational condition PO1 requires the Operator to have an Environmental Management System in place before the Installation is operational, and this will include a site closure plan.

At the definitive cessation of activities, the Operator has to satisfy us that the necessary measures have been taken so that the site ceases to pose a risk to soil or groundwater, taking into account both the baseline conditions and the site's current or approved future use. To do this, the Operator has to apply to us for surrender, which we will not grant unless and until we are satisfied that these requirements have been met.

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

We are satisfied that the Applicant is the person who will have control over the operation of the Installation after the granting of the Permit and that the Applicant will be able to operate the Installation so as to comply with the conditions included in the Permit.

The co-incineration of waste is not a specified waste management activity (SWMA). The Environment Agency has considered whether any of the other activities taking place at the Installation are SWMAs and is satisfied that none is taking place.

We are satisfied that the Applicant's submitted Opra profile is accurate.

The Opra score will be used as the basis for subsistence and other charging, in accordance with our Charging Scheme. Opra is the Environment Agency's method of ensuring application and subsistence fees are appropriate and proportionate for the level of regulation required.

4.3.2 Management

The Applicant has stated in the Application that they will implement an Environmental Management System (EMS) that will be certified under ISO14001. A pre-operational condition (PO1) is included requiring the Operator to provide a summary of the EMS prior to commissioning of the plant and to make available for inspection all EMS documentation. The Environment Agency recognises that certification of the EMS cannot take place until the Installation is operational. An improvement condition (IC4) is included requiring the Operator to report progress towards gaining accreditation of its EMS.

We are satisfied that appropriate management systems and management structures will be in place for this Installation, and that sufficient resources are available to the Operator to ensure compliance with all the Permit conditions.

4.3.3 Site security

Having considered the information submitted in the Application, we are satisfied that appropriate infrastructure and procedures are in place to ensure that the site remains secure.

4.3.4 Accident management

The Applicant has not submitted an Accident Management Plan. However, having considered the other information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. An Accident Management Plan will form part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO1).

4.3.5 Off-site conditions

We do not consider that any off-site conditions are necessary.

4.3.6 Operating techniques

We have specified that the Applicant must operate the Installation in accordance with the following documents contained in the Application:

Description	Parts Included	Justification
The Application	Supporting Information Document AVON-R-009 in response to section 3a of application form B3 – technical standards, the installation, management systems and raw materials. Document includes a description of: plant capacity • the waste feed cessation system • start-up and shut-down • energy recovery from the installation • temperature, oxygen, water vapour and pressure at air release sampling points • continuous measurement of flow and temperature at the discharge points to sewer Section entitled Environmental Risk Assessment including a description of: • Odour management • Noise management	Sets out the method of operation, the proposed management systems and raw material specifications

	• Fugitive emission management	

The details set out above describe the techniques that will be used for the operation of the Installation that have been assessed by the Environment Agency as BAT; they form part of the Permit through Permit condition 2.3.1 and Table S1.2 in the Permit Schedules.

We have also specified the following limits and controls on the use of raw materials and fuels:

Raw Material or Fuel	Specifications	Justification
Gas Oil	< 0.1% sulphur content	As required by Sulphur Content of Liquid Fuels Regulations.

Article 45(1) of the IED requires that the Permit must include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2005/532/EC, if possible, and containing information on the quantity of each type of waste, where appropriate. The Application contains a list of those wastes coded by the European Waste Catalogue (EWC) number, which the Applicant will accept in the waste streams entering the plant and which the plant is capable of burning in an environmentally acceptable way. We have specified the permitted waste types, descriptions and where appropriate quantities which can be accepted at the installation in Table S2.2.

We are satisfied that the Applicant can accept the wastes contained in Table S2.2 of the Permit because: -

- the wastes are all categorised as non-hazardous in the European Waste Catalogue and are capable of being safely burnt at the installation.
- these wastes are likely to be within the design calorific value (CV) range for the plant;
- these wastes are unlikely to contain harmful components that cannot be safely processed at the Installation.

We have limited the capacity of the Installation to 850,000 tonnes per annum. This is based on the installation operating 8,000 – 8760 hours per year at a nominal capacity of 60 – 115 tonnes per hour (depending on the moisture content and calorific value of the feedstock/waste).

The Installation will be designed, constructed and operated using BAT for the incineration of the permitted wastes. We are satisfied that the operating and abatement techniques are BAT for incinerating these types of waste. Our assessment of BAT is set out later in this document.

4.3.7 Energy efficiency

(i) Consideration of energy efficiency

We have considered the issue of energy efficiency in the following ways:

- The use of energy within, and generated by, the Installation which are normal aspects of all EPR permit determinations. This issue is dealt with in this section.

- The extent to which the Installation meets the requirements of Article 50(5) of the IED, which requires "any heat generated by waste incineration plants and waste co-incineration plants shall be recovered as far as practicable". This issue is covered in this section.
- The combustion efficiency and energy utilisation of different design options for the Installation are relevant considerations in the determination of BAT for the Installation, including the Global Warming Potential of the different options. This aspect is covered in the BAT assessment in section 6 of this decision document.

(ii) Use of energy within the Installation

Having considered the information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that energy is used efficiently within the Installation.

The Application details a number of measures that will be implemented at the Installation in order to increase its energy efficiency, including efficient boiler heat transfer design, use of adequate insulation, use of high efficiency motors, preventative and planned maintenance, regular cleaning of heat exchangers and monitoring of site energy usage.

(iii) Generation of energy within the Installation - Compliance with Article 50(5) of the IED

Article 50(5) of the IED requires that "*the heat generated during the incineration and co-incineration process is recovered as far as practicable*".

Our draft CHP Ready Guidance (Dec 2012) considers that BAT for energy efficiency for Energy from Waste (EfW) plant is the use of CHP in circumstances where there are technically and economically viable opportunities for the supply of heat from the outset.

The term CHP in this context represents a plant which also provides a supply of heat from the electrical power generation process to either a district heating network or to an industrial / commercial building or process. However, it is recognised that opportunities for the supply of heat do not always exist from the outset (i.e. when a plant is first consented, constructed and commissioned).

In cases where there are no immediate opportunities for the supply of heat from the outset, the Environment Agency considers that BAT is to build the plant to be CHP Ready (CHP-R) to a degree which is dictated by the likely future opportunities which are technically viable and which may, in time, also become economically viable.

The BREF says that where a plant generates electricity only, it is BAT to recover 0.4 – 0.65 MWh/ tonne of waste (based on LCV of 10.4 MJ/kg). Our technical guidance note, SGN EPR S5.01, states that where electricity only is generated, 5–9 MW of electricity should be recoverable per 100,000 tonnes/annum of waste (which equates to 0.4 – 0.72 MWh/tonne of waste).

This Installation will generate electricity only and has been specified to maximise electrical output with little or no use of waste heat. The Sankey diagram in section 13 of the Application shows 111 MW of electricity produced

for an annual burn of 850,000 tonnes, which represents 13 MW per 100,000 tonnes/yr of waste burned (1.1 MWh/tonne of waste). The Installation is therefore in line with the indicative BAT range.

The SGN and Chapter IV of the IED both require that, as well as maximising the primary use of heat to generate electricity, waste heat should be recovered as far as practicable.

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. The Applicant carried out a feasibility study, which showed there was potential to provide district heating to local businesses; suitable opportunities are being explored, though there are no firm commitments at this stage. There is provision within the design of the steam turbine to extract low-grade steam for a district heating scheme. Establishing a district heating network to supply local users would involve significant technical, financial and planning challenges such that this is not seen as a practicable proposition at present.

We consider that, within the constraints of the location of the Installation explained above, the Installation will recover heat as far as practicable, and therefore that the requirements of Article 50(5) are met.

(iv) R1 Calculation

The R1 calculation does not form part of the matters relevant to our determination. It is however a general indicator that the installation is achieving a high level of energy recovery.

The Applicant has not presented an R1 calculation with this application, nor have we received a separate application for a determination on whether the installation is a recovery or disposal facility.

Note that the availability or non-availability of financial incentives for renewable energy such as the ROC and RHI schemes is not a consideration in determining this application.

(v) Choice of Steam Turbine

As a new development the proposed installation will be designed for the highest practical energy efficiency. Electricity will be generated through the expansion of the high pressure steam within the steam turbine, driving an electrical generator. The steam turbine will be designed for continuous operation. The turbine will be directly coupled to the generator with no gearbox and therefore no related energy losses.

(vi) Choice of Cooling System

The chosen cooling system for the installation is an air cooled condenser unit. The disadvantages are a slightly reduced electrical output, and a need to dispose of boiler blowdown and rainwater that could otherwise be used in the cooling system. The advantages cited for this, over using a cooling water tower with water sourced from the docks, include a reduced water quality risk, removal of water treatment chemical requirement, no requirement for water pipes and pumps for the dock water and the removal of an additional contractual relationship for the abstraction and associated abstraction license and effluent discharge.

Air cooled condenser cooling systems have minimal visual impact with minimal visible plumes.

There are no site-specific considerations that require the imposition of standards beyond indicative BAT, and so the Environment Agency accepts that the Applicant's proposals represent BAT for this Installation.

(vii) Permit conditions concerning energy efficiency

Pre-operational condition PO2 requires the Operator to carry out a comprehensive review of the available heat recovery options prior to commissioning, in order to ensure that waste heat from the plant is recovered as far as possible.

Conditions 1.2.2 and 1.2.3 have also been included in the Permit, which require the Operator to review the options available for heat recovery on an ongoing basis, and to provide and maintain the proposed steam/hot water pass-outs.

The Operator is required to report energy usage and energy generated under condition 4.2 and Schedule 4. The following parameters are required to be reported: total electrical energy generated; electrical energy exported and total energy usage. Together with the total biomass fuel and waste burned per year, this will enable the Environment Agency to monitor energy recovery efficiency at the Installation and take action if at any stage the energy recovery efficiency is less than proposed.

There are no site-specific considerations that require the imposition of standards beyond indicative BAT, and so the Environment Agency accepts that the Applicant's proposals represent BAT for this Installation.

4.3.8 Efficient use of raw materials

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place to ensure the efficient use of raw materials and water.

The Operator is required to report with respect to raw material usage under condition 4.2 and Schedule 4, including consumption of lime, activated carbon and ammonia used per tonne of fuel burned. This will enable the Environment Agency to assess whether there have been any changes in the efficiency of the air pollution control plant, and the operation of the SNCR to abate NOx. These are the most significant raw materials that will be used at the Installation, other than the waste feed itself (addressed elsewhere). The efficiency of the use of auxiliary fuel will be tracked separately as part of the energy reporting requirement under condition 4.2.1. Optimising reagent dosage for air abatement systems and minimising the use of auxiliary fuels is further considered in the section on BAT.

4.3.9 Avoidance, recovery or disposal with minimal environmental impact of wastes produced by the activities

This requirement addresses wastes produced at the Installation and does not apply to the waste being treated there. The principal waste streams the Installation will produce are bottom ash and air pollution control residues.

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree of burnout of the ash in the furnace, which results in a material that is both reduced in volume and in chemical reactivity. Condition 3.1.3 and associated Table S3.5 specify limits for loss on ignition (LOI) of <5% in bottom ash. Compliance with this limit will demonstrate that good combustion control and waste burnout is being achieved in the furnace and waste generation is being avoided where practicable.

Incinerator bottom ash (IBA) will normally be classified as non-hazardous waste. However, IBA is classified on the European List of Wastes as a “mirror entry”, which means IBA is a hazardous waste if it possesses a hazardous property relating to the content of dangerous substances. Monitoring of incinerator ash will be carried out in accordance with the requirements of Article 53(3) of IED. Classification of IBA for its subsequent use or disposal is controlled by other legislation and so is not duplicated within the permit.

Air pollution control (APC) residues from flue gas treatment are hazardous waste and therefore must be sent for disposal to a landfill site permitted to accept hazardous waste, or to an appropriately permitted facility for hazardous waste treatment. The amount of APC residues is minimised through optimising the performance of the air emissions abatement plant.

In order to ensure that the IBA and APC residues are adequately characterised, pre-operational condition PO3 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.5 requires the Operator to carry out an ongoing programme of monitoring.

Having considered the information submitted in the Application, we are satisfied that the waste hierarchy referred to in Article 4 of the WFD will be applied to the generation of waste and that any waste generated will be treated in accordance with this Article.

We are satisfied that waste from the Installation that cannot be recovered will be disposed of using a method that minimises any impact on the environment. Standard condition 1.4.1 will ensure that this position is maintained.

5. Minimising the Installation's environmental impact

Regulated activities can present different types of risk to the environment, these include odour, noise and vibration; accidents, fugitive emissions to air and water; as well as point source releases to air, discharges to ground or groundwater, global warming potential and generation of waste. Consideration may also have to be given to the effect of emissions being subsequently deposited onto land (where there are ecological receptors). All these factors are discussed in this and other sections of this document.

For an installation of this kind, the principal emissions are those to air, although we also consider those to land and water.

The next sections of this document explain how we have approached the critical issue of assessing the likely impact of the emissions to air from the Installation on human health and the environment and what measures we are requiring to ensure a high level of protection.

5.1 Assessment Methodology

5.1.1 Application of Environment Agency H1 Guidance

A methodology for risk assessment of point source emissions to air, which we use to assess the risk of applications we receive for permits, is set out in our Horizontal Guidance Note H1 and has the following steps:

- Describe emissions and receptors
- Calculate process contributions
- Screen out insignificant emissions that do not warrant further investigation
- Decide if detailed air modelling is needed
- Assess emissions against relevant standards
- Summarise the effects of your emissions

The H1 methodology uses a concept of "process contribution (PC)", which is the estimated concentration of emitted substances after dispersion into the receiving environmental media at the point where the magnitude of the concentration is greatest. The guidance provides a simple method of calculating PC primarily for screening purposes and for estimating process contributions where environmental consequences are relatively low. It is based on using dispersion factors. These factors assume worst case dispersion conditions with no allowance made for thermal or momentum plume rise and so the process contributions calculated are likely to be an overestimate of the actual maximum concentrations. More accurate calculation of process contributions can be achieved by mathematical dispersion models, which take into account relevant parameters of the release and surrounding conditions, including local meteorology – these techniques are expensive but normally lead to a lower prediction of PC.

5.1.2 Use of Air Dispersion Modelling

For incineration applications, we normally require the Applicant to submit a full air dispersion model as part of their application. Air dispersion modelling

enables the process contribution to be predicted at any environmental receptor that might be impacted by the plant.

Once short-term and long-term PCs have been calculated in this way, they are compared with Environmental Quality Standards (EQS) referred to as “benchmarks” in the H1 Guidance.

Where an EU EQS exists, the relevant standard is the EU EQS. Where an EU EQS does not exist, our guidance sets out a National EQS (also referred to as Environmental Assessment Level - EAL) which has been derived to provide a similar level of protection to Human Health and the Environment as the EU EQS levels. In a very small number of cases, e.g. for emissions of Lead, the National EQS is more stringent than the EU EQS. In such cases, we use the National EQS standard for our assessment.

National EQSs do not have the same legal status as EU EQSs, and there is no explicit requirement to impose stricter conditions than BAT in order to comply with a national EQS. However, national EQSs are a standard for harm and any significant contribution to a breach is likely to be unacceptable.

PCs are considered **Insignificant** if:

- the **long term** process contribution is less than **1%** of the relevant EQS; and
- the **short term** process contribution is less than **10%** of the relevant EQS.

The **long term** 1% process contribution insignificance threshold is based on the judgements that:

- It is unlikely that an emission at this level will make a significant contribution to air quality;
- The threshold provides a substantial safety margin to protect health and the environment.

The **short term** 10% process contribution insignificance threshold is based on the judgements that:

- spatial and temporal conditions mean that short term process contributions are transient and limited in comparison with long term process contributions;
- the proposed threshold provides a substantial safety margin to protect health and the environment.

Where an emission is screened out in this way, we would normally consider that the Applicant’s proposals for the prevention and control of the emission to be BAT. That is because if the impact of the emission is already insignificant, it follows that any further reduction in this emission will also be insignificant.

However, where an emission cannot be screened out as insignificant, it does not mean it will necessarily be significant.

For those pollutants which do not screen out as insignificant, we determine whether exceedences of the relevant EQS are likely. This is done through detailed audit and review of the Applicant’s air dispersion modelling taking background concentrations and modelling uncertainties into account. Where

an exceedence of an EU EQS is identified, we may require the Applicant to go beyond what would normally be considered BAT for the Installation or we may refuse the application. Whether or not exceedences are considered likely, the application is subject to the requirement to operate in accordance with BAT.

This is not the end of the risk assessment, because we also take into account local factors (for example, particularly sensitive receptors nearby such as a SSSIs, SACs or SPAs). These additional factors may also lead us to include more stringent conditions than BAT.

If, as a result of reviewing of the risk assessment and taking account of any additional techniques that could be applied to limit emissions, we consider that emissions **would cause significant pollution**, we would refuse the Application.

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in Sections 8 and 9 of the supporting information document (AVON-R-009) and Appendix 10 (AVON-R-013) of the Application. The assessment comprises:

- An H1 screening assessment of emissions to air from the operation of the incinerator.
- Dispersion modelling of emissions to air from the operation of the co-incinerator.
- A study of the impact of emissions on nearby sensitive habitat / conservation sites.

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the co-incinerator chimney and its impact on local air quality. The impact on conservation sites is considered in section 5.4.

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS versions 4.2 and 5 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at Avonmouth between 2007 and 2011. This is the nearest weather station to the installation site. The impact of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling.

The air impact assessments, and the dispersion modelling upon which they were based, employed the following assumptions.

- First, they assumed that the ELVs in the Permit would be the maximum permitted by Article 46(2) of the IED. These substances are:
    - Oxides of nitrogen (NOx), expressed as NO_2
    - Total dust
    - Carbon monoxide (CO)
    - Sulphur dioxide (SO_2)
    - Hydrogen chloride (HCl)

    - Hydrogen fluoride (HF)
    - Metals (Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium)
    - Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)
    - Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC)
- Second, they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate
- Third, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically ammonia (NH_3) and Polycyclic Aromatic Hydrocarbons (PAH). Emission rates used in the modelling have been drawn from data in the Waste Incineration BREF and are considered further in section 5.2.5.

We are in agreement with this approach. The assumptions underpinning the model have been checked and are reasonably precautionary.

The Applicant has assessed data on background concentrations of pollutants from a number of available sources. These include monitoring undertaken by Bristol City Council at a number of locations in and around Bristol. The applicant has also drawn information from Background Air Pollution Maps published by DEFRA.

As well as calculating the peak ground level concentration, the Applicant has modelled the concentration of key pollutants at a number of specified locations within the surrounding area.

The way in which the Applicant used dispersion models, its selection of input data, use of background data and the assumptions it made have been reviewed by the Environment Agency's modelling specialists to establish the robustness of the Applicant's air impact assessment. The output from the model has then been used to inform further assessment of health impacts and impact on habitats and conservation sites.

Our review of the Applicant's assessment leads us to agree with the Applicant's conclusions. We have also audited the air quality and human health impact assessment and similarly agree that the conclusions drawn in the reports were acceptable.

The Applicant's modelling predictions are summarised in the following sections.

5.2.1 Assessment of Air Dispersion Modelling Outputs

The Applicant's modelling PC predictions are summarised in the tables below. The figures shown indicate the predicted peak ground level exposure to pollutants in ambient air. Whilst we have used the Applicant's modelling predictions in the table below, we have made our own simple verification calculation of the percentage process contribution and predicted environmental concentration. These are the numbers shown in the tables below and so may be very slightly different to those shown in the Application.

Any such minor discrepancies do not materially impact on our conclusions. Where a PC is indicated as being less than the relevant insignificance threshold, no further analysis of PEC has been carried out.

Predicted Long Term Impacts

Pollutant	EQS / EAL	PC ($\mu g/m^3$)	PC as % of EQS / EAL	Background Conc ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC as % EQS / EAL
NO_2	40	2.2	5.5	26.1	28.3	70.8
PM_{10}	40	0.31	0.78	--	--	--
$PM_{2.5}$	25	0.31	1.24	10.5	10.81	43.2
TOC [1]	5	0.31	6.2	0.3	0.610	12.2
HF	16	0.023	0.14	--	--	--
Cadmium	0.005	0.00039	7.8	3.2×10^{-4}	0.00071	14.2
Mercury	0.25	0.00078	0.31	--	--	--
Antimony	5.0	0.0078	0.16	--	--	--
Arsenic	0.003	0.00086	28.67	0.00066	0.00152	50.7
Chromium	5.0	0.0078	0.16	--	--	--
Chromium VI	0.0002	5.5×10^{-7}	0.27	--	--	--
Copper	10	0.0078	0.08	--	--	--
Lead	0.5	0.00086	0.34	--	--	--
Manganese	0.15	0.0078	5.20	6.2×10^{-6}	0.007806	5.20
Nickel	0.02	0.00086	4.30	0.0016	0.00246	12.3
Vanadium	5.0	0.0078	0.16	--	--	--
PAH [2]	0.00025	0.0000014	0.56	--	--	--
Ammonia	180	0.23	0.13	--	--	--
PCBs	0.2	1.54×10^{-7}	0.00008	--	--	--
Dioxins		1.60×10^{-10}	--	8.5×10^{-9}	8.6×10^{-9}	--

Note [1]: TOC as benzene
Note [2]: PAH as benzo[a]pyrene

Predicted Short Term Impacts

Pollutant	EQS / EAL	PC ($\mu g/m^3$)	PC as % of EQS / EAL	Background Conc (LTx2)	PEC ($\mu g/m^3$)	PEC as % EQS / EAL
NO_2	200	10.7	5.4	--	--	--
PM_{10}	50	1	2.00	--	--	--
SO_2 (15 min)	266	24.9	9.4	--	--	--
SO_2 (1 hr)	350	22.8	6.51	--	--	--
SO_2 (24 hr)	125	15.9	12.7	4	19.9	15.9
CO (8 hr)	10000	10.8	0.11	--	--	--
HCl (1 hr)	750	2.6	0.35	--	--	--
HF	160	0.26	0.1625	--	--	--
Mercury	7.5	0.0086	0.11	--	--	--
Antimony	150	0.086	0.06	--	--	--
Chromium	150	0.086	0.06	--	--	--
Copper	200	0.086	0.04	--	--	--
Manganese	1500	0.086	0.01	--	--	--
Vanadium	1	0.06	6.0	--	--	--
Ammonia	2500	2.6	0.10	--	--	--
PCBs	6	1.61×10^{-6}	0.00008	--	--	--

(i) Screening out emissions which are insignificant

From the tables above the following emissions can be screened out as insignificant in that the process contribution is < 1% of the long term EQS/EAL and <10% of the short term EAQ/EAL. These are:

- In respect of long term impacts: PM_{10}, HF, Hg, Sb, Cr, Cr VI, Cu, Pb, V, PAH, NH_3 and PCBs
- In respect of short term impacts: all emissions except 24 hour SO_2 impact

Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation subject to the detailed audit referred to below.

(ii) Emissions unlikely to give rise to significant pollution

Also from the tables above the following emissions (which were not screened out as insignificant) have been assessed as being unlikely to give rise to significant pollution in that the predicted environmental concentration is less than 100% (taking expected modelling uncertainties into account) of both the long term and short term EQS/EAL

- In respect of long term impacts: NO_2, $PM_{2.5}$, TOC, Cd, As, Mn and Ni
- In respect of short term impacts: 24 hour SO_2 impact

For these emissions, we have carefully scrutinised the Applicant's proposals to ensure that they are applying the Best Available Techniques to prevent and minimise emissions of these substances. This is reported in section 6 of this document. Improvement condition IC5 requires that an environmental impact assessment of NO_2, $PM_{2.5}$, TOC, Cd, As, Mn and Ni is carried out by the Applicant when monitoring in the first year of operation to produce actual site-specific results. Even so, from the table above, the emissions are not expected to result in the EAL being exceeded.

Thallium and Cobalt do not have an EAL. As shown below, the process contribution of these metals is similar to that of the other metals and we consider the emissions of these metals to be not significant.

Pollutant	EQS / EAL	Background Conc	PC
Cobalt	None	None available	0.0078
Thallium	None	None available	0.00078

(iii) Emissions requiring further assessment

All emissions either screen out as insignificant or where they do not screen out as insignificant are considered unlikely to give rise to significant pollution.

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

The impact on air quality from NO_2 emissions has been assessed against the EU EQS of 40 $\mu g/m^3$ as a long term annual average and a short term hourly average of 200 $\mu g/m^3$. The model assumes a 70% NOx to NO_2 conversion for the long term and 35% for the short term assessment in line with Environment Agency guidance on the use of air dispersion modelling.

The above tables show that the peak long term PC is greater than 1% of the EUEQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EUEQS being exceeded. The peak short term PC is less than 10% of the EU EQS and so can be screened out as insignificant.

(ii) Particulate matter PM_{10} and $PM_{2.5}$

The impact on air quality from particulate emissions has been assessed against the EQS for PM_{10} (particles of 10 microns and smaller) and $PM_{2.5}$ (particles of 2.5 microns and smaller). For PM_{10}, the EUEQS are a long term annual average of 40 $\mu g/m^3$ and a short term daily average of 50 $\mu g/m^3$. For $PM_{2.5}$ the EUEQS of 25 $\mu g/m^3$ as a long-term annual average to be achieved by 2010 as a Target Value and by 2015 as a Limit Value has been used.

The Applicant's predicted impact of the Installation against these EQSs is shown in the tables above. The assessment assumes that all particulate emissions are present as PM_{10} for the PM_{10} assessment and that all particulate emissions are present as $PM_{2.5}$ for the $PM_{2.5}$ assessment.

The above assessment is considered to represent a worst case assessment in that:

- It assumes that the plant emits particulates continuously at the IED Annex VI limit for total dust, whereas actual emissions from similar plant are normally lower
- It assumes all particulates emitted are below either 10 microns (PM_{10}) or 2.5 microns ($PM_{2.5}$), when some are expected to be larger.

We have reviewed the Applicant's particulate matter impact assessment and are satisfied in the robustness of the Applicant's conclusions.

The above assessment shows that the predicted process contribution for emissions of PM_{10} are below 1% of the long term EQS and below 10% of the short term EQS and so can be considered insignificant. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of PM_{10} particulates to be BAT for the Installation.

The above assessment also shows that the predicted process contribution for emissions of $PM_{2.5}$ is slightly above 1% EQS and so cannot be considered insignificant. However, the assessment is based very much on a worst case scenario, and in reality the process contribution is expected to be <1% of the EQS. Even so, from the table above, the emission is not expected to result in the EQS being exceeded.

There is currently no emission limit prescribed nor any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition has been included (IC1) that will require a full analysis of particle size distribution in the flue gas, and hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however, the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions as explained in section 5.3.3.

(iii) Acid gases, SO_2, HCl and HF

From the tables above, emissions of HCl and HF can be screened out as insignificant in that the process contribution is <10% of the short term EQS/EAL. There is no long term EQS/EAL for HCl. HF has 2 assessment criteria – a 1-hr EAL and a monthly EAL – the process contribution is <1% of the monthly EAL and so the emission is insignificant if the monthly EAL is interpreted as representing a long term EAL.

There is no long term EAL for SO_2 for the protection of human health. Protection of ecological receptors from SO_2 for which there is a long term EAL is considered in section 5.4.

Whilst SO_2 emissions cannot be screened out as insignificant, the Applicant's modelling shows that the installation is unlikely to result in a breach of the EAL or EUEQS. The Applicant is required to prevent, minimise and control SO_2 emissions using the best available techniques, this is considered further in Section 6. We are satisfied that SO_2 emissions will not result in significant pollution.

(iv) Emissions to Air of CO, TOCs, PAHs, PCBs, Dioxins and NH_3

CO: The above tables show that for CO the peak short term PC is less than 10% of the EAL/EQS and so can be screened out as insignificant.

TOC: The above tables show that for TOC emissions, the peak long term PC is greater than 1% of the EAL/EQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EQS being exceeded.

The Applicant has used the EQS for benzene for their assessment of the impact of TOC. This is based on benzene having the lowest EQS of organic species likely to be present in TOC (other than PAH, PCBs, dioxins and furans).

PAHs and PCBs: The Applicant has also used the EQS for benzo[a]pyrene (BaP) for their assessment of the impact of PAH. We agree that the use of the BaP EQS is sufficiently precautionary. The above tables show that for PAH and PCB emissions, the peak long term PC is less than 1% of the EAL/EQS and for PCB emissions the peak short term PC is less than 10% of the EAL/EQS. These emissions therefore can be screened out as insignificant.

Dioxin: There is no EAL for dioxins and furans as the principal exposure route for these substances is by ingestion and the risk to human health is through the accumulation of these substances in the body over an extended period of time. This issue is considered in more detail in section 5.3.

NH_3: The ammonia emission is based on a release concentration of 15 mg/m^3. We are satisfied that this level of emission is consistent with the operation of a well controlled SNCR NOx abatement system.

Whilst all emissions cannot be screened out as insignificant, the Applicant's modelling shows that the installation is unlikely to result in a breach of the EAL. The Applicant is required to prevent, minimise and control PAH and TOC emissions using the best available techniques, this is considered further in Section 6. We are satisfied that PAH and TOC emissions will not result in significant pollution.

In summary for the above emissions to air, we have carefully scrutinised the Applicant's proposals to ensure that they are applying the Best Available Techniques to prevent and minimise emissions of these substances. This is reported in section 6 of this document. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of CO, TOC, NH_3, PAHs and PCBs to be BAT for the Installation. Dioxins and furans are considered further in section 5.3.2.

5.2.3 Assessment of Emission of Metals

The Applicant has assessed the impact of metal emissions to air, as previously described.

Annex VI of IED sets three limits for metal emissions:

- An emission limit value of 0.05 mg/m^3 for mercury and its compounds (formerly WID group 1 metal).
- An aggregate emission limit value of 0.05 mg/m^3 for cadmium and thallium and their compounds (formerly WID group 2 metals).

- An aggregate emission limit of 0.5 mg/m^3 for antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel and vanadium and their compounds (formerly WID group 3 metals).

In addition the UK is a Party to the Heavy Metals Protocol within the framework of the UN-ECE Convention on long-range trans-boundary air pollution. Compliance with the IED Annex VI emission limits for metals along with the Application of BAT also ensures that these requirements are met.

The applicant has taken information from Environment agency guidance on emissions of metals which has been derived from municipal waste incinerators. The applicant states that due to the nature of the fuel, emissions from municipal waste incinerators are likely to be substantially higher than for the Applicant's facility utilising biomass fuel.

In section 5.2.1 above, the following emissions of metals were screened out as insignificant:

- On a short term basis: All metals.
- On a long term basis: Hg, Sb, Cr, Cu, Pb and V

Also in section 5.2.1, the following emissions of metals whilst not screened out as insignificant were assessed as being unlikely to give rise to significant pollution:

- On a long term basis: Cd, As, Mn and Ni

There were no metal emissions requiring further assessment. From this assessment the Applicant has concluded that exceedences of the EAL for all metals are not likely to occur. The installation has been assessed as meeting BAT for control of metal emissions to air (see section 6 of this document). The Environment Agency's experience of regulating incineration plant is that emissions of metals are in any event below the Annex VI limits set in IED We therefore agree with the Applicant's conclusions.

The 2009 report of the Expert Panel on Air Quality Standards (EPAQS) – "Guidelines for Metal and Metalloids in Ambient Air for the Protection of Human Health", sets non statutory ambient air quality guidelines for Arsenic, Nickel and Chromium VI. These guidelines have been incorporated as EALs in the revised H1 Guidance issued by the Agency in 2010.

Chromium VI is not specifically referenced in Annex VI of IED, which includes only total Chromium as one of the nine Group 3 metals, the impact of which has been assessed above. The EPAQS guidelines refer only to that portion of the metal emissions contained within PM_{10} in ambient air. The guideline for Chromium (VI) is 0.2 ng/m^3.

- Measurement of Chromium VI at the levels anticipated at the stack emission points is expected to be difficult, with the likely levels being below the level of detection by the most advanced methods. We have considered the concentration of total chromium and chromium VI in the APC residues collected upstream of the emission point for existing Municipal Waste Incinerators and have assumed these to be similar to the particulate matter released from the emission point. This data

shows that the mean CrVI emission concentration (based on the bag dust ratio) is $3.5 * 10^{-5}$ mg/m^3 (max $1.3 * 10^{-4}$).

Based on this data, we consider it remains a conservative assumption for the Applicant to consider that the CrVI emission concentration will be 5.5×10^{-7} mg/m^3 .

There is little data available on the background levels of CrVI; so we have assumed this to be 20% of the total Cr background level, 20% is the typical value of CrVI in total Cr reported in the environment in the EPAQS Guidelines.

The Applicant has used the above data to model the predicted CrVI impact. The PC is predicted as 0.27% of the EAL. This assessment shows that emissions of Chromium VI are likely to be insignificant. We agree with the Applicant's conclusions.

5.2.4 Consideration of Local Factors

(i) Impact on Air Quality Management Areas (AQMAs)

Bristol City Council has declared one Air Quality Management Area (AQMA) with respect to Nitrogen Dioxide This is located as follows:

- City Centre and arterial routes

There was a previously declared AQMA for the Avonmouth road area that was revoked in 2008, but was also assessed.

From the Applicant's model, the process contribution at all points within each of the AQMAs is predicted to be well below 1% of the EUEQS and can therefore be considered insignificant.

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

The Environment Agency has a statutory role to protect the environment and human health from all processes and activities it regulates. We assessed the effects on human health for this application in the following ways:

i) Applying Statutory Controls

The plant will be regulated under EPR. These regulations include the requirements of relevant EU Directives, notably, the industrial emissions directive (IED), the waste framework directive (WFD), and ambient air directive (AAD).

The main conditions in an EfW permit are based on the requirements of the IED. Specific conditions have been introduced to specifically ensure compliance with the requirements of Chapter IV. The aim of the IED is to prevent or, where that is not practicable, to reduce emissions to air, water and land and prevent the generation of waste, in order to achieve a high level of protection of the environment taken as a whole. IED achieves this aim by setting operational conditions, technical requirements and emission limit values to meet the requirements set out in Articles 11 and 18 of the IED. These requirements include the application of BAT, which may in some circumstances dictate tighter emission limits and controls than those set out in Chapter IV of IED on waste incineration and co-incineration plants. The

assessment of BAT for this installation is detailed in section 6 of this document.

ii) Environmental Impact Assessment

Industrial activities can give rise to odour, noise and vibration, accidents, fugitive emissions to air and water, releases to air (including the impact on Photochemical Ozone Creation Potential (POCP)), discharges to ground or groundwater, global warming potential and generation of waste. For an installation of this kind, the principal environmental effects are through emissions to air, although we also consider all of the other impacts listed. Section 5.1 and 5.2 above explain how we have approached the critical issue of assessing the likely impact of the emissions to air from the Installation on human health and the environment and any measures we are requiring to ensure a high level of protection.

iii) Expert Scientific Opinion

We take account of the views of national and international expert bodies. Following is a summary of some of the publications which we have considered (in no particular order).

An independent review of evidence on the health effects of municipal waste incinerators was published by **DEFRA** in 2004. It concluded that there was no convincing link between the emissions from MSW incinerators and adverse effects on public health in terms of cancer, respiratory disease or birth defects. On air quality effects, the report concluded "Waste incinerators contribute to local air pollution. This contribution, however, is usually a small proportion of existing background levels which is not detectable through environmental monitoring (for example, by comparing upwind and downwind levels of airborne pollutants or substances deposited to land). In some cases, waste incinerator facilities may make a more detectable contribution to air pollution. Because current MSW incinerators are located predominantly in urban areas, effects on air quality are likely to be so small as to be undetectable in practice."

HPA (now PHE) in 2009 states that "The Health Protection Agency has reviewed research undertaken to examine the suggested links between emissions from municipal waste incinerators and effects on health. While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable".

Policy Advice from Government also points out that the minimal risk from modern incinerators. Paragraph 22 (Chapter 5) of WS2007 says that "research carried out to date has revealed no credible evidence of adverse health outcomes for those living near incinerators." It points out that "the relevant health effects, mainly cancers, have long incubation times. But the research that is available shows an absence of symptoms relating to exposures twenty or more years ago when emissions from incinerators were much greater than is now the case." **Paragraph 30 of PPS10** explains that "modern, appropriately located, well run and well regulated waste management facilities should pose little risk to public health."

The **Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (CoC)** issued a statement in 2000 which said that "any potential risk of cancer due to residency (for periods in excess of 10 years) near to municipal solid waste incinerators was exceedingly low and probably not measurable by the most modern epidemiological techniques." In 2009, CoC considered six further relevant epidemiological papers that had been published since the 2000 statement, and concluded that "there is no need to change the advice given in the previous statement in 2000 but that the situation should be kept under review".

Republic of Ireland Health Research Board report stated that "It is hard to separate the influences of other sources of pollutants, and other causes of cancer and, as a result, the evidence for a link between cancer and proximity to an incinerator is not conclusive".

The **Food Safety Authority of Ireland (FSAI) (2003)** investigated possible implications on health associated with food contamination from waste incineration and concluded: "In relation to the possible impact of introduction of waste incineration in Ireland, as part of a national waste management strategy, on this currently largely satisfactory situation, the FSAI considers that such incineration facilities, if properly managed, will not contribute to dioxin levels in the food supply to any significant extent. The risks to health and sustainable development presented by the continued dependency on landfill as a method of waste disposal far outweigh any possible effects on food safety and quality."

Health Protection Scotland (2009) considered scientific studies on health effects associated with the incineration of waste particularly those published after the Defra review discussed earlier. The main conclusions of this report were: "(a) For waste incineration as a whole topic, the body of evidence for an association with (non-occupational) adverse health effects is both inconsistent and inconclusive. However, more recent work suggests, more strongly, that there may have been an association between emissions (particularly dioxins) in the past from industrial, clinical and municipal waste incinerators and some forms of cancer, before more stringent regulatory requirements were implemented. (b) For individual waste streams, the evidence for an association with (non-occupational) adverse health effects is inconclusive. (c) The magnitude of any past health effects on residential populations living near incinerators that did occur is likely to have been small. (d) Levels of airborne emissions from individual incinerators should be lower now than in the past, due to stricter legislative controls and improved technology. Hence, any risk to the health of a local population living near an incinerator, associated with its emissions, should also now be lower."

The **US National Research Council Committee on Health Effects of Waste Incineration (NRC) (NRC 2000)** reviewed evidence as part of a wide ranging report. The Committee view of the published evidence was summarised in a key conclusion: "Few epidemiological studies have attempted to assess whether adverse health effects have actually occurred near individual incinerators, and most of them have been unable to detect any effects. The studies of which the committee is aware that did report finding health effects had shortcomings and failed to provide convincing evidence.

That result is not surprising given the small populations typically available for study and the fact that such effects, if any, might occur only infrequently or take many years to appear. Also, factors such as emissions from other pollution sources and variations in human activity patterns often decrease the likelihood of determining a relationship between small contributions of pollutants from incinerators and observed health effects. Lack of evidence of such relationships might mean that adverse health effects did not occur, but it could mean that such relationships might not be detectable using available methods and sources."

The **British Society for Ecological Medicine (BSEM)** published a report in 2005 on the health effects associated with incineration and concluded that "Large studies have shown higher rates of adult and childhood cancer and also birth defects around municipal waste incinerators: the results are consistent with the associations being causal. A number of smaller epidemiological studies support this interpretation and suggest that the range of illnesses produced by incinerators may be much wider. Incinerator emissions are a major source of fine particulates, of toxic metals and of more than 200 organic chemicals, including known carcinogens, mutagens, and hormone disrupters. Emissions also contain other unidentified compounds whose potential for harm is as yet unknown, as was once the case with dioxins. Abatement equipment in modern incinerators merely transfers the toxic load, notably that of dioxins and heavy metals, from airborne emissions to the fly ash. This fly ash is light, readily windborne and mostly of low particle size. It represents a considerable and poorly understood health hazard."

The BSEM report was reviewed by the HPA and they concluded that "Having considered the BSEM report, the HPA maintains its position that contemporary and effectively managed and regulated waste incineration processes contribute little to the concentrations of monitored pollutants in ambient air and that the emissions from such plants have little effect on health." The BSEM report was also commented on by the consultants who produced the Defra 2004 report referred to above. They said that "It fails to consider the significance of incineration as a source of the substances of concern. It does not consider the possible significance of the dose of pollutants that could result from incinerators. It does not fairly consider the adverse effects that could be associated with alternatives to incineration. It relies on inaccurate and outdated material. In view of these shortcomings, the report's conclusions with regard to the health effects of incineration are not reliable."

A Greenpeace review on incineration and human health concluded that a broad range of health effects have been associated with living near to incinerators as well as with working at these installations. Such effects include cancer (among both children and adults), adverse impacts on the respiratory system, heart disease, immune system effects, increased allergies and congenital abnormalities. Some studies, particularly those on cancer, relate to old rather than modern incinerators. However, modern incinerators operating in the last few years have also been associated with adverse health effects."

The Health Protection Scotland report referred to above says that "the authors of the Greenpeace review do not explain the basis for their conclusion that

there is an association between incineration and adverse effects in terms of criteria used to assess the strength of evidence. The weighting factors used to derive the assessment are not detailed. The objectivity of the conclusion cannot therefore be easily tested."

From this published body of scientific opinion, we take the view stated by the HPA that "While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable". We therefore ensure that permits contain conditions which require the installation to be well-run and regulate the installation to ensure compliance with such permit conditions.

iv) Health Risk Models

Comparing the results of air dispersion modelling as part of the H1 Environmental Impact assessment against European and national air quality standards effectively makes a health risk assessment for those pollutants for which a standard has been derived. These air quality standards have been developed primarily in order to protect human health via known intake mechanisms, such as inhalation and ingestion. Some pollutants, such as dioxins, furans and dioxin-like PCBs, have human health impacts at lower ingestion levels than lend themselves to setting an air quality standard to control against. For these pollutants, a different human health risk model is required which better reflects the level of dioxin intake.

Models are available to predict the dioxin, furan and dioxin-like PCB intake for comparison with the Tolerable Daily Intake (TDI) recommended by the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment, known as COT. These include HHRAP and the HMIP model.

HHRAP has been developed by the US EPA to calculate the human body intake of a range of carcinogenic pollutants and to determine the mathematic quantitative risk in probabilistic terms. In the UK, in common with other European Countries, we consider a threshold dose below which the likelihood of an adverse effect is regarded as being very low or effectively zero. The HMIP model uses a similar approach to the HHRAP model, but does not attempt to predict probabilistic risk. Either model can however be used to make comparisons with the TDI.

The TDI is the amount of a substance that can be ingested daily over a lifetime without appreciable health risk. It is expressed in relation to bodyweight in order to allow for different body size, such as for children of different ages. In the UK, the COT has set a TDI for dioxins, furans and dioxin-like PCBs of 2 picograms I-TEQ/Kg-body weight/day (N.B. a picogram is a million millionths (10^{-12}) of a gram).

In addition to an assessment of risk from dioxins and furans, the HHRAP model enables a risk assessment from human intake of a range of heavy metals. The HMIP report does not consider metals and PCBs. In principle, the respective EQS for these metals are protective of human health. It is not therefore necessary to model the human body intake.

COMEAP developed a methodology based on the results of time series epidemiological studies which allows calculation of the public health impact of exposure to the classical air pollutants (NO_2, SO_2 and particulates) in terms of the numbers of "deaths brought forward" and the "number of hospital admissions for respiratory disease brought forward or additional". COMEAP has issued a statement expressing some reservations about the applicability of applying its methodology to small affected areas. Those concerns generally relate to the fact that the exposure-response coefficients used in the COMEAP report derived from studies of whole urban populations where the air pollution climate may differ from that around a new industrial installation. COMEAP identified a number of factors and assumptions that would contribute to the uncertainty of the estimates. These were summarised in the Defra review as below:

- Assumption that the spatial distribution of the air pollutants considered is the same in the area under study as in those areas, usually cities or large towns, in which the studies which generated the coefficients were undertaken.
- Assumption that the temporal pattern of pollutant concentrations in the area under study is similar to that in the areas in which the studies which generated the coefficients were undertaken (i.e. urban areas).
- It should be recognised that a difference in the pattern of socio-economic conditions between the areas to be studied and the reference areas could lead to inaccuracy in the predicted level of effects.
- In the same way, a difference in the pattern of personal exposures between the areas to be studied and the reference areas will affect the accuracy of the predictions of effects.

The use of the COMEAP methodology is not generally recommended for modelling the human health impacts of individual installations. However it may have limited applicability where emissions of NOx, SO_2 and particulates cannot be screened out as insignificant in an H1 Environmental Impact assessment, there are high ambient background levels of these pollutants and we are advised that its use was appropriate by our public health consultees.

Our recommended approach is therefore the use of the H1 assessment methodology comparison for most pollutants (including metals) and dioxin intake model using the HHRAP model as described above for dioxins and furans. Where an alternative approach is adopted for dioxins, we check the predictions ourselves.

v) Consultations

As part of our normal procedures for the determination of a permit application, we would consult Public Health England, LHB (Wales), the Director of Public Health and FSA. We also consult the local communities who may raise health related issues. All issues raised by these consultations are considered in determining the application as described in Annex 4 of this document.

5.3.2 Assessment of Intake of Dioxins and Furans

For dioxins and furans, the principal exposure route is through ingestion, usually through the food chain, and the main risk to health is through accumulation in the body over a period of time.

The human health risk assessment calculates the dose of dioxins and furans that would be received by local receptors if all their food and water were sourced from the locality where the deposition of dioxins and furans is predicted to be the highest. This is then assessed against the Tolerable Daily Intake (TDI) levels established by the COT of 2 picograms I-TEQ / Kg bodyweight/ day.

The results of the Applicant's assessment of dioxin intake are detailed in the table below. (worst – case results for each category are shown). The results showed that the predicted daily intake of dioxins at all receptors, resulting from emissions from the proposed facility, were significantly below the recommended TDI levels.

Receptor	Adult	Child
Resident	0.08	0.15
Farmer	0.78	1.19
Fisher	0.17	0.28

Calculated maximum daily intake of dioxins by local receptors resulting from the operation of the proposed facility (I-TEQ/ kg-BW/day)

The FSA has reported that dietary studies have shown that estimated total dietary intakes of dioxins and dioxin-like PCBs from all sources by all age groups fell by around 50% between 1997 and 2001, and are expected to continue to fall. In 2001, the average daily intake by adults in the UK from diet was 0.9 pg WHO-TEQ/kg bodyweight. The additional daily intake predicted by the modelling as shown in the table above is substantially below this figure.

In 2010, FSA studied the levels of chlorinated, brominated and mixed (chlorinated-brominated) dioxins and dioxin-like PCBs in fish, shellfish, meat and eggs consumed in UK. It asked COT to consider the results and to advise on whether the measured levels of these PXDDs, PXDFs and PXBs indicated a health concern ('X' means a halogen). COT issued a statement in December 2010 and concluded that " The major contribution to the total dioxin toxic activity in the foods measured came from chlorinated compounds. Brominated compounds made a much smaller contribution, and mixed halogenated compounds contributed even less (1% or less of TDI). Measured levels of PXDDs, PXDFs and dioxin-like PXBs do not indicate a health concern". COT recognised the lack of quantified TEFs for these compounds but said that "even if the TEFs for PXDDs, PXDFs and dioxin-like PXBs were up to four fold higher than assumed, their contribution to the total TEQ in the diet would still be small. Thus, further research on PXDDs, PXDFs and dioxin-like PXBs is not considered a priority."

In the light of this statement, we assess the impact of chlorinated compounds as representing the impact of all chlorinated, brominated and mixed dioxins / furans and dioxin like PCBs.

5.3.3 Particulates smaller than 2.5 microns

The Operator will be required to monitor particulate emissions using the method set out in Table S3.1 of Schedule 3 of the Permit. This method requires that the filter efficiency must be at least 99.5 % on a test aerosol with a mean particle diameter of 0.3 µm, at the maximum flow rate anticipated. The filter efficiency for larger particles will be at least as high as this. This means that particulate monitoring data effectively captures everything above 0.3 µm and much of what is smaller. It is not expected that particles smaller than 0.3 µm will contribute significantly to the mass release rate / concentration of particulates because of their very small mass, even if present. This means that emissions monitoring data can be relied upon to measure the true mass emission rate of particulates.

Nano-particles are considered to refer to those particulates less than 0.1 µm in diameter ($PM_{0.1}$). Questions are often raised about the effect of nano-particles on human health, in particular on children's health, because of their high surface to volume ratio, making them more reactive, and their very small size, giving them the potential to penetrate cell walls of living organisms. The small size also means there will be a larger number of small particles for a given mass concentration. However the HPA statement (referenced below) says that due to the small effects of incinerators on local concentration of particles, it is highly unlikely that there will be detectable effects of any particular incinerator on local infant mortality.

The HPA (now PHE) addresses the issue of the health effects of particulates in their September 2009 statement 'The Impact on Health of Emissions to Air from Municipal Incinerators'. It refers to the coefficients linking PM_{10} and $PM_{2.5}$ with effects on health derived by COMEAP and goes on to say that if these coefficients are applied to small increases in concentrations produced, locally, by incinerators; the estimated effects on health are likely to be small. The HPA notes that the coefficients that allow the use of number concentrations in impact calculations have not yet been defined because the national experts have not judged that the evidence is sufficient to do so. This is an area being kept under review by COMEAP.

In December 2010, COMEAP published a report on The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. It says that "a policy which aims to reduce the annual average concentration of $PM_{2.5}$ by 1 µg/m^3 would result in an increase in life expectancy of 20 days for people born in 2008." However, "The Committee stresses the need for careful interpretation of these metrics to avoid incorrect inferences being drawn – they are valid representations of population aggregate or average effects, but they can be misleading when interpreted as reflecting the experience of individuals."

The HPA also point out that in 2007 incinerators contributed 0.02% to ambient ground level PM_{10} levels compared with 18% for road traffic and 22% for industry in general. The HPA note that in a sample collected in a day at a typical urban area the proportion of $PM_{0.1}$ is around 5-10% of PM_{10}. It goes on to say that PM_{10} includes and exceeds $PM_{2.5}$ which in turn includes and exceeds $PM_{0.1}$.

This is consistent with the assessment of this application which shows emissions of PM_{10} to air to be insignificant.

We take the view, based on the foregoing evidence, that techniques which control the release of particulates to levels which will not cause harm to human health will also control the release of fine particulate matter to a level which will not cause harm to human health.

5.3.4 Assessment of Health Effects from the Installation

We have assessed the health effects from the operation of this installation in relation to the above (sections 5.3.1 to 5.3.3). We have applied the relevant requirements of the national and European legislation in imposing the permit conditions. We are satisfied that compliance with these conditions will ensure protection of the environment and human health.

Taking into account all of the expert opinion available, we agree with the conclusion reached by the HPA that "While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable."

In carrying out air dispersion modelling as part of the H1 Environmental Impact Assessment and comparing the predicted environmental concentrations with European and national air quality standards, the Applicant has effectively made a health risk assessment for many pollutants. These air quality standards have been developed primarily in order to protect human health.

The Applicant's assessment of the impact from emitted substances (see tables in section 5.2.1) have indicated that several emissions screen out as insignificant; where the impact of other emissions have not been screened out as insignificant, the assessment still shows that the predicted environmental concentrations are well within air quality standards or environmental action levels.

The Environment Agency has reviewed the methodology employed by the Applicant to carry out the health impact assessment.

Overall, taking into account the conservative nature of the impact assessment (i.e. that it is based upon an individual exposed for a life-time to the effects of the highest predicted airborne concentrations and consuming mostly locally grown food), it was concluded that the operation of the proposed facility will not pose a significant carcinogenic or non-carcinogenic risk to human health.

Public Health England and the Director of Public Health were consulted on the Application and concluded that they had no significant concerns regarding the risk to the health of humans from the installation. The Food Standards Agency was also consulted during the permit determination process; as FSA declined to respond, we concluded that it is unlikely that there will be any unacceptable effects on the human food chain as a result of the operations at the Installation. Details of the responses provided by the consultees on this Application can be found in Annex 4.

The Environment Agency is therefore satisfied that the Applicant's conclusions presented above are soundly based and we conclude that the

potential emissions of pollutants including dioxins, furans and metals from the proposed facility are unlikely to have an impact upon human health.

5.4 Impact on Habitats sites, SSSIs, non-statutory conservation sites

5.4.1 Sites Considered

The following Habitats (i.e. Special Areas of Conservation, Special Protection Areas and Ramsar) sites are located within 10 km of the Installation:

- Severn Estuary SAC, SPA, Ramsar
- Avon Gorge Woodland SAC

The following Sites of Special Scientific Interest are located within 2 km of the Installation:

- Severn Estuary SSSI

The following non-statutory local wildlife and conservation sites are located within 2 km of the Installation:

- St. Andrews Road Rhine
- Kings Weston Lane Rhine
- Gloucester Road Railway Sidings
- Land adjacent to Royal Portbury Dock
- Barracks Lane Rhine Complex
- Salt Rhine and Moorhouse Rhine
- Hallen Marsh Junction
- Avonmouth Sewage Works and Hoar Gout
- M40 Interchange
- Lawrence Weston Road Rhines
- Severn Estuary
- Land adjacent to Severn Estuary SSS1 (Portbury)
- Severn Estuary SSSI (part of) – New Passage to Chittening Warth

5.4.2 Habitats Assessment

The Applicant's Habitats assessment was reviewed by the Environment Agency's technical specialists for modelling, air quality, conservation and ecology technical services, who agreed with the assessment's conclusions, that there would be no likely significant effect on the interest feature of the protected site.

The following table shows the modelling results for the Severn Estuary Habitats site:

Modelling results for Severn Estuary SAC / Ramsar / SPA

Toxic contamination

Parameter	AQS/Cle µg/m^3	PC µg/m^3	PC as % of AQS/Cle	Background µg/m^3 [1]	PEC µg/m^3	PEC % of AQS/Cle
Nitrogen dioxide	30 (LT)	0.95	3.2	25.15	26.1	87
	75 (ST)	10.2	13.7	50.3	60.3	80
Sulphur dioxide	20	0.71	3.6	0.80	1.51	7.6
Hydrogen Fluoride	0.5 (ST)	0.046	9.2	--	--	--
	5 (ST)	0.079	1.6	--	--	--
Ammonia	3	0.073	2.4	0.79	0.86	29
Note 1: Where the PC is less than 1% of the benchmark for a long term measurement or less than 10% of the short term measurement the impact can be considered insignificant. In these cases, examination of the PEC is not required.						

Ground level concentrations of the compounds, except for HF, were not screened out as they were not below the benchmark criteria. As these predictions were derived from a detailed modelling assessment they can be compared directly with the standards. No exceedances of air quality standards are predicted with the maximum predicted PEC's ranging from 7.6 to 87% of the relevant air quality standards.

Nutrient deposition

The table below represents the predicted nitrogen deposition rates at the Severn Estuary SAC/Ramsar/SPA. The lower range of the critical load (20 kgN/ha/yr) has been used to assess deposition for Pioneer, low-mid, mid-upper saltmarshes. The nitrogen deposition rate for the Severn Estuary SAC/Ramsar/SPA site was obtained from the APIS website. The maximum predicted deposition rates from the modelling are as follows:

Habitat Site	Critical Load (CLo) kgN/ha/yr	Background N deposition kgN/ha/yr	PC N deposition kgN/ha/yr	PC as % of minimum threshold level	PEC as % of minimum threshold level
Severn Estuary SAC/Ramsar/SPA	20-30 kgN/ha/yr (Pioneer, lo-mid, mid-upper saltmarshes)	12.88	0.52	2.6	67.0

The maximum predicted nutrient nitrogen deposition rate due to process emissions for the Severn Estuary SAC/Ramsar/SPA site is potentially significant at 2.6% of the lower critical load. However, when the background deposition is taken into account the deposition is at maximum 67% of the lower critical load and an exceedance is considered unlikely.

Acid deposition

No critical load for the Severn Estuary SAC/Ramsar/SPA site is given as the habitat site is not sensitive to acidification.

Habitat Site	Critical Load (CLo) keq/ha/yr	Background deposition keq/ha/yr	PC deposition keq/ha/yr	PC as % of threshold level	PEC as % of threshold level
Severn Estuary SAC/Ramsar/SPA	Pioneer, lo-mid, mid-upper saltmarshes [Note 1]	1.12	0.14	[Note 1]	[Note 1]
Note 1 – The habitat is not sensitive to acidification. No critical load available.					

We consider therefore that there will be no likely significant effect of acid deposition on the interest features of the Severn Estuary SAC/Ramsar/SPA site from the installation.

The following table shows the modelling results for the Avon Gorge Woodlands SAC:

Modelling results for Avon Gorge Woodlands SAC

Toxic contamination

Parameter	AQS /Cle µg/m^3	PC µg/m^3	PC as % of AQS/Cle	Background µg/m^3 [1]	PEC µg/m^3	PEC % of AQS/Cle
Nitrogen dioxide	30 (LT)	0.057	0.19	--	--	--
	75 (ST)	1.2	1.6	--	--	--
Sulphur dioxide	10	0.042	0.42	--	--	--
Hydrogen Fluoride	0.5 (ST)	0.0024	0.48	--	--	--
	5 (ST)	0.0093	0.19	--	--	--
Ammonia	1	0.0044	0.44	--	--	--
Note 1: Where the PC is less than 1% of the benchmark for a long term measurement or less than 10% of the short term measurement the impact can be considered insignificant. In these cases, examination of the PEC is not required.						

Ground level concentrations for Nitrogen dioxide (long term), Sulphur dioxide, Hydrogen fluoride and Ammonia all screen out as insignificant with process contribution less than 1% of the air quality standard. The short term ground level concentrations for Nitrogen dioxide also screens out as insignificant.

Nutrient deposition

The table below represents the predicted nitrogen deposition rates at the Avon Gorge Woodlands SAC. The lower range of the critical load (5 kgN/ha/yr) has been used to assess deposition for Meso- and eutrophic Quercus Woodland. The nitrogen deposition rates for the Avon Gorge Woodlands SAC site was obtained from the APIS website. The maximum predicted deposition rates from the modelling are as follows:

Habitat Site	Critical Load (CLo) kgN/ha/yr	Background N deposition kgN/ha/yr	PC N deposition kgN/ha/yr	PC as % of minimum threshold level [1]	PEC as % of minimum threshold level
Avon Gorge Woodland SAC	5-15 kgN/ha/yr (Meso- and eutrophic Quercus Woodland)	26.53	0.05	1.0	532.0
Note 1: Where the PC is less than 1% of the lower critical load, the impact can be considered insignificant. In these cases, examination of the PEC is not required.					

For the Avon Gorge Woodland SAC the maximum nutrient nitrogen deposition rate due to process emissions is predicted at 1% of the lower critical load. This figure is on the limit where we test for potential significant effect. As conservative assumptions are used in the air dispersion modelling and the facility will not be operating continuously for the year, the effect of nutrient nitrogen can be assessed as not significant.

Acid deposition

The acid deposition rate for the Avon Gorge Woodland SAC site was obtained from the APIS website as follows:

Habitat Site	Critical Load (CLo) keq/ha/yr	Background deposition keq/ha/yr	PC deposition keq/ha/yr	PC as % of threshold level [1]	PEC as % of threshold level
Avon Gorge Woodland SAC	Meso- and eutrophic Quercus Woodland	2.5	0.016	0.26	41.17
Note 1: Where the PC is less than 1% of the lower critical load, the impact can be considered insignificant. In these cases, examination of the PEC is not required.					

The maximum predicted acid deposition rate as a result of emissions from the proposed facility is less than 1% of the critical load and can therefore be considered as not significant. Using the APIS Critical Load Function Tool shows no exceedance of CL function is predicted.

Summary: Our check modelling and calculations agree with those of the Applicant that there would be no likely significant effect on interest features at the Severn Estuary SAC/Ramsar/SPA and Avon Gorge Woodland SAC sites in respect of toxic contamination, nutrient nitrogen or acid deposition. We concluded that the proposed Installation will not adversely affect the integrity of the European habitat sites. This was recorded on an Appendix 11 and sent to Natural England on 18/02/2014. Natural England agreed with this assessment in their response dated 21/03/2014.

5.4.3 SSSI Assessment

The Applicant's assessment of SSSI was reviewed by the Environment Agency's technical specialists for modelling, air quality, conservation and ecology technical services, who agreed with the assessment's conclusions, that the proposal does not damage the special features of the SSSI.

The following table shows the predicted impacts on Severn Estuary SSSI from the proposed Installation:

Pollutant	Benchmark	PC	PC as% of Benchmark	Background	PEC	PEC as % of Benchmark
Nitrogen oxides (as NO_2)	30 µg/m^3	0.95 µg/m^3	3.17	25.15 µg/m^3	26.1 µg/m^3	87.0
Nitrogen oxides (as NO_2)	75 µg/m^3	12.3 µg/m^3	16.4	50.30 µg/m^3 [note 1]	62.6 µg/m^3	83.5
Sulphur dioxide	20 µg/m^3	0.71 µg/m^3	3.55	0.8 µg/m^3	1.51 µg/m^3	7.56
Ammonia	3 µg/m^3	0.073 µg/m^3	2.43	0.79 µg/m^3	0.86 µg/m^3	28.6
Hydrogen fluoride (weekly)	0.5 µg/m^3	0.046 µg/m^3	9.2	[note 2]	[note 2]	[note 2]
Hydrogen fluoride (daily)	5 µg/m^3	0.095 µg/m^3	1.9	[note 2]	[note 2]	[note 2]
Nut-N deposition CLo	20-30 kgN/ha/yr	0.52 kgN/ha/yr	2.6	14.02 kgN/ha/yr	14.54 kgN/ha/yr	72.7
Acid deposition CLo	[note 3]	0.14 keq/ha/yr	[note 3]	1.22 keq/ha/yr	[note 3]	[note 3]

Note [1]: Short-term background concentration derived by multiplying the long term concentration by 2.

Note [2]: Where the PC is less than 1% of the benchmark for a long term measurement or less than 10% for a short term measurement, the impact is considered to be insignificant. In these cases, examination of the PEC is not required.

Note [3]: No designated critical load. The habitat is not sensitive to acidification.

Nitrogen oxides: The long term process contribution is greater than 1% of the relevant long term environmental benchmark. The short term process contribution also exceeds 10% of the relevant short term environmental benchmark. Whilst NO_2 emissions cannot be screened out as insignificant, the Applicant's modelling shows that the installation is unlikely to result in a breach of the EAL or EUEQS. We consider that emissions are not likely to damage the interest features of the SSSI as the process contribution and background concentration (PEC) is less than 100% of the long term and short

term environmental benchmark. The IED limits assume continuous operation of the plant, and therefore the PC and PEC data calculated above represents worst case and this is unlikely to ever be realised at the facility. We are satisfied the Applicant is using BAT.

Sulphur dioxide: The long term process contribution is greater than 1% of the relevant long term environmental benchmark. Whilst SO_2 emissions cannot be screened out as insignificant, the Applicant's modelling shows that the installation is unlikely to result in a breach of the EAL or EUEQS. We consider that emissions are not likely to damage the interest features of the SSSI as the process contribution and background concentration (PEC) is less than 100% of the long term environmental benchmark.

Hydrogen fluoride (HF): The results show that the predicted weekly and daily (which are both considered short term periods) process contributions at the SSSI are less than 10% of the environmental benchmarks for each averaging period. We conclude therefore that emissions are not likely to damage the interest features of the SSSI. We are satisfied the Applicant is using BAT.

Nutrient N deposition: The intertidal sands and mud features of the SSSI are not considered sensitive to nutrient enrichment. However, the Severn is a highly turbid system and it is considered that additions of nitrogen from the atmosphere will be insignificant compared with point and diffuse aqueous sources to the system. Nitrogen deposition is 0.52 kg N/ha/yr which is not considered likely to damage the features of the SSSI through nutrient enrichment.

Acid deposition: The SSSI is not considered to be sensitive to acidification and a critical level has not been set. The process contribution is 0.14 keq/ha/yr at the Severn Estuary SSSI.

5.4.4 Assessment of Non-Statutory Sites

The Applicant's assessment of non-statutory sites was reviewed by the Environment Agency's technical specialists for modelling, air quality, conservation and ecology technical services, who agreed with the assessment's conclusions, that the proposal will not damage the special features of the non-statutory sites.

As there are no specific regulations for the protection of these sites *(beyond our requirements to enhance biodiversity under the Natural Environment and Rural Communities Act 2006 and our wider conservation duties under the Environment Act*), we are required to ensure that the permitting of the Installation will not result in significant pollution.

The Applicant has assessed the dispersion of important pollutants against critical level criteria for the protection of vegetation and ecosystems which is summarised in the following table. The values shown represent the worst for any of the receptors for each pollutant.

Pollutant	EQS / EAL (µg/m^3)	PC (µg/m^3)[1]	PC as % of EQS / EAL
SO_2	20 (LT)	1.4	7.0
NO_x	75 (ST)	12.2	16.2
	30 (LT)	1.8	6.0
HF	5 (ST)	0.094	1.88
	0.5 (LT)	0.047	9.4
NH_3	3 (LT)	0.14	4.6

Note [1] PC is given as the worst case of results for all non-statutory sites

The Applicant has assessed the critical loads for nitrogen and acid deposition against critical load criteria for sites as obtained from the UK Air Pollution Information System (APIS) which is summarised in the following table. The values shown represent the worst for any of the receptors for each parameter.

Pollutant	Critical load (most severe criterion used to exemplify receptors)	PC	PC as % of CL
Nitrogen deposition	20 kg N/ha/yr	0.99 kg N/ha/yr	4.95
Acid deposition	4.00 keq/ha/yr	0.26 keq/ha/yr	6.5

In accordance with Environment Agency guidance, we consider that given the size of the PC which is a small fraction of the critical level/load, the impact on the sites is not likely to cause significant pollution. As modelling and assessment has demonstrated that the predicted ground level environmental concentrations of pollutants in the area even at a maximum will not compromise any Air Quality Objectives then we are satisfied that the operation of the incinerator will not compromise the integrity of the above sites.

5.5 Impact of abnormal operations

Article 50(4)(c) of IED requires that waste incineration and co-incineration plants shall operate an automatic system to prevent waste feed whenever any of the continuous emission monitors show that an emission limit value (ELV) is exceeded due to disturbances or failures of the purification devices. Notwithstanding this, Article 46(6) allows for the continued incineration and co-incineration of waste under such conditions provided that this period does not (in any circumstances) exceed 4 hours uninterrupted continuous operation or the cumulative period of operation does not exceed 60 hours in a calendar year. This is a recognition that the emissions during transient states (e.g. start-up and shut-down) are higher than during steady-state operation, and the overall environmental impact of continued operation with a limited exceedance of an ELV may be less than that of a partial shut-down and re-start.

For incineration plant, IED sets backstop limits for particulates, CO and TOC which must continue to be met at all times. The CO and TOC limits are the same as for normal operation, and are intended to ensure that good combustion conditions are maintained. The backstop limit for particulates is

150 mg/m^3 (as a half hourly average) which is five times the limit in normal operation.

Article 45(1)(f) requires that the permit shall specify the maximum permissible period of any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air may exceed the prescribed emission limit values. In this case we have decided to set the time limit at 4 hours, which is the maximum period prescribed by Article 46(6).

Given that these abnormal operations are limited to no more than a period of 4 hours continuous operation and no more than 60 hours aggregated operation in any calendar year, this is less than 1% of total operating hours. As such, abnormal operating conditions are not expected to have any significant long term environmental impact unless the background conditions were already close to, or exceeding, an EQS. For the most part therefore, consideration of abnormal operations is limited to consideration of its impact on short term EQSs.

In response to a Notice under Schedule 5 EPR for further information, the Applicant provided estimations of the likely worst case emissions under abnormal operations:

Failure mode	Pollutant	Abnormal Emission Concentration (mg/m^3)
Lime injection system	SO_2	225
	HCl	60
Activated carbon injection system	Hg	0.15
Ammonia injection system	NO_2	250
Bag filter	Particulate matter	40
	Group 1 & 2 Metals	0.1
	Group 3 Metals	1
	Cd	0.25

This is a worst case scenario in that IED abnormal conditions include a number of different equipment failures not all of which will necessarily result in an adverse impact on the environment (e.g. a failure of a monitoring instrument does not necessarily mean that the co-incinerator or abatement plant is malfunctioning). This analysis assumes that any failure of any equipment results in all the negative impacts set out above occurring simultaneously.

The result on the Applicant's short-term environmental impact is summarised in the table below.

Pollutant	EQS / EAL	Background concentration [1]	Process Contribution (PC)		Predicted Environmental Concentration (PEC) [1]	
	µg/m^3	µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
NO_2	200	--	13.38	6.7	--	--
PM_{10}	50	--	1.17	2.34	--	--
SO_2 (1 hour)	350	--	34.2	9.77	--	--
SO_2 (15 min)	266	4.7	37.35	14.0	42.05	15.8
HCl	750	--	10.4	1.39	--	--
Hg	7.5	--	0.0258	0.34	--	--
Sb	150	--	0.172	0.11	--	--
Cu	200	--	0.172	0.09	--	--
Mn	1500	--	0.172	0.11	--	--
Cr (II)(III)	150	--	0.172	5.73	--	--
Co	6	--	0.172	0.57	--	--
V	1	--	0.07	7.0	--	--
As	15	--	0.172	1.15	--	--
Th	30	--	0.0172	0.06	--	--

Note 1 – Where the PC is demonstrated to be less than 10% of the short term EAL, a level below which we consider to indicate insignificant impact, examination of the PEC and background is not required. For the assessment of short term impacts the PEC is determined by adding twice the long term background concentration to the short term process contribution.

From the table above the emissions of the following substances can still be considered insignificant, in that the PC is still <10% of the short-term EQS/EAL for PM_{10}, NO_2, HCl, Sb, Cu, Mn, As, Co, Hg, Th and Cr.

Also from the table above, emissions of SO_2 which was not screened out as insignificant has been assessed as being unlikely to give rise to significant pollution in that the predicted environmental concentration (PEC) is less than 100% of short term EQS/EAL.

We have not assessed the impact of abnormal operations against long term EQSs for the reasons set out above. If dioxin emissions were at 10 ng/m^3 for the maximum period of abnormal operation, 60 hours per year for every year for the duration of the co-incinerator operation, there would be an increase in the TDI reported in section 5.3.2. We consider that this represents the worst case situation and is in practice a highly unlikely scenario. In these

circumstances the TDI would be (for a human lifespan of 70 years with appropriate proportions as a child and adult) 0.164 pg (I-TEQ)/ kg-bw/day for a resident, 1.459 pg (I-TEQ)/ kg-bw/day for a farmer and 0.327 pg (I-TEQ)/ kg-bw/day for a fisher and would still not pose a risk to human health.

6. Application of Best Available Techniques

6.1 Scope of Consideration

In this section, we explain how we have determined whether the Applicant's proposals are the Best Available Techniques for this Installation.

- The first issue we address is the fundamental choice of incineration technology. There are a number of alternatives, and the Applicant has explained why it has chosen one particular kind for this Installation.
- We then consider in particular control measures for the emissions which were not screened out as insignificant in the previous section on minimising the installation's environmental impact.
- We also have to consider the combustion efficiency and energy utilisation of different design options for the Installation, which are relevant considerations in the determination of BAT for the Installation, including the Global Warming Potential of the different options.
- Finally, the prevention and minimisation of Persistent Organic Pollutants (POPs) must be considered, as we explain below.

Chapter IV of the IED specifies a set of maximum emission limit values. Although these limits are designed to be stringent, and to provide a high level of environmental protection, they do not necessarily reflect what can be achieved by new plant. Article 14(3) of the IED says that BAT conclusions shall be the reference for setting the permit conditions, so it may be possible and desirable to achieve emissions below the limits referenced in Chapter IV.

Even if the Chapter IV limits are appropriate, operational controls complement the emission limits and should generally result in emissions below the maximum allowed; whilst the limits themselves provide headroom to allow for unavoidable process fluctuations. Actual emissions are therefore almost certain to be below emission limits in practice, because any Operator who sought to operate its installation continually at the maximum permitted level would almost inevitably breach those limits regularly, simply by virtue of normal fluctuations in plant performance, resulting in enforcement action (including potentially prosecution) being taken. Assessments based on, say, Chapter IV limits are therefore "worst-case" scenarios.

Should the Installation, once in operation, emit at rates significantly below the limits included in the Permit, we will consider tightening ELVs appropriately. We are, however, satisfied that emissions at the permitted limits would ensure a high level of protection for human health and the environment in any event.

6.1.1 Consideration of Furnace Type

The prime function of the furnace is to achieve maximum combustion of the waste. Chapter IV of the IED requires that the plant (furnace in this context) should be designed to deliver its requirements. The main requirements of Chapter IV in relation to the choice of a furnace are compliance with air emission limits for CO and TOC and achieving a low TOC/LOI level in the bottom ash.

The Waste Incineration BREF elaborates the furnace selection criteria as:

- the use of a furnace (including secondary combustion chamber) dimensions that are large enough to provide for an effective combination of gas residence time and temperature such that combustion reactions may approach completion and result in low and stable CO and TOC emissions to air and low TOC in residues.
- use of a combination of furnace design, operation and waste throughput rate that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures.
- The use of furnace design that, as far as possible, physically retain the waste within the combustion chamber (e.g. grate bar spacing) to allow its complete combustion.

The BREF also provides a comparison of combustion and thermal treatment technologies and factors affecting their applicability and operational suitability used in EU and for all types of wastes. There is also some information on the comparative costs. The table below has been extracted from the BREF tables. This table is also in line with the Guidance Note "The Incineration of Waste (EPR 5.01)). However, it should not be taken as an exhaustive list nor that all technologies listed have found equal application across Europe.

Overall, any of the furnace technologies listed below would be considered as BAT provided the Applicant has justified it in terms of:

- nature/physical state of the waste and its variability
- proposed plant throughput which may affect the number of incineration lines
- preference and experience of chosen technology including plant availability
- nature and quantity/quality of residues produced.
- emissions to air – usually NOx as the furnace choice could have an effect on the amount of unabated NOx produced
- energy consumption – whole plant, waste preparation, effect on GWP
- Need, if any, for further processing of residues to comply with TOC
- Costs

Comparison of thermal treatment technologies

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Moving grate (air-cooled)	Low to medium heat values (LCV 5 – 16.5 GJ/t); Municipal and other heterogeneous solid wastes; Can accept a proportion of sewage sludge and/or medical waste with municipal waste; Applied at most modern MSW installations	1 to 50 t/h with most projects 5 to 30 t/h. Most industrial applications not below 2.5 or 3 t/h.	Widely proven at large scales; Robust; Low maintenance cost; Long operational history; Can take heterogeneous wastes without special preparation.	Generally not suited to powders, liquids or materials that melt through the grate.	TOC 0.5 % to 3 %	High capacity reduces specific cost per tonne of waste
Moving grate (liquid cooled)	Same as air-cooled grates except: LCV 10 – 20 GJ/t	Same as air-cooled grates	As air-cooled grates but: higher heat value waste treatable; better combustion control possible.	As air-cooled grates but: risk of grate damaging leaks and higher complexity	TOC 0.5 % to 3 %	Slightly higher capital cost than air-cooled
Rotary Kiln	Can accept liquids and pastes. Solid feeds more limited than grate (owing to refractory damage) often applied to hazardous wastes	<10 t/h	Very well proven with broad range of wastes and good burn out even of HW	Throughputs lower than grates	TOC <3 %	Higher specific cost due to reduced capacity
Fluid bed - bubbling	Only finely divided consistent wastes. Limited use for raw MSW often applied to sludges	1 to 10 t/h	Good mixing; Fly ashes of good leaching quality	Careful operation required to avoid clogging bed; Higher fly ash quantities.	TOC <3 %	FGT cost may be lower; Costs of waste preparation
Fluid bed - circulating	Only finely divided consistent wastes; Limited use for raw MSW, often applied to sludges / RDF.	1 to 20 t/h most used above 10 t/h	Greater fuel flexibility than BFB Fly ashes of good leaching quality	Cyclone required to conserve bed material; Higher fly ash quantities	TOC <3 %	FGT cost may be lower. Costs of preparation
Oscillating furnace	MSW / heterogeneous wastes	1 – 10 t/h	Robust; Low maintenance; Long history; Low NOX level; Low LOI of bottom ash	Higher thermal loss than with grate furnace; LCV under 15 G/t	TOC 0.5 – 3 %	Similar to other technologies
Pulsed hearth	Only higher CV waste (LCV >20 GJ/t) mainly used for clinical wastes	<7 t/h	Can deal with liquids and powders	bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Stepped and static hearths	Only higher CV waste (LCV >20 GJ/t); Mainly used for clinical wastes	No information	Can deal with liquids and powders	Bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Spreader – stoker combustor	RDF and other particle feeds, poultry manure, wood wastes	No information	simple grate construction; less sensitive to particle size than FB	Only for well defined mono-streams	No information	No information
Gasification - fixed bed	mixed plastic wastes; other similar consistent streams; gasification less widely used/proven than incineration	1 to 20 t/h	Low leaching residue; good burnout if oxygen blown; syngas available; Reduced oxidation of recyclable metals	Limited waste feed; not full combustion; high skill level; tar in raw gas; less widely proven	Low leaching bottom ash; good burnout with oxygen	High operation / maintenance costs
Gasification – entrained flow	mixed plastic wastes; other similar consistent streams; not suited to untreated MSW; gasification less widely used/proven than incineration	To 10 t/h	Low leaching slag; reduced oxidation of recyclable metals	Limited waste feed; not full combustion; high skill level; less widely proven	Low leaching slag	High operation/ maintenance costs pre-treatment costs high
Gasification - fluid bed	Mixed plastic wastes; shredded MSW; shredder residues; sludges; metal rich wastes; other similar consistent streams; less widely used/proven than incineration	5 – 20 t/h	Temperatures e.g. for Al recovery; separation of non-combustibles; can be combined with ash melting; reduced oxidation of recyclable metals	Limited waste size (<30cm); tar in raw gas; higher UHV raw gas; less widely proven	If Combined with ash melting chamber ash is vitrified	Lower than other gasifiers
Pyrolysis	Pre-treated MSW; high metal inert streams; shredder residues/plastics; pyrolysis is less widely used/proven than incineration	~ 5 t/h (short drum); 5 – 10 t/h (medium drum)	no oxidation of metals; no combustion energy for metals/inert in reactor acid; neutralisation possible; syngas available	limited wastes; process control and engineering critical; high skill req. not widely proven; need market for syngas	Dependent on process temperature; Residue produced requires further processing, sometimes combustion	High pre-treatment, operation and capital costs

The Applicant has carried out a review of the following candidate furnace types:

- Bubbling Fluidised Bed
- Circulating Fluidised Bed

The Applicant has proposed to use a furnace technology comprising a circulating fluidised bed, all of which are identified in the tables above as being considered BAT in the BREF or TGN for this type of waste feed.

The Applicant proposes to use gas oil as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is based on availability of supply.

6.1.2 Boiler Design

In accordance with our Technical Guidance Note, S5.01, the Applicant has confirmed that the boiler design will include the following features to minimise the potential for reformation of dioxins within the de-novo synthesis range:

- ensuring that the steam/metal heat transfer surface temperature is a minimum where the exhaust gases are within the de-novo synthesis range;
- design of the boilers using CFD to ensure no pockets of stagnant or low velocity gas;
- boiler passes are progressively decreased in volume so that the gas velocity increases through the boiler; and
- Design of boiler surfaces to prevent boundary layers of slow moving gas

We have considered the assessments made by the Applicant and agree that the furnace technology chosen represents BAT. We believe that, based on the information gathered by the BREF process, the chosen technology will achieve the requirements of Chapter IV of the IED for the air emission of TOC/CO and the TOC on bottom ash.

6.2 BAT and emissions control

The prime function of flue gas treatment is to reduce the concentration of pollutants in the exhaust gas as far as practicable. The techniques which are described as BAT individually are targeted to remove specific pollutants, but the BREF notes that there is benefit from considering the FGT system as a whole unit. Individual units often interact, providing a primary abatement for some pollutants and an additional effect on others.

The BREF lists the general factors requiring consideration when selecting flue-gas treatment (FGT) systems as:

- type of waste, its composition and variation
- type of combustion process, and its size
- flue-gas flow and temperature
- flue-gas content, size and rate of fluctuations in composition
- target emission limit values
- restrictions on discharge of aqueous effluents

- plume visibility requirements
- land and space availability
- availability and cost of outlets for residues accumulated/recovered
- compatibility with any existing process components (existing plants)
- availability and cost of water and other reagents
- energy supply possibilities (e.g. supply of heat from condensing scrubbers)
- reduction of emissions by primary methods
- release of noise

Taking these factors into account, the Technical Guidance Note points to a range of technologies being BAT subject to circumstances of the Installation.

6.2.1 Particulate Matter

Comparison of particulate matter abatement techniques

Particulate matter				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Bag / Fabric filters (BF)	Reliable abatement of particulate matter to below 5 mg/m^3	Max temp 250°C	Multiple compartments; Bag burst detectors	Most plants
Wet scrubbing	May reduce acid gases simultaneously.	Not normally BAT; Liquid effluent produced	Require reheat to prevent visible plume and dew point problems.	Where scrubbing required for other pollutants
Ceramic filters	High temperature applications; Smaller plant.	May "blind" more than fabric filters		Small plant; High temperature gas cleaning required.
Electrostatic precipitators	Low pressure gradient; Use with BF may reduce the energy consumption of the induced draft fan.	Not normally BAT.		When used with other particulate abatement plant

The Applicant proposes to use fabric filters for the abatement of particulate matter. Fabric filters provide reliable abatement of particulate matter to below 5 mg/m^3 and are BAT for most installations. The Applicant proposes to use multiple compartment filters with burst bag detection to minimise the risk of increased particulate emissions in the event of bag rupture.

Emissions of PM_{10} have been previously assessed as insignificant for long term and short term impacts (section 5.2.1 above). Although the long term impact for $PM_{2.5}$ is marginally above the threshold of insignificance, emissions of $PM_{2.5}$ in respect of long term impacts cannot be screened out as

insignificant. The Environment Agency considers that the use of fabric filters is BAT for the Installation for the reasons given above.

6.2.2 Oxides of Nitrogen

Comparison of nitrogen oxide abatement techniques

Oxides of Nitrogen : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Low NOx burners	Reduces NOx at source		Start-up, supplementary firing.	Where auxiliary burners required.
Starved air systems	Reduce CO simultaneously.			Pyrolysis, Gasification systems.
Optimise primary and secondary air injection				All plant.
Flue Gas Recirculation (FGR)	Reduces the consumption of reagents used for secondary NOx control; May increase overall energy recovery	Some applications experience corrosion problems.		All plant unless impractical in design (needs to be demonstrated)

Oxides of Nitrogen : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Selective catalytic reduction (SCR)	NOx emissions < 70mg/ m^3; Reduces CO, VOC, dioxins	Expensive; Re-heat required – reduces plant efficiency		All plant
Selective non-catalytic reduction (SNCR)	NOx emissions typically 150 – 180 mg/m^3	Relies on an optimum temperature around 900°C, and sufficient retention time for reduction; May lead to Ammonia slip	Port injection location	All plant unless lower NOx release required for local environmental protection.
Reagent Type: Ammonia	Likely to be BAT; Lower nitrous oxide formation	More difficult to handle; Narrower temperature window		All plant
Reagent Type: Urea	Likely to be BAT			All plant

The Applicant proposes to implement the following primary measures:

- Low NOx burners – this technique reduces NOx at source and is defined as BAT where auxiliary burners are required.
- Optimise primary and secondary air injection – this technique is BAT for all plant.
- Flue gas recirculation – this technique reduces the consumption of reagents for secondary NOx control and can increase overall energy recovery, although in some applications there can be corrosion problems – the technique is considered BAT for all plant.

There are two recognised techniques for secondary measures to reduce NOx. These are Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR). For each technique, there is a choice of urea or ammonia reagent.

SCR can reduce NOx levels to below 70 mg/m^3 and can be applied to all plant, it is generally more expensive than SNCR and requires reheating of the waste gas stream which reduces energy efficiency, periodic replacement of the catalysts also produces a hazardous waste. SNCR can typically reduce NOx levels to between 150 and 180 mg/m^3, it relies on an optimum temperature of around 900°C and sufficient retention time for reduction. SNCR is more likely to have higher levels of ammonia slip. The technique can be applied to all plant unless lower NOx releases are required for local environmental protection. Urea or ammonia can be used as the reagent with either technique, urea is somewhat easier to handle than ammonia and has a wider operating temperature window, but tends to result in higher emissions of N_2O. Either reagent is BAT and the use of one over the other is not normally significant in environmental terms.

The Applicant proposes to use SNCR with ammonia as the reagent.

Emissions of NOx have been previously assessed as insignificant for short term impacts (section 5.2.1 above). Although the long term impact is marginally above the threshold of insignificance, emissions of NOx in respect of long term impacts cannot be screened out as insignificant. The Environment Agency considers that SNCR is BAT for the Installation for the reasons given above.

The amount of ammonia used for NOx abatement will need to be optimised to maximise NOx reduction and minimise NH_3 slip. Improvement condition IC2 requires the Operator to report to the Environment Agency on optimising the performance of the NOx abatement system. The Operator is also required to monitor and report on NH_3 emissions quarterly.

6.2.3 Acid Gases, SOx, HCl and HF

Comparison of acid gas abatement techniques

Acid gases and halogens : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Low sulphur fuel, (<0.1%	Reduces SOx at source		Start-up, supplementary	Where auxiliary fuel required.

S gas oil or natural gas)			firing.	
Management of waste streams	Disperses sources of acid gases (e.g. PVC) through feed.	Requires closer control of waste management		All plant with heterogeneous waste feed

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Wet	High reaction rates; Low solid residues production; Reagent delivery may be optimised by concentration and flow rate	Large effluent disposal and water consumption if not fully treated for re-cycle; Effluent treatment plant required; May result in wet plume; Energy required for effluent treatment and plume reheat		Plants with high acid gas and metal components in exhaust gas – HWIs
Dry	Low water use; Reagent consumption may be reduced by recycling in plant; Lower energy use; Higher reliability	Higher solid residue production; Reagent consumption controlled only by input rate		All plant
Semi-dry	Medium reaction rates; Reagent delivery may be varied by concentration and input rate	Higher solid waste residues		All plant
Reagent Type: Sodium Hydroxide	Highest removal rates; Low solid waste production	Corrosive material; ETP sludge for disposal		HWIs
Reagent Type: Lime	Very good removal rates; Low leaching solid residue; Temperature of reaction well suited to use with bag filters	Corrosive material; May give greater residue volume if no in-plant recycle	Wide range of uses	MWIs, CWIs
Reagent Type: Sodium Bicarbonate	Good removal rates; Easiest to handle; Dry recycle systems proven	Efficient temperature range may be at upper end for use with bag filters; Leachable solid residues; Bicarbonate more	Not proven at large plant	CWIs

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
		expensive		

The Applicant proposes to implement the following primary measures:

- Use of low sulphur fuels for start-up and auxiliary burners (i.e. <0.1%S); this will reduce SOx at source. The Applicant has justified its choice of gas oil as the support fuel on the basis that alternatives are not available and we agree with that assessment.

There are three recognised techniques for secondary measures to reduce acid gases. These are wet, dry and semi-dry. Wet scrubbing produces an effluent for treatment and disposal in compliance with Article 46(3) of IED. It will also require reheat of the exhaust to avoid a visible plume. Wet scrubbing is unlikely to be BAT except where there are high acid gas and metal components in the exhaust gas as may be the case for some hazardous waste incinerators. In this case, the Applicant does not propose using wet scrubbing, and the Environment Agency agrees that wet scrubbing is not appropriate in this case.

The Applicant has therefore considered dry and semi-dry methods of secondary measures for acid gas abatement. Either can be BAT for this type of facility.

Both dry and semi-dry methods rely on the dosing of powdered materials into the exhaust gas stream. Semi-dry systems (i.e. hydrated reagent) offer reduced material consumption through faster reaction rates, but reagent recycling in dry systems can offset this.

In both dry and semi-dry systems, the injected powdered reagent reacts with the acid gases and is removed from the gas stream by the bag filter system. The powdered materials are either lime or sodium bicarbonate. Both are effective at reducing acid gases, and dosing rates can be controlled from continuously monitoring acid gas emissions. The decision on which reagent to use is normally economic. Lime produces a lower leaching solid residue in the APC residues than sodium bicarbonate and the reaction temperature is well suited to bag filters, it tends to be lower cost, but it is a corrosive material and can generate a greater volume of solid waste residues than sodium bicarbonate. Either reagent is BAT, and the use of one over the other is not significant in environmental terms in this case.

In this case, the Applicant proposes to use hydrated lime. The Environment Agency is satisfied that this is BAT

6.2.4 Carbon monoxide and total organic compounds (TOCs)

The prevention and minimisation of emissions of carbon monoxide and volatile organic compounds is through the optimisation of combustion controls, where all measures will increase the oxidation of these species.

Carbon monoxide and total organic compounds (TOCs)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN**
Optimise combustion control	All measures will increase oxidation of these species.		Covered in section on furnace selection	All plants

6.2.5 Dioxins and furans (and Other POPs)

Dioxins and furans				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN**
Optimise combustion control	All measures will increase oxidation of these species.		Covered in section on furnace selection	All plants
Avoid *de novo* synthesis			Covered in boiler design	All plant
Effective Particulate matter removal			Covered in section on particulate matter	All plant
Activated Carbon injection	Can be combined with acid gas absorber or fed separately.	Combined feed rate usually controlled by acid gas content.		All plant; Separate feed normally BAT unless feed is constant and acid gas control also controls dioxin release.

The prevention and minimisation of emissions of dioxins and furans is achieved through:

- optimisation of combustion control including the maintenance of permit conditions on combustion temperature and residence time, which has been considered in 6.1.1 above;
- avoidance of de novo synthesis, which has been covered in the consideration of boiler design;
- the effective removal of particulate matter, which has been considered in 6.2.1 above;
- injection of activated carbon. This can be combined with the acid gas reagent or dosed separately. Where the feed is combined, the combined feed rate will be controlled by the acid gas concentration in the exhaust. Therefore, separate feed of activated carbon would normally be considered BAT unless the feed was relatively constant. Effective control of acid gas emissions also assists in the control of dioxin releases.

The Applicant has justified combined feed on the ground that the nature of the feed material will give rise to relatively stable requirements and we are satisfied their proposals are BAT.

6.2.6 Metals

Metals				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Effective Particulate matter removal			Covered in section on particulate matter	All plant
Activated Carbon injection for mercury recovery	Can be combined with acid gas absorber or fed separately.	Combined feed rate usually controlled by acid gas content.		All plant; Separate feed normally BAT unless feed is constant and acid gas control also controls dioxin release.

The prevention and minimisation of metal emissions is achieved through the effective removal of particulate matter, and this has been considered in 6.2.1 above.

Unlike other metals however, mercury if present will be in the vapour phase. BAT for mercury removal is also dosing of activated carbon into the exhaust gas stream. This can be combined with the acid gas reagent or dosed separately. Where the feed is combined, the combined feed rate will be controlled by the acid gas concentration in the exhaust. Therefore, separate feed of activated carbon would normally be considered BAT unless the feed was relatively constant.

The Applicant has justified combined feed on the ground that the nature of the feed material will give rise to relatively stable requirements and we are satisfied their proposal are BAT.

6.3 BAT and global warming potential

This section summarises the assessment of greenhouse gas impacts which has been made in the determination of this Permit. Emissions of carbon dioxide (CO_2) and other greenhouse gases differ from those of other pollutants in that, except at gross levels, they have no localised environmental impact. Their impact is at a global level and in terms of climate change. Nonetheless, CO_2 is clearly a pollutant for IED purposes.

The principal greenhouse gas emitted is CO_2, however wood is considered to be a renewable fuel and its CO_2 emissions from combustion attract a GWP of zero in accordance with our guidance H1 annex H. The plant also emits small amounts of N_2O arising from the operation of secondary NOx abatement. N_2O has a global warming potential 310 times that of CO_2. The Applicant will therefore be required to optimise the performance of the secondary NOx abatement system to ensure its GWP impact is minimised.

There will also be CO_2 emissions from the burning of support fuels at start up, shut down and should it be necessary to maintain combustion temperatures. BAT for greenhouse gas emissions is to maximise energy recovery and efficiency.

Taking this into account, the net emissions of CO_2 from the installation are estimated at minus 302,995 tonnes per annum (i.e. there is a net reduction of CO_2 in the atmosphere as the result of the operation of this co-incineration plant). At this level, emissions can be characterised as insignificant. The Applicant has considered GWP as part of its BAT options appraisal.

In summary: the following factors influence the GWP of the facility:-

On the debit side

- CO_2 emissions from the burning of the wood (however wood is considered to be a renewable fuel and with a GWP of zero in accordance with our guidance H1 annex H);
- CO_2 emissions from burning auxiliary or supplementary fuels;
- CO_2 emissions associated with electrical energy used;
- N_2O from the de-NOx process.

On the credit side

- CO_2 saved from the export of electricity to the public supply by displacement of burning of virgin fuels.

Ammonia has no direct GWP effect.

The Applicant's assessment shows that the GWP of the plant is dominated by the emissions of nitrous oxide that are released as a result of the selected NOx abatement technique. However this emission is insignificant in relation to the saving of carbon dioxide emissions by the burning of wood, a renewable fuel with a GWP of zero. The Environment Agency agrees with this assessment and that the chosen option is BAT for the installation.

6.4 BAT and POPs

International action on Persistent Organic pollutants (POPs) is required under the UN's Stockholm Convention, which entered into force in 2004. The EU implemented the Convention through the POPs Regulation (850/2004), which is directly applicable in UK law. The Environment Agency is required by national POPs Regulations (SI 2007 No 3106) to give effect to Article 6(3) of the EC POPs Regulation when determining applications for environmental Permits.

However, it needs to be borne in mind that this application is for a particular type of installation, namely a waste co-incinerator. The Stockholm Convention distinguishes between intentionally-produced and unintentionally-produced POPs. Intentionally-produced POPs are those used deliberately (mainly in the past) in agriculture (primarily as pesticides) and industry. Those intentionally-produced POPs are not relevant where waste incineration is concerned, as in fact high-temperature incineration is one of the prescribed methods for destroying POPs.

The unintentionally-produced POPs addressed by the Convention are:

- dioxins and furans;
- HCB (hexachlorobenzene)
- PCBs (polychlorobiphenyls) and
- PeCB (pentachlorobenzene)

The UK's national implementation plan for the Stockholm Convention, published in 2007, makes explicit that the relevant controls for unintentionally-produced POPs, such as might be produced by waste incineration, are delivered through the requirements of IED. That would include an examination of BAT, including potential alternative techniques, with a view to preventing or minimising harmful emissions. These have been applied as explained in this document, which explicitly addresses alternative techniques and BAT for the minimisation of emissions of dioxins.

Our legal obligation, under regulation 4(b) of the POPs Regulations, is, when considering an application for an environmental permit, to comply with Article 6(3) of the POPs Regulation:

> "Member States shall, when considering proposals to construct new facilities or significantly to modify existing facilities using processes that release chemicals listed in Annex III, without prejudice to Council Directive 1996/61/EC, give priority consideration to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of substances listed in Annex III."

The 1998 Protocol to the Convention recommended that unintentionally-produced POPs should be controlled by imposing emission limits (e.g. 0.1 ng/m^3 for MWIs) and using BAT for incineration. UN Economic Commission for Europe (Executive Body for the Convention) (ECE-EB) produced BAT guidance for the parties to the Convention in 2009. This document considers various control techniques and concludes that primary measures involving management of feed material by reducing halogenated substances are not technically effective. This is not surprising because halogenated wastes still need to be disposed of and because POPs can be generated from relatively low concentrations of halogens. In summary, the successful control techniques for waste incinerators listed in the ECE-EB BAT are:

- maintaining furnace temperature of 850^oC and a combustion gas residence time of at least 2 seconds
- rapid cooling of flue gases to avoid the de novo reformation temperature range of 250-450^oC
- use of bag filters and the injection of activated carbon or coke to adsorb residual POPs components.

Using the methods listed above, the UN-ECE BAT document concludes that incinerators can achieve an emission concentration of 0.1 ng TEQ/m^3.

We believe that the Permit ensures that the formation and release of POPs will be prevented or minimised. As we explain above, high-temperature incineration is one of the prescribed methods for destroying POPs. Permit conditions are based on the use of BAT and Chapter IV of IED and incorporate all the above requirements of the UN-ECE BAT guidance and deliver the requirements of the Stockholm Convention in relation to unintentionally-produced POPs.

The release of **dioxins and furans** to air is required by the IED to be assessed against the I-TEQ (International Toxic Equivalence) limit of 0.1 ng/m^3. Further development of the understanding of the harm caused by dioxins has resulted in the World Health Organisation (WHO) producing updated factors to calculate the WHO-TEQ value. Certain **PCBs** have structures which make them behave like dioxins (dioxin-like PCBs), and these also have toxic equivalence factors defined by WHO to make them capable of being considered together with dioxins. The UK's independent health advisory committee, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has adopted WHO-TEQ values for both dioxins and dioxin-like PCBs in their review of Tolerable Daily Intake (TDI) criteria. EPR requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be specified for monitoring and reporting purposes, to enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. We require monitoring of a range of PAHs and dioxin-like PCBs in waste incineration Permits at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs identified by Defra in the Environmental Permitting Guidance on the IED. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

Hexachlorobenzene (HCB) is released into the atmosphere as an accidental product from the combustion of coal, waste incineration and certain metal processes. It has also been used as a fungicide, especially for seed treatment although this use has been banned in the UK since 1975. Natural fires and volcanoes may serve as natural sources. Releases of (HCB) are addressed by the European Environment Agency (EEA), which advises that:

> "*due to comparatively low levels in emissions from most (combustion) processes special measures for HCB control are usually not proposed. HCB emissions can be controlled generally like other chlorinated organic compounds in emissions, for instance dioxins/furans and PCBs: regulation of time of combustion, combustion temperature, temperature in cleaning devices, sorbents application for waste gases cleaning etc*." [reference http://www.eea.europa.eu/publications/EMEPCORINAIR4/sources_of_HCB.pdf]

Pentachlorobenzene (PeCB) is another of the POPs list to be considered under incineration. PeCB has been used as a fungicide or flame retardant, there is no data available however on production, recent or past, outside the UN-ECE region. PeCBs can be emitted from the same sources as for PCDD/F: waste incineration, thermal metallurgic processes and combustion plants providing energy. As discussed above, the control techniques

described in the UN-ECE BAT guidance and included in the permit, are effective in controlling the emissions of all relevant POPs including PeCB.

We have assessed the control techniques proposed for dioxins by the Applicant and have concluded that they are appropriate for dioxin control. We are confident that these controls are in line with the UN-ECE BAT guidance and will minimise the release of HCB, PCB and PeCB.

We are therefore satisfied that the substantive requirements of the Convention and the POPs Regulation have been addressed and complied with.

6.5 Other Emissions to the Environment

6.5.1 Emissions to water

The emissions to water are limited to uncontaminated rain water and reject water from the reverse osmosis water treatment facility. Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and /or minimise emissions to water.

6.5.2 Emissions to sewer

Boiler blow down liquors and other process waters will be discharged to foul sewer. The effluent is then subject to treatment at Bristol sewage treatment works, which is operated by the Sewerage Undertaker (Wessex Water). The Applicant reports that discussions with Wessex Water have taken place and the sewage treatment works is capable of handling discharges from the installation.

Such discharges are periodic because a closed loop process water recycling system collects water releases from the boiler and water treatment plant for use in the installation. These include:

- Boiler blow down water and cleaning effluent;
- Reverse osmosis plant waste water
- Back wash from water treatment ion exchange columns

As the discharges would be controlled by a Trade Effluent Consent, there is no need for us to set limits as releases are capable of being treated by the sewage treatment works, which in turn has limits set to protect the environment.

Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and /or minimise emissions to sewer.

6.5.3 Fugitive emissions

The IED specifies that plants must be able to demonstrate that the plant is designed in such a way as to prevent the unauthorised and accidental release of polluting substances into soil, surface water and groundwater. In addition storage requirements for waste and for contaminated water of Article 46(5) must be arranged.

The Applicant has proposed measures to minimise the impact of fugitive emissions from on-site activities. Key proposals are:

- Processing activities are carried out in enclosed buildings on impermeable surfaces

- Facilities for damping down of stockpiles of biomass fuel/waste to prevent emissions of dust will be installed in storage and handling areas

- Biomass fuel/waste will be stored in the reception area on impermeable surfaces. All surfaces are of hard standing and designed to accommodate the operations carried out and constructed so as to consider permeability and resistance to chemical attack.

- Spill kits are kept at several locations on site in the event of a spillage.

- Tanks containing potentially polluting liquids are constructed so that any leaks/spillages are contained. Bunds have a capacity greater than 110% of largest tank or 25% of total tankage, whichever is the greater.

- Rainwater and firewater will be stored in swales and attenuation ponds. Process water will be collected for re-use.

- Air Pollution Control (APC) and bottom ash residues will be handled within an enclosed system. Ash will be stored in silos and discharged via sealed connections to fully contained disposal vehicles. There will be a filter on the silo vent fitted with a differential pressure alarm.

- Activated carbon and sodium bicarbonate will be used within the flue gas treatment plant. These reagents are potentially dusty. Sealed connections will be used for deliveries. Air displaced during deliveries will vent via a filter unit installed on the storage vessel. The filter unit will be visually inspected during unloading operations to ensure that it is operating effectively. In the event of a dust emission, the filter will be replaced.

- During a delivery of ammonium hydroxide, displaced air will be vented back to the delivery vehicle. In the event of a spillage, any spilt material will be cleaned up immediately and disposed of appropriately.

- An inspection and maintenance programme will be implemented as appropriate.

Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and/or minimise fugitive emissions. Improvement condition (IC7) requires the Operator to carry out ambient monitoring of dust over a period of one year. This is to assess whether or not

dust from the facility is a potential nuisance or is of a significant risk to human health.

6.5.4 Odour

The fuel will not be significantly odorous and should not attract scavengers and pests or release bioaerosols. The fuel stores will be managed to handle the fuel stock residence times. Once the facility is running the continuous nature of the operation ensures a continuous turnover of feedstock and the potential for degradation will be minimal. There are different fuel stores designated for virgin wood fuels and recycled wood fuels.

Based upon the information in the application we are satisfied that the appropriate measures will be in place to prevent or where that is not practicable to minimise odour and to prevent pollution from odour.

6.5.5 Noise and vibration

Based upon the information in the application we are satisfied that the appropriate measures will be in place to prevent or where that is not practicable to minimise noise and vibration and to prevent pollution from noise and vibration outside the site.

The application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures. Measurements were taken of the prevailing ambient noise levels to produce a baseline noise survey and an assessment was carried out in accordance with BS4142 to compare the predicted plant rating noise levels with the established background levels.

The operations include a number of unloading, conveying and screening operations which will generate some noise. The screening activities will be in enclosed covered areas and the conveyors will also be covered. Equipment is to be selected with noise minimization as a design criteria.

The Applicant has proposed noise mitigation measures which include:

- Maximising natural screening provided by site buildings;
- Siting key plant away from noise-sensitive receptors (in enclosed buildings);
- Site activities which have the potential to cause annoyance via noise emissions are to be undertaken in enclosed buildings;
- Site buildings to be designed and constructed using concrete structures with steel roofs which will provide noise reduction;
- Operational controls – restriction of delivery of fuel and removal of wastes, testing of the fire pumps and the emergency generator, switching off plant when not in use.

The Applicant's predictions are dependent on the proposed plant being constructed to meet the mitigation as specified in the impact assessment. Performance against this assessment is to be included in the written report submitted to the Environment Agency on the commissioning of the installation under Improvement Condition IC2.

6.6 Setting ELVs and other Permit conditions

6.6.1 Translating BAT into Permit conditions

The Operator proposes to burn biomass fuel mixed with wood waste. We have taken the "mixing rule" into account whilst setting the appropriate emission limits. We have set half-hourly average limits for particulate matter, TOC, HCl, CO, SO_2 and NO_2. We consider that these emission limits are appropriate in the event the Operator burns 100% waste at the facility.

Article 14(3) of IED states that BAT conclusions shall be the reference for permit conditions. Article 15(3) further requires that under normal operating conditions; emissions do not exceed the emission levels associated with the best available techniques as laid down in the decisions on BAT conclusions.

At the time of writing of this document, no BAT conclusions have been published for waste incineration or co-incineration.

The use of IED Chapter IV emission limits for air dispersion modelling sets the worst case scenario. If this shows emissions are insignificant then we have accepted that the Applicant's proposals are BAT, and that there is no justification to reduce ELVs below the Chapter IV limits in these circumstances.

Below we consider whether, for those emissions not screened out as insignificant, different conditions are required as a result of consideration of local or other factors, so that no significant pollution is caused (Article 11(c)) or to comply with environmental quality standards (Article 18).

(i) Local factors

We have considered the impact on local receptors and habitat conservation sites for those emissions not screened out as insignificant and do not consider it necessary to impose further conditions, or set more stringent emission limits than those specified in the IED.

(ii) National and European EQSs

There are no additional National or European EQSs that indicate that IED limits are insufficient to protect the local environment.

(iii) Global Warming

CO_2 is an inevitable product of the combustion of waste. The amount of CO_2 emitted will be essentially determined by the quantity and characteristics of waste being incinerated, which are already subject to conditions in the Permit. It is therefore inappropriate to set an emission limit value for CO_2, which could do no more than recognise what is going to be emitted. The gas is not therefore targeted as a key pollutant under Annex II of IED, which lists the main polluting substances that are to be considered when setting emission limit values (ELVs) in Permits.

We have therefore considered setting equivalent parameters or technical measures for CO_2. However, provided energy is recovered efficiently (see section 4.3.7 above), there are no additional equivalent technical measures (beyond those relating to the quantity and characteristics of the waste) that can be imposed that do not run counter to the primary purpose of the plant,

which is the recovery of energy from waste. Controls in the form of restrictions on the volume and type of waste that can be accepted at the Installation and permit conditions relating to energy efficiency effectively apply equivalent technical measures to limit CO_2 emissions.

(iv) Commissioning

Before the plant can become fully operational it will be necessary for it to be commissioned. Before commissioning is allowed to start the operator is required by pre-operational condition PO4 to submit a commissioning plan to the Environment Agency for approval. Commissioning can only be carried out in accordance with the approved proposals in the plan.

In addition, it is recognised that certain information presented in the application was based on design data, or data from comparable equipment, the commissioning phase is the earliest opportunity to verify much of this information. The following improvement conditions have been included in the permit so that appropriate verifications will be determined by the applicant:

- Calibration of the CEMs in accordance with BS EN 14181 (IC6).
- Verification of furnace residence time, temperature and oxygen content (PO5 and IC3).
- The plant in total conforms to the permit conditions and that satisfactory process control procedures for the plant have been developed (IC2).
- Abatement plant optimisation details (IC2).

6.7 Monitoring

6.7.1 Monitoring during normal operations

We have decided that monitoring should be carried out for the parameters listed in Schedule 3 using the methods and to the frequencies specified in those tables. These monitoring requirements have been imposed in order to demonstrate compliance with emission limit values and to enable correction of measured concentration of substances to the appropriate reference conditions; to gather information about the performance of the SNCR system; to deliver the EPR requirement that dioxin-like PCBs and PAHs should be monitored and to deliver the requirements of Chapter IV of IED for monitoring of residues and temperature in the combustion chamber.

For emissions to air, the methods for continuous and periodic monitoring are in accordance with the Environment Agency's Guidance M2 for monitoring of stack emissions to air.

Based on the information in the Application and the requirements set in the conditions of the permit we are satisfied that the Operator's techniques, personnel and equipment will have either MCERTS certification or MCERTS accreditation as appropriate.

6.7.2 Monitoring under abnormal operations arising from the failure of the installed CEMs

The Operator has stated that they will provide back-up CEMS working in parallel to the operating CEMS. These will be switched into full operation immediately in the event that there is any failure in the regular monitoring equipment. The back-up CEMS measure the same parameters as the

operating CEMS. In the unlikely event that the back-up CEMS also fail Condition 2.3.10 of the permit requires that the abnormal operating conditions apply.

6.7.3 Continuous emissions monitoring for dioxins and heavy metals

Chapter IV of IED specifies manual extractive sampling for heavy metals and dioxin monitoring. However, Article 48(5) of the IED enables The Commission to act through delegated, authority to set the date from which continuous measurements of the air emission limit values for heavy metals, dioxins and furans shall be carried out, as soon as appropriate measurement techniques are available within the Community. No such decision has yet been made by the Commission.

The Environment Agency has reviewed the applicability of continuous sampling and monitoring techniques to the installation.

Recent advances in mercury monitoring techniques have allowed standards to be developed for continuous mercury monitoring, including both vapour-phase and particulate mercury. There is a standard which can apply to CEMs which measure mercury (EN 15267-3) and standards to certify CEMs for mercury, which are EN 15267-1 and EN 15267-3. Furthermore, there is an MCERTS-certified CEM which has been used in trials in the UK and which has been verified on-site using many parallel reference tests as specified using the steps outlined in EN 14181.

In the case of dioxins, equipment is available for taking a sample for an extended period (several weeks), but the sample must then be analysed in the conventional way. However, the continuous sampling systems do not meet the requirements of BS EN 1948 which is the standard for dioxin analysis. BS EN 1948 requires traversing the sampler across the duct and collecting parts of the sample at various points across the duct to ensure that all of the gas phase is sampled proportionately, in case there are variations in gas flow rate or composition resulting in a non-homogeneous gas flow. This requirement is particularly important where suspended solids are present in the gas, and dioxins are often associated with suspended solid particles. Continuous samplers are currently designed for operation at one or two fixed sampling points within the duct, and traverses are not carried out automatically. Using such samplers, more information could be obtained about the variation with time of the dioxin measurement, but the measured results could be systematically higher or lower than those obtained by the approved standard method which is the reference technique required to demonstrate compliance with the limit specified in the IED. The lack of a primary reference method (e.g. involving a reference gas of known concentration of dioxin) prohibits any one approach being considered more accurate than another. Because compliance with the IED's requirements is an essential element of EPR regulation, we have set emission limits for dioxins in the permit based on the use of BS EN 1948 and the manual sampling method remains the only acceptable way to monitor dioxins for the purpose of regulation.

For either continuous monitoring of mercury or continuous sampling of dioxins to be used for regulatory purposes, an emission limit value would need to be devised which is applicable to continuous monitoring. Such limits for mercury

and dioxins have not been set by the European Commission. Use of a manual sample train is the only technique which fulfils the requirements of the IED. At the present time, it is considered that in view of the predicted low levels of mercury and dioxin emissions, it is not justifiable to require the Operator to install additionally continuous monitoring or sampling devices for these substances.

In accordance with its legal requirement to do so, the Environment Agency reviews the development of new methods and standards and their performance in industrial applications. In particular the Environment Agency considers continuous sampling systems for dioxins to have promise as a potential means of improving process control and obtaining more accurate mass emission estimates.

6.8 Reporting

We have specified the reporting requirements in Schedule 4 of the Permit either to meet the reporting requirements set out in the IED, or to ensure data is reported to enable timely review by the Environment Agency to ensure compliance with permit conditions and to monitor the efficiency of material use and energy recovery at the installation.

7. Other legal requirements

In this section we explain how we have addressed other relevant legal requirements, to the extent that we have not addressed them elsewhere in this document.

7.1 The EPR 2010 and related Directives

The EPR delivers the requirements of a number of European and national laws.

7.1.1 Schedules 1 and 7 to the EPR 2010 – **IED Directive**

We address the requirements of the IED in the body of this document above and the specific requirements of Chapter IV in Annex 1 of this document.

There is one requirement not addressed above, which is that contained in Article 5(3) IED. Article 5(3) requires that "In the case of a new installation or a substantial change where Article 4 of Directive 85/337/EC (the EIA Directive) applies, any relevant information obtained or conclusion arrived at pursuant to articles 5, 6 and 7 of that Directive shall be examined and used for the purposes of granting the permit."

- Article 5 of EIA Directive relates to the obligation on developers to supply the information set out in Annex IV of the Directive when making an application for development consent.
- Article 6(1) requires Member States to ensure that the authorities likely to be concerned by a development by reason of their specific environmental responsibilities are consulted on the Environmental Statement and the request for development consent.
- Article 6(2)-6(6) makes provision for public consultation on applications for development consent.
- Article 7 relates to projects with transboundary effects and consequential obligations to consult with affected Member States.

The grant or refusal of development consent is a matter for the relevant local planning authority. The Environment Agency's obligation is therefore to examine and use any relevant information obtained or conclusion arrived at by the local planning authorities pursuant to those EIA Directive articles.

In determining the Application we have considered the following documents:

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The response of the Environment Agency to the local planning authority in its role as consultee to the planning process.

From consideration of all the documents above, the Environment Agency considers that no additional or different conditions are necessary.

The Environment Agency has also carried out its own consultation on the Environmental Permitting Application which includes the Environmental Statement submitted to the local planning authority. The results of our consultation are described elsewhere in this decision document.

7.1.2 Schedule 9 to the EPR 2010 – **Waste Framework Directive**

As the Installation involves the treatment of waste, it is carrying out a *waste operation* for the purposes of the EPR 2010, and the requirements of Schedule 9 therefore apply. This means that we must exercise our functions so as to ensure implementation of certain articles of the WFD.

We must exercise our relevant functions for the purposes of ensuring that the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste and that any waste generated is treated in accordance with Article 4 of the Waste Framework Directive. (See also section 4.3.9)

The conditions of the permit ensure that waste generation from the facility is minimised. Where the production of waste cannot be prevented it will be recovered wherever possible or otherwise disposed of in a manner that minimises its impact on the environment. This is in accordance with Article 4.

We must also exercise our relevant functions for the purposes of implementing Article 13 of the Waste Framework Directive; ensuring that the requirements in the second paragraph of Article 23(1) of the Waste Framework Directive are met; and ensuring compliance with Articles 18(2)(b), 18(2)(c), 23(3), 23(4) and 35(1) of the Waste Framework Directive.

Article 13 relates to the protection of human health and the environment. These objectives are addressed elsewhere in this document.

Article 23(1) requires the permit to specify:

(a) the types and quantities of waste that may be treated;

(b) for each type of operation permitted, the technical and any other requirements relevant to the site concerned;

(c) the safety and precautionary measures to be taken;

(d) the method to be used for each type of operation;

(e) such monitoring and control operations as may be necessary;

(f) such closure and after-care provisions as may be necessary.

These are all covered by permit conditions.

The permit does not allow the mixing of hazardous waste so Article 18(2) is not relevant.

We consider that the intended method of waste treatment is acceptable from the point of view of environmental protection so Article 23(3) does not apply.

Energy efficiency is dealt with elsewhere in this document but we consider the conditions of the permit ensure that the recovery of energy takes place with a high level of energy efficiency in accordance with Article 23(4).

Article 35(1) relates to record keeping and its requirements are delivered through permit conditions.

7.1.3 Schedule 22 to the EPR 2010 – **Groundwater, Water Framework and Groundwater Daughter Directives**

To the extent that it might lead to a discharge of pollutants to groundwater (a "groundwater activity" under the EPR 2010), the Permit is subject to the requirements of Schedule 22, which delivers the requirements of EU Directives relating to pollution of groundwater. The Permit will require the taking of all necessary measures to prevent the input of any hazardous substances to groundwater, and to limit the input of non-hazardous pollutants into groundwater so as to ensure such pollutants do not cause pollution, and satisfies the requirements of Schedule 22.

No releases to groundwater from the Installation are permitted. The Permit also requires material storage areas to be designed and maintained to a high standard to prevent accidental releases.

7.1.4 Directive 2003/35/EC – **The Public Participation Directive**

Regulation 59 of the EPR 2010 requires the Environment Agency to prepare and publish a statement of its policies for complying with its public participation duties. We have published our public participation statement.

This Application has been consulted upon in line with this statement, as well as with our guidance RGS6 on Sites of High Public Interest, which addresses specifically extended consultation arrangements for determinations where public interest is particularly high. This satisfies the requirements of the Public Participation Directive.

Our decision in this case has been reached following a programme of extended public consultation, on the original application. The way in which this has been done is set out in Section 2.2. A summary of the responses received to our consultations and our consideration of them is set out in Annex 4.

7.2 National primary legislation

7.2.1 **Environment Act 1995**

(i) Section 4 (Pursuit of Sustainable Development)

We are required to contribute towards achieving sustainable development, as considered appropriate by Ministers and set out in guidance issued to us. The Secretary of State for Environment, Food and Rural Affairs has issued *The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002).* This document:

> *"provides guidance to the Agency on such matters as the formulation of approaches that the Agency should take to its work, decisions about priorities for the Agency and the allocation of resources. It is not directly applicable to individual regulatory decisions of the Agency".*

In respect of regulation of industrial pollution through the EPR, the Guidance refers in particular to the objective of setting permit conditions "*in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters…*". The Environment Agency considers that it has pursued the objectives set out in the Government's guidance, where relevant, and that there are no additional conditions that should be included in this Permit to take account of the Section 4 duty.

(ii) Section 7 (Pursuit of Conservation Objectives)

We considered whether we should impose any additional or different requirements in terms of our duty to have regard to the various conservation objectives set out in Section 7, but concluded that we should not.

We have considered the impact of the installation on local wildlife sites within 2 km which are not designated as either European Sites or SSSIs. We are satisfied that no additional conditions are required.

(iii) Section 81 (National Air Quality Strategy)

We have had regard to the National Air Quality Strategy and consider that our decision complies with the Strategy, and that no additional or different conditions are appropriate for this Permit.

7.2.2 **Human Rights Act 1998**

We have considered potential interference with rights addressed by the European Convention on Human Rights in reaching our decision and consider that our decision is compatible with our duties under the Human Rights Act 1998. In particular, we have considered the right to life (Article 2), the right to a fair trial (Article 6), the right to respect for private and family life (Article 8) and the right to protection of property (Article 1, First Protocol). We do not believe that Convention rights are engaged in relation to this determination.

7.2.3 **Countryside and Rights of Way Act 2000 (CROW 2000)**

Section 85 of this Act imposes a duty on Environment Agency to have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty (AONB). There is no AONB which could be affected by the Installation.

7.2.4 **Wildlife and Countryside Act 1981**

Under section 28G of the Wildlife and Countryside Act 1981 the Environment Agency has a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest. Under section 28I the Environment Agency has a duty to consult Natural England in relation to any permit that is likely to damage SSSIs.

We assessed the Application and concluded that the Installation will not damage the special features of any SSSI. This was recorded on a CROW Appendix 4 form and sent to Natural England.

7.2.5 **Natural Environment and Rural Communities Act 2006**

Section 40 of this Act requires us to have regard, so far as is consistent with the proper exercise of our functions, to the purpose of conserving biodiversity. We have done so and consider that no different or additional conditions in the Permit are required.

7.3 National secondary legislation

7.3.1 The Conservation of Natural Habitats and Species Regulations 2010

We have assessed the Application in accordance with guidance agreed jointly with Natural England and concluded that there will be no likely significant effect on any European Site.

We consulted Natural England by means of an Appendix 11 assessment, and they agreed with our conclusion, that the operation of the Installation would not have a likely significant effect on the interest features of protected sites.

The habitat assessment is summarised in greater detail in section 5.4 of this document. A copy of the full Appendix 11 Assessment can be found on the public register.

7.3.2 Water Framework Directive Regulations 2003

Consideration has been given to whether any additional requirements should be imposed in terms of the Environment Agency's duty under regulation 3 to secure the requirements of the Water Framework Directive through (inter alia) EP permits, but it is felt that existing conditions are sufficient in this regard and no other appropriate requirements have been identified.

7.3.3 The Persistent Organic Pollutants Regulations 2007

We have explained our approach to these Regulations, which give effect to the Stockholm Convention on POPs and the EU's POPs Regulation, above.

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

S23 of the Local Democracy, Economic Development and Construction Act 2009 require us where we consider it appropriate to take such steps as we consider appropriate to secure the involvement of interested persons in the exercise of our functions by providing them with information, consulting them or involving them in any other way. S24 requires us to have regard to any Secretary of State guidance as to how we should do that.

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2.2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 4. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. In addition to meeting our consultation responsibilities, we have also taken account of our guidance in Environment Agency Guidance Note RGS6 and the Environment Agency's Building Trust with Communities toolkit.

ANNEX 1: APPLICATION OF CHAPTER IV OF THE INDUSTRIAL EMISSIONS DIRECTIVE

IED Article	Requirement	Delivered by
45(1)(a)	The permit shall include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2000/532/EC, if possible, and containing information on the quantity of each type of waste, where appropriate.	Condition 2.3.3 and Table S2.2 in Schedule 2 of the Permit.
45(1)(b)	The permit shall include the total waste incinerating or co-incinerating capacity of the plant.	Condition 2.3.3 and Table S2.2 in Schedule 2 of the Permit.
45(1)(c)	The permit shall include the limit values for emissions into air and water.	Condition 3.1.1 and 3.1.2 and Tables S3.1, S3.2 and S3.3 in Schedule 3 of the permit.
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	Condition 3.1.1 and 3.1.2 and Tables 3.2 and S3.3.
45(1)(e)	The permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Conditions 3.5.1 and Tables S3.1, S3.2, S3.3, S3.4 and S3.5. also compliance with Articles 10 and 11
45(1)(f)	The permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.10 to 2.3.11
46(1)	Waste gases shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Emissions and their ground-level impacts are discussed in the body of this document.
46(2)	Emission into air shall not exceed the emission limit values set out in parts 4 or determined in accordance with part 4 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Table S3.1.
46(5)	Prevention of unauthorised and accidental release of any polluting substances into soil, surface water or groundwater. Adequate storage capacity for contaminated rainwater run-off from the site or for contaminated water from spillage or fire-fighting.	Condition 2.3.1(a) and Table S1.2 of Schedule 1 of the permit.
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance,	Conditions 2.3.6, 2.3.10 and 2.3.11

IED Article	Requirement	Delivered by
	and with a maximum cumulative limit of 60 hours per year.	
47	In the event of breakdown, reduce or close down operations as soon as practicable.	Condition 2.3.10
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Conditions 3.5.1 to 3.5.5. Reference conditions are defined in Schedule 6
48(2)	Installation and functioning of the automated measurement systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Conditions 3.5.2 and 3.5.3, and Tables S3.1 and S3.5
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Tables S3.1, S3.2 and S3.3
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Conditions 4.1.1 and 4.1.2
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	Conditions 3.1.1, 3.1.2 and Table S3.1
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Conditions 3.5.1 and Table S3.5
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Pre-operational condition PO6. The Application specifies measurement point. Improvement Condition 3 requires a demonstration.
50(3)	At least one auxiliary burner which must not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil liquefied gas or natural gas.	Condition 2.3.7
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.6
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.6
50(4)(c)	Automatic shut to prevent waste feed if the CEMs show that ELVs are exceeded due to disturbances or failure of waste cleaning	Conditions 2.3.6 and 2.3.10

IED Article	Requirement	Delivered by
	devices.	
50(5)	Any heat generated from the process shall be recovered as far as practicable.	Conditions 1.2.1 to 1.2.3 and Pre-operational condition PO2
50(6)	Relates to the feeding of infectious clinical waste into the furnace.	No infectious clinical waste will be burnt
50(7)	Management of the Installation to be in the hands of a natural person who is competent to manage it.	Conditions 1.1.1 to 1.1.3 and 2.3.1 of the Permit fulfil this requirement
51(1)	Different conditions than those laid down in Articles 50(1), (2) and (3) and, as regards the temperature Article 50(4) may be authorised, provided the other requirements of this chapter are me.	No such conditions have been allowed
51(3)	Changes in operating conditions shall include emission limit values for CO and TOC set out in Part 3 of Annex VI.	No such conditions have been allowed
52(1)	Take all necessary precautions concerning delivery and reception of wastes, to prevent or minimise pollution.	- EPR require prevent or minimise pollution. - Conditions 2.3.1, 2.3.3, 3.2, 3.3 and 3.4
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	The application describes procedures for the reception and monitoring of incoming waste
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Conditions 3.5.1 and 1.4.1
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	Conditions 1.4.1, 2.3.1 and 3.2.1
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1, Table 3.5 and pre-operational condition PO3.
55(1)	Application, decision and permit to be publicly available.	All documents are accessible from the Environment Agency Public Register
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Conditions 4.2.2 and 4.2.3

ANNEX 2: Pre-Operational Conditions

Based on the information on the Application, we consider that we do need to impose pre-operational conditions. These conditions are set out below and referred to, where applicable, in the text of the decision document. We are using these conditions to require the Operator to confirm that the details and measures proposed in the Application have been adopted or implemented prior to the operation of the Installation.

Reference	Pre-operational measures
PO1	Prior to the commencement of commissioning, the operator shall submit a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with the requirements set out in Section 1 of "How to comply with your environmental permit". The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1(a) of the permit.
PO2	Prior to the commencement of commissioning, the operator shall send a report to the Environment Agency which will contain a comprehensive review of the options available for utilising the heat generated by the waste co-incineration process in order to ensure that it is recovered as far as practicable. The review shall detail any identified proposals for improving the recovery and utilisation of waste heat and shall provide a timetable for their implementation.
PO3	Prior to the commencement of commissioning, the operator shall submit to the Environment Agency for approval a protocol for the sampling and testing of bottom ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.
PO4	Prior to the commencement of commissioning the operator shall provide a written commissioning plan for approval by the Agency. The plan shall include: • the expected emissions to the environment during the different stages of commissioning, • the expected durations of commissioning activities and estimated timeline for completion • the actions to be taken to protect the environment and report to the Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.
PO5	After completion of furnace design and at least three calendar months before any furnace operation; the operator shall submit a written report to the Environment Agency of the details of the computational fluid dynamic (CFD) modelling or equivalent procedure to be agreed with the Environment Agency. The report shall demonstrate whether the design combustion conditions comply with the residence time and temperature requirements as defined by article 50(2) of the IED.
PO6	Prior to the commencement of commissioning, the operator shall submit a report on the baseline conditions of soil and groundwater at the installation. The report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for in Article 22(3) of the IED. The report shall contain information, supplementary to that already provided in application Site Condition Report, needed to meet the information requirements of Article 22(2) of the IED.
PO7	Prior to the commencement of commissioning, the Operator shall submit the written protocol referenced in condition 3.2.4 for the monitoring of soil and groundwater for approval by the Environment Agency. The protocol shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The procedure shall be implemented in accordance with the written approval from the Agency.

ANNEX 3: Improvement Conditions

Based in the information in the Application we consider that we need to set improvement conditions. These conditions are set out below - justifications for these are provided at the relevant section of the decision document. We are using these conditions to require the Operator to provide the Environment Agency with details that need to be established or confirmed during and/or after commissioning.

Reference	Requirement	Date
IC1	The operator shall carry out a programme of tests, in accordance with a method to be agreed with the Environment Agency, to determine the size distribution of the particulate matter in the exhaust gas emissions to air from emission point A1, identifying the fractions within the PM_{10} and $PM_{2.5}$ ranges. The programme shall conclude with the submission of a report on the results.	Within 6 months of the completion of commissioning.
IC2	The operator shall submit a written post-commissioning report to the Environment Agency which shall include: • a review of performance of the facility during the commissioning phase against the conditions of this permit. • details of optimisation of the NOx emission abatement system; how the Selective Non-Catalytic Reduction (SNCR) system and combustion settings are controlled to optimise NH_3, NOx and N_2O emissions. • details of procedures developed during commissioning for achieving and demonstrating satisfactory process control and covering the range of designed operating rates.	Within 6 months of the completion of commissioning.
IC3	The operator shall carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnace whilst operating under the anticipated most unfavourable operating conditions. The results shall be submitted in writing to the Environment Agency.	Within 4 months of the completion of commissioning.
IC4	The Operator shall submit a written report to the Environment Agency on the implementation of its Environmental Management System and the progress made in the accreditation of the system by an external body or if appropriate submit a schedule by which the EMS will be subject to accreditation.	Within 12 months of the date on fuel is first burnt.
IC5	The Operator shall carry out an assessment of the impact of emissions to air of NO_2, $PM_{2.5}$, TOC, Cd, As, Mn and Ni. The assessment shall predict the impact of the pollutants against the relevant EQS/EAL through the use of emissions monitoring data obtained during the first year of operation and air dispersion modelling. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work. A report of the assessment shall be made to the Environment Agency.	Within 15 months of the commencement of operations
IC6	The Operator shall submit • a written summary report to the Agency to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified in Table S3.1 complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3. • a full summary evidence compliance report	Within 4 months of the completion of commissioning. Within 18 months of the completion of commissioning

Reference	Requirement	Date
IC7	The operator shall carry out a programme of ambient monitoring of dust, over a period of at least one year, to verify whether or not dust emanating from the installation is a potential nuisance or a risk to human health. The programme shall have regard to Environment Agency Technical Guidance Note (Monitoring) M17 'Monitoring particulate matter in ambient air around waste facilities'. If at any time during the programme the operator measures levels that he believes could cause concern, he shall notify the Environment Agency in writing within 24 hours, and agree what remediation is required. The operator shall submit written reports to the Environment Agency as follows: • Interim summary reports at 3 month intervals • A full report within one month of concluding the programme	Within 15 months of the completion of commissioning.

ANNEX 4: Consultation Reponses

A) Advertising and Consultation on the Application

The Application has been advertised and consulted upon in accordance with the Environment Agency's Public Participation Statement. The way in which this has been carried out along with the results of our consultation and how we have taken consultation responses into account in reaching our decision is summarised in this Annex. Copies of all consultation responses have been placed on the Environment Agency and Local Authority public registers.

The Application was advertised on the Environment Agency website from 01/08/2013 to 30/08/2013. Copies of the Application were placed in the Environment Public Register at Horizon House and the Bristol City Council Public Register at Bristol.

The following statutory and non-statutory bodies were consulted:

- Natural England
- Director of Public Health (Bristol City Council)
- Public Health England
- Avon Fire & Rescue Service
- Bristol Port Authority
- Wessex Water
- National Grid
- Health & Safety Executive
- Food Standards Agency
- Bristol City Council (Environmental Health Department)
- Devon and Severn Inshore Fisheries and Conservation Authority

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Bristol Port Authority dated 13/08/13	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
No issues raised	None required

Response Received from Avon Fire and Rescue dated 22/08/13	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
No issues raised	None required

Response Received from Public Health England dated 05/09/13	
Brief summary of issues raised:	Summary of action taken / how this has been covered
1. PHE recommend that the Environment Agency ensure that dust mitigation measures are actively in place before commencement of any works on site. 2. PHE recommend that the Environment Agency consult the Local Authority with regard to potential risks to public health, in relation to site contamination and	1. The management of emissions during construction is not in the remit of environmental permitting, but will be covered through the planning process. We will regulate the operational activities at the site as defined in the permit and this will commence when any process materials are first brought to the site for

ground gas from historical use of the site. In addition, the Agency should consult the Local Authority on matters relating to noise, odour, dust and other nuisance emissions. 3. PHE recommend that the Environment Agency consult the Food Standards Agency (FSA) where there is a potential for deposition on land used for growing food crops or animal rearing. 4. PHE recommend that any Environmental Permit issued should contain conditions to ensure that the following potential emissions do not impact upon public health: • Emissions to air: SO_2, NO_2, PM, metals and dioxins • Fugitive dust emissions • Emissions from transport and vehicles • Releases to water from cooling water discharges and aqueous discharges from air pollution control equipment. • Releases to land and air including ash and residues from air pollution control measures 5. PHE concludes that they have no significant concerns regarding risk to health of the local population from the proposed activity, provided that the Applicant complies with the relevant regulatory requirements.	initial storage. We have required regular monitoring and reporting through the environmental permit. Measures to control dust emissions will be put in place and are discussed in section 6.5.3 of this document. Permit conditions will then ensure that these measures are used. 2. We consulted Bristol City Council (Environmental Health Department) during the determination of the application. We did not receive any comments or concerns on the proposals. No further action. 3. We consulted Food Standards Agency during the determination of the application. We did not receive any comments or concerns on the proposals. No further action. 4. Appropriate conditions have been included in the environmental permit to address issues raised by the PHE: • Emissions to air from the facility and their potential impacts are discussed in section 5.2 of this document. We also audited the Applicant's air quality and human health impact assessment and agree that the conclusions drawn in the reports are acceptable, that there would be no significant impact to the environment or human health. We have set conditions in the permit in relation to emissions to air (3.1.1, 3.1.2, 3.5.1 (a) and Table S3.1). • Permit conditions 3.2.1 and 3.2.2 address fugitive emissions (including dust) • We have not included any permit conditions to address emissions from transport and vehicles bringing waste/feedstock to the facility. This issue is a consideration for the Local Authority. • Permit conditions 3.2.1 and 3.2.2 address fugitive emissions (including dust) 5. No further action.

Response Received from Natural England dated 21/03/14	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
Agreed with our conclusion of "no likely significant effect" as detailed in the Appendix 11 assessment.	None required
We sent an Appendix 4 (CROW Act) form to Natural England for information only. Our conclusion is that there is no likely impact on the SSSI.	No further action

No responses received from	**Wessex Water** **National Grid** **Health & Safety Executive** **Food Standards Agency** **Bristol City Council (Environmental Health Department)** **Devon and Severn Inshore Fisheries and Conservation Authority** **Director of Public Health (Bristol City Council)**

2) Consultation Responses from Members of the Public and Community Organisations

No consultation responses were received.