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/NP3837NV
The Applicant / Operator is:	Energy Works (Hull) Limited
The Installation is located at:	Hull Energy Works, Cleveland Street, Hull, East Yorkshire, HU8 8AD

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/NP3837NV/A001. 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 EPR/NP3837NV. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 1 April 2015.

The Applicant is Energy Works (Hull) Limited. We refer to Energy Works (Hull) Limited as "the **Applicant**" in this document. Where we are talking about what would happen after the Permit is granted, we call Energy Works (Hull) Limited “the **Operator**”.

Energy Works (Hull) Limited’s proposed facility is located at Hull Energy Works, Cleveland Street, Hull, East Yorkshire, HU8 8AD. 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.)

AAD	Ambient Air Directive (2008/50/EC)
APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BREF	BAT Reference Note
CEM	Continuous emissions monitor
CFD	Computerised fluid dynamics
CHP	Combined heat and power
COMEAP	Committee on the Medical Effects of Air Pollutants
CROW	Countryside and rights of way Act 2000
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
EAL	Environmental assessment level
EIAD	Environmental Impact Assessment Directive (85/337/EEC)
ELV	Emission limit value
EMAS	EU Eco Management and Audit Scheme
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended
EQS	Environmental quality standard
EU-EQS	European Union Environmental Quality Standard
EWC	European waste catalogue
FPP	Fire Prevention Plan
FSA	Food Standards Agency
GWP	Global Warming Potential
HHRAP	Human Health Risk Assessment Protocol
HMIP	Her Majesty's Inspectorate of Pollution
HPA	Health Protection Agency (now PHE – Public Health England)
HRA	Human Rights Act 1998
HW	Hazardous waste

HWI	Hazardous waste incinerator
IBA	Incinerator Bottom Ash
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
I-TEF	Toxic Equivalent Factors set out in Annex VI Part 2 of IED
I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
LCPD	Large Combustion Plant Directive (2001/80/EC) – now superseded by IED
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
LADPH	Local Authority Director(s) of Public Health
LOI	Loss on Ignition
MBT	Mechanical biological treatment
MSW	Municipal Solid Waste
MWI	Municipal waste incinerator
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
Opra	Operator Performance Risk Appraisal
PAH	Polycyclic aromatic hydrocarbons
PC	Process Contribution
PCB	Polychlorinated biphenyls
PEC	Predicted Environmental Concentration
PHE	Public Health England
POP(s)	Persistent organic pollutant(s)
PPS	Public participation statement
PR	Public register
PXDD	Poly-halogenated di-benzo-p-dioxins
PXB	Poly-halogenated biphenyls
PXDF	Poly-halogenated di-benzo furans
RDF	Refuse derived fuel
RGS	Regulatory Guidance Series
SAC	Special Area of Conservation
SED	Solvent Emissions Directive (1999/13/EC) – now superseded by IED
SCR	Selective catalytic reduction
SGN	Sector guidance note

SHPI(s)	Site(s) of High Public Interest
SNCR	Selective non-catalytic reduction
SPA(s)	Special Protection Area(s)
SS	Sewage sludge
SSSI(s)	Site(s) of Special Scientific Interest
SWMA	Specified waste management activity
TDI	Tolerable daily intake
TEF	Toxic Equivalent Factors
TGN	Technical guidance note
TOC	Total Organic Carbon
UHV	Upper heating value – also termed gross calorific value
UN_ECE	United Nations Environmental Commission for Europe
US EPA	United States Environmental Protection Agency
WFD	Waste Framework Directive (2008/98/EC)
WHO	World Health Organisation
WID	Waste Incineration Directive (2000/76/EC) – now superseded by IED

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 1 April 2015. 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.

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 and our statutory PPS. 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 made a copy of the Application and all other documents relevant to our determination (see below) available to view on our Public Register at our office at Lateral, 8 City Walk, Leeds, LS11 9AT. 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”:

- Local Authority Environmental Protection department
- Local sewerage undertaker
- Food Standards Agency
- Health & Safety Executive
- Public Health England and Director of Public
- Local Fire & Rescue Service
- National Grid

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.

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 several information notices as follow:

- 17 April 2015, requesting further information on the outdoor storage of baled Refuse Derived Fuel (RDF). It should be noted that this proposed activity was subsequently cancelled by the Applicant
- 11 June 2015, requesting a revised air emissions impact assessment
- 16 July 2015, requesting a Fire Prevention Plan
- 21 August 2015, requesting a Noise Management Plan.

A copy of each information notice was placed on our public register and sent as was the response when received.

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* and a *waste 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 of 3 tonnes or more 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.

An installation may also comprise "directly associated activities", which at this Installation includes the generation of electricity using a steam turbine and a back up electricity generator 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 proposed site is located approximately 1.4km to the northeast of Hull city centre, East Yorkshire, at National Grid Reference TA 10130 30134. The surrounding land use is largely industrial, being predominantly associated with waste management facilities. The site is located alongside a bend in the River Hull, and consists of two main parts (referred to in the application as the 'Cleveland Street' and the 'Dalton Street' parts of the site). These are joined by a narrow strip of land (referred to as the 'Link Strip') which is also part of the site and which forms a flood defence wall beside the river. The overall site measures approximately 5.13 hectares in area. The nearest residential properties are a row of flats amongst commercial premises on the east of Glass House Row, approximately 10m to the north of the site, and a permanent Traveller's site, which is located approximately 20m to the east. The site is generally flat at 2m above ordnance datum, and is accessed from Dalton Street or by barge from the River Hull, at the southwest corner of the site.

The Humber Estuary Special Area of Conservation (SAC), Special Area of Conservation (SPA), and Ramsar site is located 1.9km due south of the proposed facility. These are the only sites designated under the Habitats Regulations located within 10km of the proposed facility. The Humber Estuary Site of Special Scientific Interest (SSSI) is also located 1.9 kilometres due south of the proposed facility. This is the only site designated under the Wildlife and Countryside Act located within 2km of the proposed facility. A number of non-statutory conservation sites are also located within 2km of the proposed facility.

The site is located on an aquifer but not within a groundwater source protection zone. It is also within the indicative tidal floodplain of the River Humber, however the area is protected by significant flood defences. The site is not located within an AQMA (Air Quality Management Area), the nearest being the Hull No.1(A) AQMA designated by Kingston-upon-Hull City Council, which is located approximately 1.3km to the southwest.

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 Energy Recovery. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the installation is a waste incineration plant because:

Notwithstanding the fact that energy will be recovered from the process; the process is never the less 'incineration' because it is considered that its main purpose is the thermal treatment of waste and:

- the plant only produces electricity and heat but no material output;
- the waste is the principal source of fuel;
- the waste being burned is mixed waste comprising different materials; and
- the waste has not been treated to improve its quality to a relevant standard.

In addition, although the process used to thermally treat the waste is gasification; for the process not to be considered to be a waste incineration plant, the resultant gases from the gasification process must be purified to such an extent that they are no longer a waste prior to their combustion and can cause emissions no higher than those from the burning of natural gas. The Applicant has not demonstrated to our satisfaction that the gases have passed the 'end of waste' test as referred to in the Waste Framework Directive; therefore the whole process is considered to be a waste incineration plant and therefore subject to the requirements of Chapter IV of the IED.

The EfW facility has a total capacity of approximately 100 MW (thermal input) and is capable of generating up to approximately 28 MWe of electrical power, the majority of which is exported to the National Grid. Provision has been made to supply additional heat in the form of steam or hot water, of up to 10 MWth, should a commercial scheme becomes available to take the heat.

The facility consists of a single fluidised bed gasification line with a nominal design throughput of up to 215,000 tonnes per year of waste materials (based on 28.8 tonnes per hour and 7500 operational hours per year) with a design average net calorific value (NCV) of 12.5 MJ/kg.

The maximum throughput of the facility is up to 315,000 tonnes per year of waste materials (based on a maximum mechanical capacity of 36 tonnes per hour and 8,760 operational hours per year) with an average NCV of 10 MJ/kg. The Applicant has requested that the permit reflects the maximum mechanical capacity of the plant to take account of the following scenarios:

- Planned and unplanned shutdown time periods which will vary from year to year, where as a consequence the annual fuel input capacity could increase or decrease depending on the availability of the plant.

- If the gasification plant performed above average and operated above the nominal availability during the year, it could be required to shut down unnecessarily if there was no ‘headroom’ allowance in the annual permitted fuel tonnage.

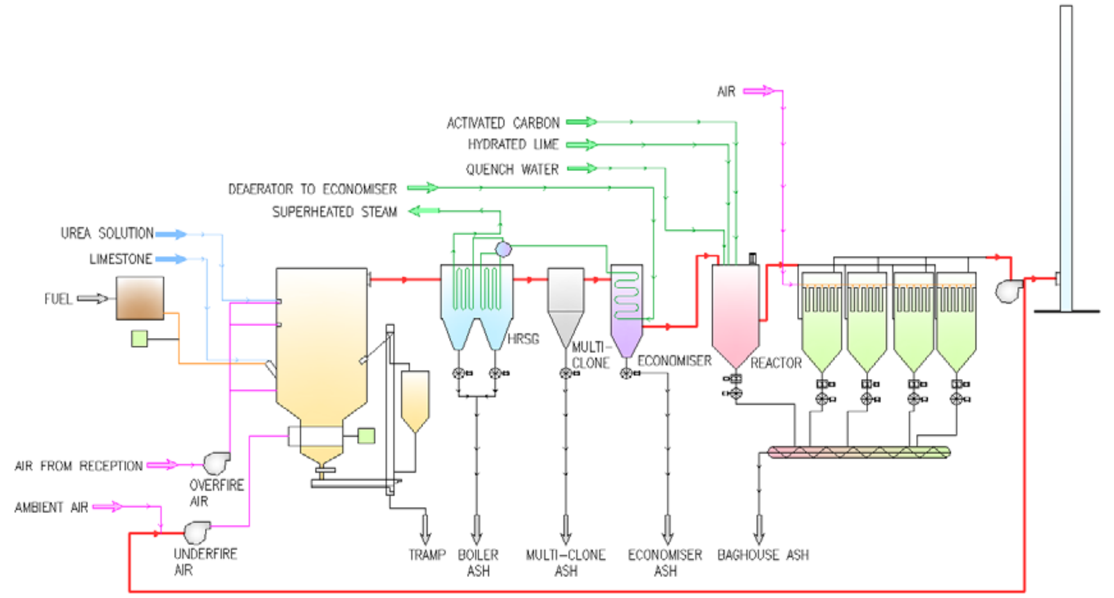
- Fluctuations in the net calorific value of the incoming fuel. If the net calorific value of the fuel received is lower than expected, the gasification plant will be required to operate at a higher mechanical throughput than its nominal design capacity. If the gasification plant operates at this increased mechanical throughput, it again could be required to shut down unnecessarily before the end of the year if there was no ‘headroom’ allowance in the annual permitted tonnage.

We have confirmed with the Applicant that their detailed modelling was based on the plant operating at a maximum throughput of 315,000 tonnes per annum and as such we have included this figure in Table S2.2 of the permit.
.
In outline the process would be as follows:

- Waste derived fuels, comprising of Municipal Solid Waste (MSW), Commercial and Industrial (C&I) waste, and waste wood, will be delivered to the facility.
- Waste will initially be delivered directly by road, while in the future the site may also accept pre-processed waste in wrapped bales, delivered by barge along the River Humber.
- These waste derived fuels will be unloaded into the storage facilities within the waste reception building.
- Once in the reception building, waste derived fuels will (where necessary) be passed through a mechanical treatment (MT) plant to remove non-combustible materials, and to size the fuel ready for the gasifier.
- Overhead grab cranes will then mix the fuel and deposit it into metering bins ready for gasification in a fluidised bed gasification plant.
- The resultant syngas will be combusted in the combustion zone of the gasifier.
- Residual tramp material (inerts and clinkers) and other non-combustible materials will be extracted from the fluidised bed through the bed recycle system.
- Emissions of nitrogen oxides would be controlled by the injection of urea into the combustion zone of the gasifier.
- A cyclone system will remove larger particulates from the flue gases.
- Hot gases from the combustion of the syngas would be passed through a boiler to raise steam. The steam would then be passed to a steam turbine to generate electricity for export to the National Grid.
- The facility will be “CHP ready”. When a district heating market becomes available, the provision of a heat off-take to supply a network would be possible without any modifications to the installed system.
- The flue gases would be cleaned in a flue gas treatment plant. This would include the injection of carbon, primarily to control dioxin and metals emissions, the injection of lime to control acid gas emissions, and the use of a fabric filter to remove dust.

- Residues collected from the flue gas treatment system will be temporarily stored on site prior to being transferred off site for further treatment and/or disposal.
- The cleaned exhaust gases would be released to atmosphere via a 70m stack.

The key features of the Installation are summarised in the schematic diagram and table below.



Waste throughput (t/line)	315,000/annum	36/hour
Waste processed	Municipal Solid Waste, Commercial and Industrial Waste, and Waste Wood	
Number of lines	One	
Furnace technology	Fluidised bed gasification	
Auxiliary Fuel	Low sulphur light fuel oil	
Acid gas abatement	Dry	Hydrated lime
NOx abatement	SNCR	Urea
Reagent consumption	Auxiliary fuel: 300 te/annum Urea: 3200 te/annum Hydrated lime: 3200 te/annum Activated carbon: 125 te/annum Limestone: 230 te/annum Process water: 88 te/annum	
Flue gas recirculation	Yes	
Dioxin abatement	Activated carbon	
Stack	Grid Reference, TA 10279 30124	
	Height, 70 m	Diameter, 2.49 m
Flue gas	Flow, 55.66 Nm^3/s	Velocity, 17.7 m/s
	Temperature, 133 °C	
Electricity generated	28 MWe	210,000 MWh
Electricity exported	23.7 MWe	177,750 MWh
Steam conditions	Temperature, 400°C	Pressure, 44 bar
Waste heat use	Design incorporates heat export capability of up to 10 MW as medium pressure hot water.	

4.1.4 Key Issues in the Determination

The key issues arising during this determination were the environmental impact of emissions to air from the Installation, 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 site setting is described in section 4.1.2 above.

The applicant has submitted a detailed site layout plan which shows how the various buildings and operational components will be laid out. The gasification plant and ancillary operations will be located on the Cleveland Street site while the Dalton Street site is proposed to be used for future development including an anaerobic digestion facility, biogas conversion plant, in-vessel composting facility and waste transfer station.

Historical Ordnance Survey (OS) plans show that the site has been under commercial and industrial use for the last 160 years, having been used for grease and varnish manufacturing, tar distilling, cement manufacturing, the processing of foodstuffs (oil and flour mills, and cocoa extraction) and the storage/ maintenance of vehicles. These land uses prevailed throughout much of the 20th century, with little significant change on either the Dalton Street or Cleveland Street parts of the site until the 1980's, when redevelopment of the Dalton Street site commenced and included the construction of a cleansing depot. The Cleveland Street site was developed as a business park in the early 1990's, however this has now been demolished, as shown on the 2012 OS plan. Recent history shows the Dalton Street site to have been used by the Hull City Council as a waste management facility although this site has now been vacated.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The site has been designed such that all process areas, loading/unloading areas, materials handling areas and roadways will be covered with an impervious concrete and/or tarmac base with a sealed drainage system. All waste fuels will be unloaded inside the main waste fuel handling building to reduce the risk of contaminated run-off being generated outdoors.

Under normal circumstances foul water and process effluent will be collected on site and discharged to public sewer. Where opportunities for the re-use and recycling of process effluent exists this will be implemented where practicable. Surface water run-off from areas susceptible to pollution, for example, roads and parking areas, will pass through an interceptor prior to being discharged to sewer. Uncontaminated surface water drainage will also discharge to sewer. Existing connections to combined sewers will be utilised with controls being fitted to the sewer outlets to enable discharges to be isolated in the event of a pollution incident within the site.

The Installation will require the use of a number of potentially polluting raw materials and fuels including gas oil, reagents such as hydrated lime, crushed limestone, urea and activated carbon, boiler treatment chemicals, lubrication oils and fluids, and refrigerant gases. The gasification plant and emergency standby generator will be supplied with gas oil on an as needs basis with no provision for other flammable fuels except bottled propane gas. The fuel oil storage tanks will be have secondary containment, bunded at 110% of the total tank capacity and the offloading point will be fully contained with the appropriate capacity to contain a spill during fuel delivery.

All liquid chemicals stored on site will be kept inside areas designed with suitable primary, secondary, and, where feasible, tertiary containment. Spillages and leakages will be retained in these areas and treated locally.

Lime and activated carbon will be stored in silos, being transported pneumatically from the delivery vehicle to the appropriate silo. The loading operation will be controlled through level controls and alarms. Each silo will be equipped with a vent fitted with a filtration device. Filters will be inspected regularly for leaks.

Adequate quantities of spillage absorbent materials will be made available on-site, at an easily accessible location(s), where liquids are stored. A site drainage plan, including the locations of foul and surface water drains and interceptors will be made available onsite, where practicable.

In the event of a fire, deluge water from the waste fuel handling building will be collected and contained on the hardstanding in the north west corner of the Cleveland Street site and will subsequently be transferred off-site via road tankers to a licensed waste management facility. The design of the yard area and walls will be such as to contain this deluge water. Automatic penstock valves will actuate at the same time as the firewater deluge system to ensure no contaminated water drains to either to public sewer, or to other areas of the site. Deluge water from other areas which do not involve the handling of waste fuel, for example, the turbine hall, will discharge via interceptors to the public sewer.

All spillages will be reported to site management and a record of the incident will be made with the relevant authorities being informed as appropriate.

The effectiveness of the Emergency Plan for spillages is subject to Management Review and will be reviewed following any major spillages and revised as appropriate.

Given the materials used within the activities of the Installation, the management and physical measures available and the sensitivity of the land on which the site is located, we consider that the likelihood of incidents involving loss of containment is low and the overall risk to the environment is not significant. We also consider that the provisions for contaminated fire water retention are sufficient to meet the requirements of IED Article 46(5). The Applicant has addressed this issue in their Fire Prevention Plan (see section 4.34.) We are therefore satisfied that the ground and groundwater can be protected from the activities of this Installation.

The Applicant has submitted a preliminary drainage plan for the site showing the location of foul, process and surface water drains, monitoring points and emissions points to sewer. However the specific detail and final arrangements of the drainage system was not able to be totally confirmed, and therefore we have included pre-operational condition PO7 which requires the operator to provide a detailed as-installed site drainage plan and the specific design detail of the site containment infrastructure, including all sub-surface structures and equipment. This condition also requires that a specific inspection and maintenance programme is to be provided for the site containment infrastructure, so that the 'lifetime' sections of the SCR can be implemented from the commencement of operations at the site.

Under Article 22(2) of the IED the Applicant is required 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.

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

The IED also requires that periodic monitoring of soil and groundwater beneath the site should be undertaken throughout the life of the permit such that the absence of pollution to these media from operations at the site can be demonstrated. Condition 3.2.4 and pre-operational condition PO9 of the permit secures and makes provision for this requirement.

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 2.9 of the Supporting Information to 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 accounts both the baseline conditions and the site's current or approved future use. To do this, the Operator will apply to us for surrender of the permit, 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 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 are 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 or EMAS. 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 (IC1) 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 will be in place to ensure that the site remains secure.

4.3.4 Accident management

(a) The Applicant has not submitted a detailed Accident Management Plan. However, having considered the 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.

(b) Combustible waste will be stored on site and therefore the Applicant has submitted a Fire Prevention Plan (FPP) in accordance with our guidance. Having considered the Applicant's FPP we are satisfied that appropriate measures will be in place to prevent waste fires, but that if fire did occur, the impact on people and the environment will be reduced. We have provisionally approved the Applicant's FPP as it meets the minimum regulatory standards that we expect operators to follow. Some details remain outstanding though and as the installation is still subject to final detailed design and commissioning we have included a pre-operational condition (PO10) in the permit requiring the Applicant to submit an updated FPP prior to operation of the new facility.

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 EPR/NP3837NV/A001	Parts B2 and B3 of the Application Form. The Supporting Information document including associated Annexes. Response to Not Duly Made letter: Q18-20 (emission points); and section 4 (additional design changes) except the proposal to store baled RDF outdoors.	Together these sections describe key operating techniques and how the Installation will be operated to ensure that best available techniques are applied.
Response to Schedule 5 Notice dated 17/04/15	Confirmation that temporary outdoor storage of Refuse Derived Fuel (RDF) would not be included under this permit application	

Description	Parts Included	Justification
Additional information EPR/NP3837NV/A001	Amended site plans showing the installation boundary (plan 1402-001, Rev. A5) and emission points (plan 1402-002, Rev. A5)	
Response to Schedule 5 Notice dated 16/07/15, EPR/NP3837NV/A001	Fire Prevention Plan	
Response to Schedule 5 Notice dated 21/08/15 EPR/NP3837NV/A001	Noise Management Plan	
Additional information EPR/NP3837NV/A001	Responses to Q1 (low NOx burners), Q2 (metals and dioxins reagent injection), Q3 (odour abatement), and Q5 (steam conditions)	16/11/15

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, 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:

(i) these wastes are categorised as municipal waste in the European Waste Catalogue or are non-hazardous wastes similar in character to municipal waste;

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

The incineration plant will take residual Municipal Solid Waste (MSW), Commercial and Industrial (C&I) waste, pre-processed MSW and C&I waste and waste wood (all referred to as waste derived fuel).

We have limited the capacity of the Installation to 315,000 tonnes per annum. This is based on the installation operating 8,760 hours per year at a nominal capacity of 36 tonnes per hour.

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:

1. 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.

2. The extent to which the Installation meets the requirements of Article 50(5) of the IED, which requires *"the heat generated* during the incineration and co-incineration process is *recovered as far as practicable through the generation of heat, steam or power*". This issue is covered in this section.

3. 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. It will be designed to include all normal energy efficiency design features, including high efficiency motors, high standards of cladding and insulation. The plants thermal efficiency will be optimised inclusion of the following measures:

- The boiler will be equipped with economisers and superheaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the fuel that is being burnt;

- Unnecessary releases of steam and hot water will be avoided, to avoid the loss of boiler water treatment chemical and the heat contained within the steam and water;

- Low grade heat will be extracted from the turbine and used to preheat the boiler feed water in order to improve the efficiency of the thermal cycle;

- Steady operation will be maintained where necessary by using auxiliary fuel firing; and

- Boiler heat exchange surfaces will be cleaned on a regular basis to ensure efficient heat recovery.

The Application states that an energy efficiency plan will be built into the operation and maintenance procedures of the plant to ensure maximum, practical, sustainable, safe and controllable electricity generation. The plan is to be reviewed periodically as part of the ISO:14001 process.

The Application states that the specific energy consumption, a measure of total energy consumed per unit of waste processed, will be 105 kWh/tonne, based on the nominal design capacity of 215,000 t/a.

Data from the BREF for Municipal Waste Incinerators shows that the range of specific energy consumptions is as in the table below.

MSWI plant size range (t/yr)	**Process energy demand (kWh/t waste input)**
Up to 150,000	300 – 700
150,000 – 250,000	150 – 500
More than 250,000	60 – 200

The BREF says that it is BAT to reduce the average installation electrical demand to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. The LCV in this case is expected to be 12.5 MJ/kg which is high due to the feedstock being waste derived fuels. Taking account of the difference in

LCV, the specific energy consumption in the Application is in line with that set out above.

(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 CHP Ready Guidance - February 2013 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) for raw waste inputs or 0.6 – 1.0 MWh/tonne of waste (based on LCV of 15.2 MJ/kg) for pre-treated wastes. 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).

The 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 2.6.2 of the Application shows 28 MW of electricity produced for an annual burn of 215,000 tonnes, which represents 13.1 MW per 100,000 tonnes/yr of waste burned (1.01 MWh/tonne of waste). The predicted performance of the Installation therefore exceeds the indicative BAT range stated above.

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 and provided a CHP-R assessment as part of their application, 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. However, we have included pre-operational condition PO2 that requires the operator to provide an update on heat utilisation opportunities from the Installation prior to the commencement of commissioning.

Our CHP-R guidance also states that opportunities to maximise the potential for heat recovery should be considered at the early planning stage, when sites are being identified for incineration facilities. In our role as a statutory consultee on the planning application, we ensured that the issue of energy utilisation was brought to the planning authority's attention.

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 6(6) 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 Cooling System

The plant will operate an Air Cooled Condenser (ACC) to condense the steam output from the turbine to allow return of the condensate to the boiler. The Applicant has considered the type of cooling technology in their application with the two main alternatives to an ACC being a water cooled condenser or an evaporative condenser. All three options can be considered BAT depending on the situation, as set out in our Sector Guidance Note EPR 5.01, The Incineration of Waste. Water cooled condensers use a re-circulating water supply to condense the steam, while an evaporative condenser uses water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling.

The main advantage of both of these water based systems is that they provide improved cooling and are not susceptible to condenser efficiency fluctuation with changing air temperature. High air temperatures in the summer with an ACC for example, can result in insufficient condensing power and subsequently reduce the efficiency of the generating turbine. Another advantage of a water cooled condensing system is the reduction in noise in comparison to the noise generated by the fans in an air cooled condenser system. The disadvantage of the water cooled systems is the significant volume of water required. Chemical additives are also needed which means there is potentially a significant effluent flow to be managed and discharged. In winter there is also the risk of freezing, while maintenance costs are generally higher due to the wet nature of the technology. In the case of evaporative condensers there is also the significant potential for visual impacts through the release of water vapour plumes.

The Applicant has stated that the proposed ACC will be designed and guaranteed by the technology supplier with enough additional capacity to maintain turbine efficiency during the summer months. They therefore consider an Air Cooled Condenser to represent BAT for the installation.

(vi) 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 5. The following parameters are required to be reported: total electrical energy generated; electrical energy exported; total energy usage and energy exported as heat (if any). Together with the total MSW 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 Installation will use treated mains water for boiler feed water replenishment as part of the steam cycle maintenance programme. The gasification plant will require a water supply of approximately 88,000 m^3 per annum (11 m^3/hr). However the application indicates that a number of water utilisation efficiency measures will be deployed including re-use of spent process water for ash wetting and flue gas attemporation (to control steam temperatures) and harvesting of rainwater from building roofs for re-use in the process.

The Operator is required to report with respect to raw material usage under condition 4.2. and Schedule 5, including consumption of lime, activated carbon and urea used per tonne of waste 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 NO_x. 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 Applicant has described the principal waste streams that the Installation will produce are as follows:

- material removed from the fluidised bed (referred to as tramp material in the application), consisting of inerts and clinkers;
- fly ash extracted from the flue gases, comprising a single waste stream consisting of boiler ash, multi-clone (cyclone system) ash and economiser ash;
- air pollution control residues from the flue gas treatment system; and
- recyclates and non-combustible materials from the mechanical treatment plant.

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 S3.4 specify limits for total organic carbon (TOC) of <3% and loss on ignition (LOI) of <5%, in the bottom ash. The Operator must monitor and report against at least one of these parameters. Compliance will demonstrate that good combustion control and waste burnout is being achieved in the furnaces 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, fly ash 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 S3.4 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 and other environmental impacts. 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 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 that 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 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 excedance 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 if the applicant is unable to provide suitable proposals. 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 the following reports submitted with the Application:

- URS, Hull Energy Works, Air Quality Impact Assessment, 47071235/LERP0001, October 2014;
- Fichtner, Hull Energy Works, Air Quality Assessment: Additional Information; Abnormal Emissions Assessment, 17th December 2014; and
- URS, Hull Energy Works, Health Effects Arising from Emissions of Metals and Organic Substances, 47071235_HHRA-01, March 2015.

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 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 incinerator chimney and its impact on local air quality. It also briefly summarises the results from the applicant's H1 screening assessment. The impact on conservation sites is considered in section 5.4.

The Applicant has applied a screening and modelling approach to their assessment rather than submit a full air dispersion model as part of their application. In their duly making response, the Applicant has provided justification for this approach, and in this case we agreed to accept their submission.

The air impact assessments, and the screening and 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) and Annex VI of the IED. These substances are:

    - Oxides of nitrogen (NO_x), 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)

- o Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC), VOC (assumed to be 100% benzene)

- 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, metals were assessed in accordance with the Environment Agency guidance to applicants on impact assessment of Group 3 metals stack releases, v.3, Sept. 2012. These nine metals are antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel and vanadium and their compounds (formerly WID group 3 metals).

- Fourth, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically ammonia (NH_3), Polycyclic Aromatic Hydrocarbons (PAH) and PCB's.

Following application of the H1 screening methodology a number of pollutants screened out and were not carried forward for detailed dispersion modelling. These pollutants were:

- Long term and short term emissions of Mercury, Ammonia (human health receptors only), and Hydrogen fluoride (human health receptors only);
- Short term emissions of Carbon monoxide and Hydrogen chloride
- Long term emissions of Particulates (PM_{10} and $PM_{2.5}$), VOC and Cadmium.

The results of the Applicant's H1 screening for long term emissions are shown in the table below.

Pollutant	**EQS / EAL**	**Back-ground** Note 1	**Process Contribution (PC) (Long term)**		**Predicted Environmental Concentration (PEC)**		**Detailed modelling required?**
	μg/m³	**μg/m³**	**μg/m³**	**% of EAL**	**μg/m³**	**% of EAL**	**Yes/No**
NO_2	40	27.7	2.68	6.68	30.4	76.0	Yes
PM_{10}	40	-	0.134	0.334	-	-	No
$PM_{2.5}$	25	-	0.134	0.535	-	-	No
HF	16	-	0.0173	0.108	-	-	No
Cd	0.005	0.00018	0.00066	13.4	0.00084	17	No
Hg	0.25	-	0.00066	0.268	-	-	No
NH_3	180	-	0.134	0.0743	-	-	No
VOC	5	0.87	0.134	2.68	1.0	20.1	No

Note 1: Background concentrations are only shown where the PC is not insignificant

The results of the Applicant's H1 screening for short term emissions are shown in the table below.

Pollutant	EQS / EAL	Back-ground Note 1	Process Contribution (PC) (Short term)		PC as % of headroom (EAL-Background)	Detailed modelling required?
	µg/m³	µg/m³	µg/m³	% of EAL	%	Yes/No
NO_2	200	55.4	356	178.0	246	Yes
PM_{10}	50	39.2	26.8	53.5	247	Yes
SO_2	266	13.2	178	67.0	70.2	Yes
	350	13.2	178	50.9	52.8	Yes
	125	13.2	44.6	35.7	39.5	Yes
CO	10000	-	89.1	0.89	-	No
HCL	750	-	53.5	7.13	-	No
HF	160		3.57	2.23	-	No
Hg	7.5	-	0.0446	0.594	-	No
NH_3	2500	-	8.91	0.357	-	No

Note 1: Background concentrations are only shown where the PC is not insignificant. The short term background has been taken to be equivalent to twice the long term background in accordance with Environment Agency guidance

Based on the above results the Applicant carried out detailed dispersion modelling for those pollutants (non-metals) deemed potentially significant, as follows:

- Oxides of nitrogen (as NO_2)
- Sulphur dioxide
- Particulates (PM_{10}) (short term impacts only)

In addition detailed modelling was also applied to:

- Polychlorinated dibenzo-para-dioxins and Polychlorinated dibenzo furans (referred to as dioxins and furans)
- Dioxin like PCB's (Polychlorinated biphenyls)
- Polycyclic aromatic hydrocarbons (PAH)

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

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 5.1 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 Humberside Airport located 20km south of the installation, between 2006 and 2009 and for the year 2011. We would normally expect consecutive years of meteorological data to be used, however in their duly making response the Applicant presented justification why they have not done this, and we have accepted their submission. We would expect this data to be reasonably representative on a regional scale.

The impact of the terrain upon plume dispersion was not included in the dispersion modelling as the Applicant determined that there were no areas with a gradient exceeding 1 in 10 in the vicinity of the installation. Based on our review of the local topography we are satisfied with this approach.

The Applicant has reviewed both local air quality management reports and data held on the Defra background pollutant database, to augment the data from local authority monitoring. This data is summarised in the Application and has been used by the Applicant to establish the background (or existing) air quality against which to measure the potential impact of the incinerator. There is one local authority monitoring station relevant to the location of the installation, the "Hull Freetown" site located 1km south of the installation, which is classed as an Urban Centre. We have checked the background monitoring data used by the Applicant for the relevant pollutants and agree with the values used, which form a reasonable basis for the assessment.

As well as calculating the peak ground level concentration, the Applicant has modelled the concentration of key pollutants at a number of specified locations representing both urban and ecological sites.

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 predictions are summarised in the tables below.

The Applicant's modelling predicted peak ground level exposure to pollutants in ambient air and at discrete receptors. The tables below show the ground level concentrations at the most impacted receptor.

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.

Pollutant (non-metals)	EQS / EAL		Back-ground Note 1	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	μg/m^3		μg/m^3	μg/m^3	% of EAL	μg/m^3	% of EAL
NO_2	40	1	27.7	1.9	4.75	29.6	74.0
	200	2	55.4	21.6	10.8	77	38.5
PM_{10}	50	3	39.2	0.8	1.6	-	-
SO_2	266	4	13.2	25	9.4	-	-
	350	5	13.2	20.3	5.8	-	-
	125	6	13.2	9.2	7.4	-	-
PAH	0.00025	1	Note 2	0.0000094	3.8	-	-

Note 1: Background concentrations are only shown where the PC is not insignificant
Note 2: Background concentration not provided therefore and PEC not assessed by the Applicant
PAH as benzo[a]pyrene

1 Annual Mean
2 99.79th %ile of 1-hour means
3 90.41st %ile of 24-hour means
4 99.9th ile of 15-min means
5 99.73rd %ile of 1-hour means
6 99.18th %ile of 24-hour means
7 1-hour average
8 Monthly average
9 Maximum daily running 8-hour mean
10 1-hour maximum

Pollutant (metals)	EQS / EAL		Back-ground Note 1	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m³		µg/m³	µg/m³	% of EAL	µg/m³	% of EAL
Sb	5	1	-	0.00468	0.09	-	-
	150	2	-	0.08108	0.05	-	-
Pb	0.25	1	0.03831	0.00468	1.87	0.04299	17.20
Co Note 2	-	-	0.00014	0.00468	-	0.00482	-
Cu	10	1	-	0.00468	0.05	-	-
	200	2	-	0.08108	0.04	-	-
Mn	0.15	1	0.08627	0.00468	3.12	0.09095	60.63
	1500	2	-	0.08108	0.01	-	-
V	5	1	-	0.00468	0.09	-	-
	1	3	-	0.08108	8.11	-	-
As	0.003	1	0.00088	0.00468	156.00	0.00556	185.3
Cr (II)(III)	5	1	-	0.00468	0.09	-	-
	150	2	-	0.08108	0.05	-	-
Cr (VI)	0.0002	1	0.00104	0.00468	2340.00	0.00572	2860.0
Ni	0.02	1	0.00168	0.00468	23.40	0.00636	31.8

Note 1: Background concentrations are only shown where the PC is not insignificant
Note 2: There is no EQS / EAL for Cobalt

1 Annual Mean
2 1-hr Maximum
3 24-hr Maximum

(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:

- Sulphur dioxide, Particulates (PM_{10}), Antimony, Copper, Vanadium, Chromium (II and III),

Therefore 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

- Nitrogen dioxide, Lead, Manganese, Nickel and PAH

For PAH, the Applicant did not provide a background concentration and therefore did not consider the PEC in their assessment. We have undertaken detailed check modelling for emissions of PAH and confirm that while the emission does not screen out as insignificant it is unlikely to give rise to significant pollution.

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.

(iii) Emissions requiring further assessment

Finally from the tables above the following emissions are considered to have the potential to give rise to pollution in that the Predicted Environmental Concentration exceeds 100% of the long term or short term EQS/EAL.

- Arsenic and Chromium VI.

Further consideration is given to the emission of Arsenic and Chromium VI in section 5.2.3.

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 EUEQS 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 100% NO_x to NO_2 conversion for the long term and 50% 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 marginally above the level that would screen out as insignificant (>10% of the EUEQS). However it is not expected to result in the EUEQS being exceeded.

(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 assessment shows that the predicted process contribution for emissions of PM_{10} is below 1% of the long term EQS (following application of the Environment Agency's H1 screening methodology) and below 10% of the short term EQS and so can be screened out as insignificant. Therefore we consider the Applicant's proposals for preventing and minimising the emissions of particulates to be BAT for the Installation.

The above assessment also shows that the predicted process contribution for emissions of $PM_{2.5}$ is also below 1% of the Environmental Quality Objective and screened out as insignificant following application of the H1 screening methodology. Therefore the Environment Agency concludes that particulate emissions from the installation, including emissions of PM_{10} or $PM_{2.5}$, will not give rise to significant pollution.

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 (IC2) has been included 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 screens out as 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.

Emissions of SO_2 can also be screened out as insignificant in that the short term process contribution is also <10% of each of the three short term EUEQS values. Therefore we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

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

The above tables show that for CO emissions, the peak short term PC is less than 1% of the EAL/EQS and the peak short term PC is less than 10% of the EAL/EQS and so can be screened out as insignificant. While the Applicant did not undertake an assessment against the long term EAL/EQS for CO we have undertaken sensitivity analysis and confirm that no exceedances of the standard are likely. Therefore we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

With regard to VOC 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 VOC. They have assumed that the VOC emission comprises 100% benzene. While we consider that using the EQS for 1,3 butadiene, which has the lowest EQS of organic species likely to be present in VOC (other than PAH, PCBs, dioxins and furans) would result in a more conservative assessment, we are satisfied that the Applicant's approach remains reasonably precautionary.

The above tables show that for PAH 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 benzo[a]pyrene (BaP) for their assessment of the impact of PAH. We agree that the use of the BaP EQS is sufficiently precautionary.

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

The Applicant has confirmed that the plant will use SNCR technology (with urea injection) for NOx reduction. This technique has the potential to result in an emission of ammonia through “ammonia slip. Their ammonia emission is based on a release concentration of 10 mg/m^3 which is conservatively, at the upper end of the stated BAT Reference Document (BREF) range of 5-10 mg/m^3. We are satisfied that this level of emission is consistent with the operation of a well controlled SNCR NO_x abatement system. The above tables show that for NH_3 emissions, the peak long term PC is less than 1% of the EAL/EQS and the peak short term PC is less than 10% of the EAL/EQS and so the emission can be screened out as insignificant.

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 VOC emissions using BAT, this is considered further in Section 6. We are satisfied that PAH and VOC emissions will not result in significant pollution.

(V) Summary

For the above emissions to air, for those emissions that do not screen out, we have carefully scrutinised the Applicant’s proposals to ensure that they are applying the BAT to prevent and minimise emissions of these substances. This is reported in section 6 of this document. Therefore we consider the Applicant’s proposals for preventing and minimising emissions 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 metals).
- 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.

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

- Antimony, Copper, Vanadium, and Chromium (II and III).

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:

- Lead, Manganese and Nickel.

This left emissions of Arsenic and Chromium VI requiring further assessment. For all other metals, the Applicant has concluded that exceedences of the EAL for all metals are not likely to occur.

Where Annex VI of the IED sets an aggregate limit, the Applicant's assessment assumes that each metal is emitted individually at the relevant aggregate emission limit value. This is a something which can never actually occur in practice as it would inevitably result in a breach of the said limit, and so represents a very much worst case scenario.

For metals Arsenic and Chromium (VI) the Applicant then used a two step approach:

- Each metal is emitted as the proportion of metals in its group (i.e. one ninth of the limit for each of the group 3 metals). Historical data for Municipal Waste Incinerators indicates that $1/9^{th}$ of the limit is an over estimate of actual emissions, and so we are satisfied that the Applicant's proposal is reasonable in this context.

Then for metals that had not screened out;

- Used representative emissions data from other municipal waste incinerators using our guidance note "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases."

Based on the above, the following emissions of metals whilst not screened out as insignificant were assessed as being unlikely to give rise to significant pollution:

- Arsenic

This left emissions of Chromium VI requiring further assessment. For all other metals, the Applicant has concluded that exceedences of the EAL for all metals are not likely to occur.

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

The Applicant has used the above data to model the predicted Chromium (VI) impact. The PC is predicted as 0.61% of the EAL.

This assessment shows that emissions of Chromium (VI) screen out as insignificant. We agree with the Applicant's conclusions. The installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document.

5.2.4 Consideration of Local Factors

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

Hull City Council has declared a single Air Quality Management Area (AQMA) with respect to Nitrogen Dioxide (annual average). The AQMA is located approximately 1.3km to the south of the Installation, covering an area of the City Centre bordered to the west by Coltman Street, Hessle Road and Strickland Street, to the north by Anlaby Road, Carr Lane, Whitefriargate, Scale Lane and Silver Street, and the south and east by the Rivers Humber and Hull respectively.

From the Applicants model, the process contribution at all points within the Hull No.1(A) AQMA is predicted to be less than 1% of the EU EQS and can be considered insignificant.

The Applicant is required to prevent, minimise and control emissions using the best available techniques; this is considered further in Section 6.

(ii) Topography and meteorological data for modelling

The site is located in Hull city centre. The Applicant did not include terrain files in their ADMS model, however as our review of the local topography did not highlight an areas (within the model domain) where the gradient exceeded 1:10, we agree with the Applicant's approach. After detailed review of the Applicant's air dispersion modelling study by the Agency's air quality modelling specialists, we are satisfied that the assessment has used appropriate model inputs and representative meteorological data for the study. The Applicant has also undertaken a sensitivity analysis to establish an optimum height for the stack as part of their dispersion modelling study.

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. The gathering of evidence is a continuing process. Although gathering evidence is not our role we keep the available evidence under review. The 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.”

The European Integrated Pollution Prevention and Control Bureau stated in the Reference Document on the Best Available Techniques for Waste Incineration August 2006 “European health impact assessment studies, on the basis of current evidence and modern emission performance, suggest that the local impacts of incinerator emissions to air are either negligible or not detectable.”

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”. In January 2012 PHE confirmed they would be undertaking a study to look for evidence of any link between municipal waste incinerators and health outcomes including low birth weight, still births and infant deaths. Their current position that modern, well run municipal waste incinerators are not a significant risk to public health remains valid. The study will extend the evidence base and provide the public with further information

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's 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 and does not include biotransfer factors specific to PCBs. As such only the HHRAP model can fully 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 PCB's 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, furans and dioxin like PCB's, the HHRAP model enables a risk assessment from human intake of a range of heavy metals. The HMIP report does not consider metals. 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 derive 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 NO_x, 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, furans and dioxin like PCBs. 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 consult with Local Authorities, Local Authority Directors of Public Health, FSA and PHE. 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, Furans and Dioxin like PCBs

For dioxins, furans and dioxin like PCBs, 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 their food and water were sourced from the locality where the deposition of dioxins, furans and dioxin like PCBs 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 which shows the calculated maximum daily intake of dioxins by local receptors resulting from the operation of the proposed facility (I-TEQ/ kg-BW/day). The worst case results for each category are shown. We consider that these results should be viewed with caution because the Applicant has used the predicted Average Daily Intake to compare with the TDI which is based on a lifetime exposure. United States Environmental Protection Agency (USEPA) HHRAP contains lifetime exposure coefficients that should be applied to each prediction however there is no evidence in the application that these coefficients have been applied. Therefore the Applicant's predictions shown below are not directly comparable with the COT-TDI.

Receptor	Adult	% of TDI	Child	% of TDI
Farmer	0.2143	10.72	0.4678	23.39
Resident	0.1207	6.03	0.6534	32.67

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

We also consider that the Applicant's methodology is overly conservative because of their choice of particle deposition velocity and the assumptions made with respect to the source of all local dietary intake.

We have carried out detailed check modelling for the human intake of dioxins, furans and dioxin-like PCB's using empirical calculations based on both HHRAP and the "Risk Assessment of Dioxin releases from Municipal Waste Incinerators9 (HMIP 1996). Making conservative assumptions about dietary intake and following default screening parameters, our checks are significantly lower than those presented in the application. This is due to the overly conservative assumptions made by the Applicant referred to above. Our checks confirm that intake is highly unlikely to be any greater than those predicted by the Applicant. We consider that the use of lifetime coefficients and a more representative deposition velocity would have resulted in substantially lower predictions.

As a result of our check modelling we believe it unlikely that the COT TDI level of 2 picograms I-TEQ / Kg bodyweight/ day will be exceeded and therefore are satisfied that emissions of dioxins, furans and dioxin like PCBs from the proposed facility will not present a significant risk to human health.

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. A report in 2012 showed that Dioxin and PCB levels in food have fallen slightly since 2001. 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 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 (now PHE) 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 noted 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 <u>Assessment of Health Effects from the Installation</u>

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 (now PHE) 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 PM_{10}, $PM_{2.5}$, SO_2, CO, HCl, HF, NH_3, Hg, Sb, Cu, Cr and V have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions of NO_2, VOC, As, Cd, Cr(VI), Mn, Pb, Ni, and PAH 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. Generally, the Applicant’s assessment methodology is acceptable. Where we have found issues, our check modelling indicates that the Applicant’s conclusions are acceptable at the selected receptors.

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 relevant 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 Local Authority 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 but did not make a consultation response. Details of the responses provided by Public Health England, the Local Authority Director of Public Health to the consultation on this Application can be found in Annex 2.

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 etc.

5.4.1 Sites Considered

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

- Humber Estuary SAC/SPA/Ramsar

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

- Humber Estuary SSSI

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

- Beverley & Barmston Drain
- Oak Road playing fields
- Foredyke stream cycle track - south of Camberlain Road
- Holderness House
- Land south of Ashendon Drive and Brackley Close
- Land to the south of Ella Street and north of Victoria Avenue
- Land to the south of Queens Road
- Land to the west of Northumberland Avenue almhouses
- Land north of the junction of Air Street and Bankside
- Land to south of Oak Road playing fields
- Foredyke stream cycle track - north of Chamberlain Road
- Pearson Park
- Dismantled railway west of disused Sculcoates Power Station
- Dismantled railway south of Sculcoates Lane
- Land south of Sculcoates Lane, west of Air Street
- Dismantled railway west of Dansom Lane
- Rockford Fields
- East Park
- Lamorna Avenue allotments
- Dismantled low level railway line
- Land east of Bournemouth Street
- Oak Road/Clough Road allotments
- Mudflats to south of Sammy's point
- Dismantled railway between Sutton Road and Chamberlain Road
- Land to the south of Sweet Dews Grove
- Disused Railway
- Foredyke Stream cycle track - south of Chapman Street
- Land south of Bilsdale Grove, 'The Lozenge'
- River Hull (including banks)
- Trinity burial ground, Castle Street

5.4.2 Habitats Assessment

The Applicant's Habitats assessment was reviewed by the Environment Agency's technical specialists for modelling and air quality. The Applicant's impact data for the Humber Estuary SAC/SPA/Ramsar is shown in the table below.

Pollutant	Critical Level / Load (µg/m³)	Back-ground (µg/m³)	Process Contribution (PC) (µg/m³)	PC as % of Critical Level / Load	Predicted Environmental Concentration (PEC) (µg/m³)	PEC as % of Critical Level / Load
Direct Impacts[1]						
NO_2 Annual	30	-	0.2	0.7	-	-
NO_2 Daily Mean	75	-	4.2	5.6	-	-
SO_2 Annual	20	-	0.06	0.3	-	-
Deposition Impacts[1]						
N Deposition (kg N/ha/yr)	8-15	17.04	0.09	1.1	17.13	214.1
Acidification - Nitrogen Dep (Keq/ha/yr)	0.22-0.64	1.22	0.009	1.6	1.46	228.9
Acidification Sulphur Dep (Keq/ha/yr)	0.42	0.23	0.006			

(1) Direct impact units are µg/m³ and deposition impact units are kg N/ha/yr or Keq/ha/yr.

From the table above the direct impacts due to emissions of NO_2 and SO_2 can be screened out as insignificant and their impact considered not discernable, in that the PC is less than 1% of the long term Critical Level and less than 10% of the short term Critical Level.

The Applicant has not presented values for the direct impact of NH_3 and HF at the Humber Estuary SAC/SPA/Ramsar. They have however submitted data for the worst impacted habitats receptor, which they have determined to be a Local Wildlife Site (receptor reference E4). At this point the PC for NH_3 is 0.08µg/m^3 (or 2.8% of the long term Critical Level) while the PEC is equivalent to 69.8% of the Critical Level. For HF, the data presented for receptor E4 shows the short term PC to be 0.008µg/m^3 (or 0.2% of the short term Critical Level). No assessment of the long term PC against its respective Critical Level was made.

The closest point of the Humber Estuary SAC/SPA/Ramsar is located approximately 2km south of installation, whereas receptor E4 is located 500m northeast of the installation in the predominant downwind direction. We consider therefore that given the scale of the worst case values described above for receptor E4, emissions of NH_3 and HF are unlikely to have a significant effect on the interest features of the Humber Estuary SAC/SPA/Ramsar.

From the table above the deposition impacts due to nutrient nitrogen and acidification cannot be screened out as insignificant. However we consider that the deposition contribution from the installation will not in itself lead to a significant impact at the designated site. This is because for both pollutants background deposition already exceeds the Critical Load, while the Process Contribution from the installation represents just 1.1% and 1.6% of the Critical Load for nutrient nitrogen and acidification respectively. This is only marginally above the 1% insignificance threshold for long term emissions.

Having considered the Applicant's Habitats assessment we do not agree with some aspects of their methodology and all of their absolute numerical predictions. However, having undertaken detailed check modelling and given consideration to the location of sensitive features within the designated site, we consider that there would be no likely significant effect on the interest feature(s) of the Humber Estuary SAC/SPA/Ramsar due to emissions to air from the installation.

5.4.3 SSSI Assessment

The only SSSI within 2km of the installation is the Humber Estuary SSSI. This SSSI overlaps with the Humber Estuary SAC/SPA/Ramsar but only a small portion of the SSSI along the north bank of the estuary is within 2km of the installation. The Applicant has not undertaken a separate SSSI assessment having applied the impact data for receptor E1 (Humber Estuary) across all relevant designations. We consider that our comments in section 5.4.2 are also relevant here and therefore conclude that that the special features of the SSSI will not be damaged by emissions to air from the installation.

5.4.4 Assessment of other conservation sites

Conservation sites are protected in law by legislation. The Habitats Directive provides the highest level of protection for SACs and SPAs, domestic legislation provides a lower but important level of protection for SSSIs. Finally the Environment Act provides more generalised protection for flora and fauna rather than for specifically named conservation designations. It is under the Environment Act that we assess other sites (such as local wildlife sites) which prevents us from permitting something that will result in significant pollution; and which offers levels of protection proportionate with other European and national legislation. However, it should not be assumed that because levels of protection are less stringent for these other sites, that they are not of considerable importance. Local sites link and support EU and national nature conservation sites together and hence help to maintain the UK's biodiversity resilience.

For SACs SPAs, Ramsars and SSSIs we consider the PC and the background levels in making an assessment of impact. In assessing these other sites under the Environment Act we look at the impact from the Installation alone in order to determine whether it would cause significant pollution. This is a proportionate approach, in line with the levels of protection offered by the conservation legislation to protect these other sites (which are generally more numerous than Natura 2000 or SSSIs) whilst ensuring that we do not restrict development.

Critical levels and loads are set to protect the most vulnerable habitat types. Thresholds change in accordance with the levels of protection afforded by the legislation. Therefore the thresholds for SAC SPA and SSSI features are more stringent than those for other nature conservation sites.

Therefore we would generally conclude that the Installation is not causing significant pollution at these other sites if the PC is less than the relevant critical level or critical load, provided that the Applicant is using BAT to control emissions.

The Applicant has presented impact data for the 7 closest non-statutory conservation sites within 2km of the installation. They have determined that the worst impacts are likely to result at the Local Wildlife Site known as ‘Land south of Ashendon Drive and Brackley Close’, (receptor reference E4). The Applicant’s impact daa for receptor E4 is shown in the table below.

Pollutant	**Critical Level / Load (µg/m³)**	**Process Contribution (PC) (µg/m³)**	**PC as % of Critical Level / Load**
Direct Impacts[1]			
NO_2 Annual	30	1.7	5.6
NO_2 Daily Mean	75	10.2	13.6
SO_2 Annual	20	0.4	2.0
Ammonia	3	0.084	2.8
HF Daily mean	5	0.008	0.2
Deposition Impacts[1]			
N Deposition (kg N/ha/yr)	10-20	1.1	11.4
Acidification - Nitrogen Dep (Keq/ha/yr)	0.36-8.75	0.14	2.5
Acidification Sulphur Dep (Keq/ha/yr)	8.39	0.08	

(1) Direct impact units are µg/m³ and deposition impact units are kg N/ha/yr or Keq/ha/yr.

The table above shows that all PCs are below the relevant Critical Level or Critical Load. We are therefore satisfied that the Installation will not cause significant pollution at non-statutory sites. The Applicant is required to prevent, minimise and control emissions using BAT, this is considered further in Section 6.

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) of the IED.

These abnormal operations are limited to no more than a period of 4 hours continuous operation and no more than 60 hour aggregated operation in any calendar year. This is less than 1% of total operating hours and so 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 making an assessment of abnormal operations the following worst case scenario has been assumed:

- NO_x emissions of 774 mg/m^3 (1.9 x normal)
- Particulate emissions of 150 mg/m^3 (5 x normal)
- SO_2 emissions of 450mg/m^3 (2.25 x normal)
- HCl emissions of 1177mg/m^3 (20 x normal)
- HF emissions of 90 mg/m^3 (22.5 x normal)
- Mercury emissions are 15 times those of normal operation
- Metal emissions other than mercury are 5 times those of normal operation
- Dioxin emissions of 10 ng/m^3 (100 x normal)

This is a worst case scenario in that these 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 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**		**Back-ground**	**Process Contribution (PC)**		**Predicted Environmental Concentration (PEC)**	
	µg/m³		**µg/m³**	**µg/m³**	**% of EAL**	**µg/m³**	**% of EAL**
NO_2	200	2	55.4	41.8	20.9	97.2	48.6
PM_{10}	50	3	-	4.1	8.20	-	-
SO_2	266	4	13.2	56.2	21.1	69.4	26.1
	350	5	13.2	45.6	13.03	58.8	16.8
HCl	750	6	0.44	190.9	25.45	191.3	25.51
HF	160	6	-	14.6	9.125	-	-
Hg	7.5	1	-	0.12163	1.62	-	-
Sb	150	1	-	0.02797	0.02	-	-
Cu	200	1	-	0.03965	0.02	-	-
Mn	1500	1	-	0.08879	0.01	-	-
Cr (II)(III)	150	1	-	0.12673	0.08	-	-

1 1-hr Maximum

2 99.79th %ile of 1-hour means

3 90.41st %ile of 24-hour means

4 99.9th ile of 15-min means

5 99.73rd %ile of 1-hour means

6 1-hour average

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: PM_{10}, HF, Hg, Sb, Cu, Mn and Cr.

Also from the table above emissions of 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% of short term EQS/EAL: NO_2, SO_2 and HCl.

We are therefore satisfied that it is not necessary to further constrain the conditions and duration of the periods of abnormal operation beyond those permitted under Chapter IV of the IED.

We have not assessed the impact of abnormal operations against long term EQSs for the reasons set out above. Except that if dioxin emissions were at 10 ng/m^3 for the maximum period of abnormal operation, this would result in an increase of approximately 68% in the TDI reported in section 5.3.3. In these circumstances the TDI would be 1.09 pg(I-TEQ/ kg-BW/day), which is 54.8% of the COT TDI. At this level, emissions of dioxins will still not pose a risk to human health.

5.6 Other Emissions

5.6.1 Noise and vibration

5.6.1.1 *Impact Assessment*

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.

The Applicant's assessment of the potential noise impact during operation of the installation was based on the modelling software package CadnaA, which is a commonly used computer model for regulatory noise modelling. The assessment considered operations during both the daytime and the night-time period. Modelling predictions were made at the following sensitive receptors:

Receptor reference	Receptor type / general area	Survey Location	Distance / Direction from Installation
A	Residential properties off Stoneferry Road	12 Bilbury Close	560m due north
B	Commercial and residential properties off St. Marks Road	25 Mulgrave Street	560m due south
C	Residential properties	11 Montrose Street	350m due east
D	Travellers site and residential properties	Fountain Road (representative of traveller site) Richardson's Court / Northumberland Court	300m due west 600m due west
E	Residential flats at Glass House Row	Glass House Row Flats	10m due north
F	Travellers site	Traveller Site (East)	20m due east

The potential impact due to the operation of the installation has been determined in accordance with the methodology in British Standard BS4142:2014, 'Methods for rating and assessing industrial and commercial sound.' The significance of industrial/commercial sound depends on the difference between the rating level (which is the predicted sound output of the industrial/commercial premises, corrected to account for tonality, impulsivity, intermittency or other applicable sound characteristics) and the background sound level. Typically, the greater the difference, the greater the magnitude of the impact.

A difference of around +10dB or more is likely to be an indication of a significant adverse impact, while a difference of around +5dB is likely to be an indication of an adverse impact. The lower the rating is, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. If the rating level does not exceed the background sound level, this is an indication of a low impact. BS4142:2014 requires that the assessment of potential impact takes into account the 'context' in which the sound occurs. This entails having a sufficient understanding of the situation to be rated and assessed, and placing the sound being assessed in context when making conclusions.

The way in which the Applicant has used the noise model, the selection of input data, use of background data and the assumptions made have been reviewed by the Environment Agency's modelling specialists to establish the robustness of the Applicant's noise impact assessment. Our view is that the methodology used by the Applicant is acceptable.

The results of the Applicant's daytime assessment are shown in the table below.

Receptor Reference	**Survey Location**	**Measured background noise level (dB)**	**Modelled rating level (dB)**	**Rating minus background (dB)**
A	12 Bilbury Close	46	41	-5
B	25 Mulgrave Street	51	34	-17
C	11 Montrose Street	41	35	-6
D	Fountain Road (representative of traveller site) & Richardson's Court / Northumberland Court	45	34	-11
E	Glass House Row Flats	49	53	+4
F	Traveller Site (East)	49	51	+2

The results show that during the daytime the background level would be exceeded at the closest receptors E and F, with the predicted rating level being +4dB and +2dB above background respectively. These predictions are below the level which would indicate an adverse impact according to BS4142:2014. The predicted levels at the remaining receptors would indicate a low impact.

The results of the Applicant's night-time assessment are shown in the table below.

Receptor Reference	**Survey Location**	**Measured background noise level (dB)**	**Modelled rating level (dB)**	**Rating minus background (dB)**
A	12 Bilbury Close	42	41	-1
B	25 Mulgrave Street	49	35	-14
C	11 Montrose Street	38	37	-1
D	Fountain Road (representative of traveller site) & Richardson's Court / Northumberland Court	43	37	-6
E	Glass House Row Flats	47	52	+5
F	Traveller Site (East)	47	48	+1

The results show that during the night-time the background level would be exceeded at the closest receptors E and F, with the predicted rating level being +5dB and +1dB above background respectively. For receptor E the prediction is at a level which would indicate an adverse impact according to BS4142:2014. For receptor F the prediction is below the level which would indicate an adverse impact. The predicted levels at the remaining receptors would indicate a low impact.

The Applicant modified the above predictions in accordance with BS4142:2014 to take into account the 'context' of the assessment, stating that the area is of a mixed nature including existing industrial activities. They concluded that the operational noise levels of the plant would be below those which would indicate an adverse impact, and that therefore the noise impacts were likely to be considered acceptable.

Having reviewed the Applicant's assessment we are unable to agree with the above conclusion. We consider that although the site is located in an area which includes both industrial and residential use, this does not necessarily mean that the noise impact will be significantly reduced, principally because residential receptors are located so close to the site boundary. Whether or not the potential impact leads to complaints is a subjective matter. However as the modelling predictions show that there is a risk of an adverse impact, we have included an improvement condition IC8 in the permit requiring the Operator to undertake an assessment of operational noise from the facility in accordance with BS4142:2014 to validate the model predictions. The IC also requires that proposals for remedial action should be submitted and an associated timetable agreed, should the results of the assessment be indicative of an adverse impact (or greater) at residential receptors.

5.6.1.2 *Noise Management Plan*

The Applicant has submitted a Noise Management Plan (NMP) as part of their application. We consider this to be a draft plan which shall be finalised following completion of detailed design and a program of commissioning noise testing that the operator has proposed to undertake. Pre-operational condition PO11 requires the Operator to submit an updated NMP to the Environment Agency for approval prior to operation of the facility.

The NMP outlines the methods by which they intend to assess and minimise the potential impacts of noise generated at the installation, with the specific aim of ensuring that:

- noise impact is considered as part of routine inspections;
- noise is primarily controlled at source by good operational practices, including physical and management control measures; and
- all appropriate measures are taken to prevent or, where that is not reasonably practicable, to reduce noise emissions at nearby receptors.

The NMP sets out how noise will be managed, including the following measures:

- through appropriate design and layout, and application of BAT;
- the appointment of a Site Noise Manager responsible for ensuring that nuisances and hazards arising from the facility due to noise are minimised;
- effective management controls with respect to ongoing maintenance, staff training, and good site practice; and
- a Drivers Charter, setting out procedures for how vehicles must be operated on-site.

In the NMP the Applicant also proposes to undertake annual monitoring of noise at various locations around the site as well as periodic noise level audits during the first year of operation. This internal compliance monitoring includes trigger levels that will instigate a management review of plant operations to reduce noise as far as reasonably possible.

5.6.1.3 *Application of BAT*

The Applicant has stated that the proposed installation will incorporate the following mitigation measures to reduce noise emissions:

- the fitting of proprietary diffuser / absorptive silencers on intermittent noise sources, such as emergency steam vents;
- the use of acoustic cladding on buildings where deemed appropriate;
- potential sources of noise 'escape' being designed with acoustic performance in mind, for example, doors and louvres;
- placing the steam turbine within a high-specification acoustic enclosure;
- the installation of a noise barrier 20m high and 39.5m long on the northern boundary of the site along Glass House Row, where the nearest residential dwellings are located; and
- routine maintenance of plant and good operational site practices (as set out in the Applicant's NMP) .

We consider that the above measures represent BAT and broadly follow the noise hierarchy outlined in our H3, Part 2 guidance on 'Noise Assessment and Control'.

5.6.1.4 *Conclusion*

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

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. They are: NO_2, VOC, As, Cd, Cr(VI), Mn, Pb, Ni, and PAH.

- 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. However BAT Conclusions and a revised BREF for Incineration have not yet been drafted or published, so the existing BREF and Chapter IV of the IED remain relevant.

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 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; and
- need, if any, for further processing of residues to comply with TOC
- Costs.

<u>Summary comparison of thermal treatment technologies</u> (reproduced from the Waste Incineration BREF)

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 is treatable better Combustion control possible.	As air-cooled grates but: risk of grate damage/ leaks higher complexity	TOC 0.5 % to 3 %	Slightly higher capital cost than air-cooled

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
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 / 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 GJ/t	TOC 0.5 – 3 %	Similar to other technologies

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Pulsed hearth	Only higher CV waste (LCV >20 GJ/t) 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
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

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
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 e.g. combustion	High pre-treatment, operation and capital costs

The Applicant has carried out a qualitative review of the following candidate furnace types, with their comments summarised as follows:

- Moving Grate - these are designed to handle large volumes of waste. An air cooled grate system would not be capable of processing high CV fuels such as those proposed in this application. Therefore, a grate furnace for the proposed fuel specification would need to be a water cooled grate, however these typically have higher capital and maintenance costs than air cooled grates.

- Fixed Hearth - these are not considered suitable for large volumes of waste fuels, being best suited to low volumes of consistent waste. Therefore these systems are not considered a practical option.

- Pulsed Hearth - these have been used for waste fuels in the past, however there have been difficulties in achieving reliable and effective burnout of waste and as such, it is considered that the burnout criteria required by the IED would be difficult to achieve.

- Rotary Kiln - these have not been used in the UK for large volumes of waste fuels. The energy conversion efficiency of a rotary kiln is lower than that of other EfW technologies due to the large areas of refractory lined combustion chamber. The capacity per kiln unit is limited to 8 tonnes per hour, thus for a plant with the capacity of this application it would approximately 3 kilns to achieve the design throughput. This is not considered practical and would lead to significant efficiency losses.

- Fluidised Bed - as these are designed for the combustion of relatively homogeneous fuel, they are only appropriate for pre-treated fuels. Where waste fuels have been pre-treated at a pre-treatment facility, such as that proposed for this application, the pre-treated waste will already be suitable for feeding to the fluidised bed. While fluidised bed combustion can lead to slightly lower NOx generation, secondary NOx abatement is still required to achieve the emission limits specified in the IED.

- Pyrolysis - with these systems the waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be the combustion of part of the syngas. Various suppliers are developing pyrolysis systems for the disposal of waste fuels, however these systems are not considered proven. Currently there are no pyrolysis systems which are of a capacity required to process the nominal design capacity in this application. Therefore these systems are not considered suitable.

- Gasification - with these systems the waste is heated in the presence of some air, but insufficient air to achieve full combustion. This leads to the production of a synthetic fuel gas, or syngas, which can then be used to generate electricity. Conventional gasification; plasma gasification and close-coupled gasification have been considered in the application.

The primary benefits which are claimed for conventional gasification are higher efficiency and lower emissions, based on the use of gas engines or gas turbines, which are more efficient at generating electricity from syngas than a conventional steam turbine is at generating electricity from steam. However no developer of conventional gasification has yet managed successfully to demonstrate at a commercial scale the combination of municipal waste gasification with a gas engine or gas turbine. This is because the process produces tars in the syngas, which need to be removed before the syngas can be used in a gas engine.

As plasma gasification uses a high temperature electric arc furnace to break down the components of the waste fuel into a residue comprising of a vitrified solid and low molecular weight gases, the resultant fuel gas has to be cleaned of sulphur and chlorine gases and condensable tars. These condensable tars have proved difficult to deal with in attempts to produce a syngas suitable for use in a gas turbine or gas engine. Various technology providers are developing plasma gasification systems for the disposal of waste derived fuels. However, only a small number of these can be considered to be proven with operational plants within Europe. Furthermore, only a handful of plants are operational worldwide, but the largest single line plant only has the capacity to treat approximately 50,000 tonnes per annum. To achieve the nominal design capacity of the proposed application, multiple lines would be required.

Close-coupled gasification is considered to be a proven technology as there are a number of full-scale operational plants in Europe which comply with the requirements of Chapter IV of the IED. In close-couple gasification plants the gasification chamber operates at a lower temperature than the combustion chamber for a conventional EfW plant. The syngas is then combusted within a separate section of the chamber to generate steam. In close-couple gasification, the combustion of syngas to generate steam is simpler than using syngas in a gas engine or turbine, given the issues discussed above. The process for gasification of the incoming waste fuels would incorporate a fluidised bed, as this is appropriate where waste derived fuels, such as those to be treated within the proposed facility, have been pre-treated.

On the basis of the above, the Applicant has given more detailed consideration to Moving Grate, Fluidised Bed and Close-coupled gasification technologies on the basis of global warming potential (GWP), NOx abatement reagent (urea) consumption, residues produced, the annual operating costs and the power revenues achievable.

The Applicant has concluded that the GWP performance is similar for each technology. However while the moving grate would produce 2000 tonnes per annum less CO_2 than the other technologies, it would require approximately 80% more urea to abate the equivalent emissions of NOx.

The three combustion technologies will produce similar total quantities of ash, with the fluidised bed and the close-coupled gasification system producing more fly ash, but less bottom ash.

The total annualised operating costs are nearly 15% higher for fluidised bed and close couple gasification than for a grate system.

The Applicant considers that the lower reagent consumption associated with a fluidised bed system outweighs the additional annualised operating costs involved, compared to the grate based system, and on this basis they consider the fluidised bed to represent BAT.

Overall, the Applicant concludes that taking into account the financial incentives being offered through Renewable Obligation Certificates (ROCs), close coupled gasification employing fluidised bed technology is significantly more financially appealing than a conventional fluidised bed.

The Applicant has therefore proposed to use a furnace technology comprising fluidised bed gasification which is 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 low sulphur gas oil as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is based on being able to provide a readily available, cost-effective fuel that does not present significant risks during on-site storage and handling. The Applicant considered the use of natural gas, liquefied gas (LPG), natural gas and gasoil.

The use of LPG was discounted because as a flammable mixture of hydrocarbon gases which turn gaseous at ambient temperature and pressure, it must be stored in purpose built pressure vessels, which presents a significant explosion risk. Natural gas, although safer to handle than LPG, was discounted on the grounds of the excessive cost involved with the installation of a high-pressure gas main, which would only be needed on an intermittent basis. This gas supply would also have to be non-interruptible such that the plant could be safely shut-down in the event of an emergency. Gas oil was chosen because of ease of storage in on-site bunded tanks, and because although classed as flammable, it does not pose the same type of risks as those associated with the storage of LPG. Emissions would be minimised as far as reasonably practicable through the use of low sulphur gas oil.

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.

Any of the options listed in the BREF and summarised in the table above can be BAT. The Applicant has chosen a furnace technique that is listed in the BREF and we are satisfied that the Applicant has provided sufficient justification to show that their technique is BAT. This is not to say that the other techniques could not also be BAT, but that the Applicant has shown that their chosen technique is at least comparable with the other BAT options. 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.

However we have included pre-operational condition PO6 that requires the Applicant to submit a report providing details and conclusions from the CFD modelling design study for the specified combustion unit and boiler system design that has been selected for the plant.

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

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 $5mg/m^3$	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	May “blind” more than fabric filters		Small plant. High

Particulate matter				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
	Smaller plant.			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 particulate matter have been previously screened out as insignificant, and so the Environment Agency agrees that the Applicant's proposed technique is BAT for the installation.

6.2.2 Oxides of Nitrogen

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 - 180mg/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 NO_x burners – this technique reduces NO_x 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 NO_x 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 NO_x. 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 NO_x 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 NO_x levels to between 150 and 180 mg/m^3; it relies on an optimum temperature of around 900 deg 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 NO_x 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 urea as the reagent.

Emissions of NO_x cannot be screened out as insignificant. Therefore the Applicant has carried out a cost / benefit study of the alternative techniques. The cost per tonne of NO_x abated over the projected life of the plant has been calculated and compared with the environmental impact as shown in the table below.

	Annual NOx abated (tonnes)	Cost of NO_x removal (£/tonne)	PC (long term) (µg/m^3)	PEC (long term) (µg/m^3)
SCR	1,030	£1408	0.65	28.35
SNCR	850	£753	1.87	29.57

Based on the figures above the Applicant considers that the additional cost of SCR over SNCR is not justified by the reduction in environmental impact. Thus SCR is not BAT in this case, and SNCR is BAT for the Installation.

The amount of urea used for NO_x abatement will need to be optimised to maximise NO_x reduction and minimise NH_3 slip. Improvement condition IC5 requires the Operator to report to the Environment Agency on optimising the performance of the NO_x abatement system. The Operator is also required to monitor and report on NH_3 and N_2O emissions every 6 months.

6.2.3 Acid Gases, SO_x, HCl and HF

Acid gases and halogens : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Low sulphur fuel, (< 0.1%S gasoil or natural gas)	Reduces SOx at source		Start-up, supplementary firing.	Where auxiliary fuel required.
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:	Highest removal rates	Corrosive material		HWIs

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:**
Sodium Hydroxide	Low solid waste production	ETP sludge for disposal		
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 expensive	Not proven at large plant	CWIs

The Applicant proposes to implement the following primary measures:

- Use of low sulphur fuels for start up and auxiliary burners – gas should be used if available, where fuel oil is used, this will be low sulphur (i.e. <0.1%), this will reduce SO_x at source. The Applicant has justified the choice of gasoil as the support fuel as already described and we agree with that assessment.
- Management of heterogeneous wastes – this will disperse problem wastes such as PVC by ensuring a homogeneous waste feed.

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.

The Applicant has considered the performance of both types of system in terms of Sulphur dioxide abated, Photochemical Ozone Creation Potential, Global Warming Potential, water consumption and APC residues produced They conclude that while the performance of both options is very similar, the dry system has a much lower water consumption rate, a reduced global warming potential and a reduced annualised cost. The semi-dry option allows benefits from medium reaction rates that mean that a shorter residence time is required in comparison with a dry system. However within a semi-dry system, recycling of reagent within the process is not proven, whereas it is with in a dry system.

In this case, the Applicant proposes to use a dry system (involving the injection of hydrated lime into the flue gases as a powder) for the abatement of acid gases system. The Environment Agency is satisfied that this is BAT

6.2.4 Carbon monoxide and volatile organic compounds (VOCs)

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 volatile organic compounds (VOCs)

Technique	Advantages	Disadvantages	Optimisation	Defined as BAT in BREF or TGN for:
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 for:**
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.

In this case the Applicant proposes separate feed 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.

In this case the Applicant proposes separate feed and we are satisfied their proposals 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, but the plant also emits small amounts of N_2O arising from the operation of secondary NO_x 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 NO_x abatement system to ensure its GWP impact is minimised.

The major source of greenhouse gas emissions from the installation is however CO_2 from the combustion of waste. 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.

The electricity that is generated by the Installation will displace emissions of CO_2 elsewhere in the UK, as virgin fossil fuels will not be burnt to create the same electricity.

The Installation is not subject to the Greenhouse Gas Emissions Trading Scheme Regulations 2012 therefore it is a requirement of IED to investigate how emissions of greenhouse gases emitted from the installation might be prevented or minimised.

Factors influencing GWP and CO_2 emissions from the Installation are:

On the debit side:

- CO_2 emissions from the burning of the waste;
- 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.

The GWP of the plant will be dominated by the emissions of carbon dioxide that are released as a result of waste combustion. This will be constant for all options considered in the BAT assessment. Any differences in the GWP of the options in the BAT appraisal will therefore arise from small differences in energy recovery and in the amount of N_2O emitted.

The Applicant considered energy efficiency and compared SCR to SNCR in its BAT assessment. This is set out in sections 4.3.7, 6.1.1 and 6.2.2 of this decision document.

Note: avoidance of methane which would be formed if the waste was landfilled has not been included in this assessment. If it were included due to its avoidance it would be included on the credit side. Ammonia has no direct GWP effect.

Taking all these factors into account, the Applicant's assessment shows that the difference in global warming potential between the best option in terms of GWP and the Applicant's preferred option is minor. The purpose of a BAT appraisal is to determine which option minimises the impact on the environment as a whole. In this context the small benefit in terms of GWP of the other options is considered to be more than offset by the other benefits of the preferred option.

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 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 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^{o}C 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^{o}C
- 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. The Permit requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be monitored for 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. The Permit also requires monitoring of a range of PAHs and dioxin-like PCBs 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 as listed in the Permit. 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 5.2.1 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

There will be no emissions to surface water from the installation.

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

6.5.2 Emissions to sewer

All surface water, foul and trade effluent will be collected on site and discharged to the sewers within the Cleveland Street, Glass House Row and Dalton Street sites respectively. This will include:

- small quantities of process effluent such as boiler blowdown and wastewaters from the demineralisation water treatment plant;
- wash down waters from operational areas; and
- surface water run-off via interceptor(s).

The Applicant has stated that following consultation with the Environment Agency prior to submission of their permit application, it was agreed that surface water drainage from the site would not be discharged into the River Hull, instead being discharged via gravity sewer to the local sewerage network. We confirm that this agreement was reached during the planning process, with the Environment Agency acting as a statutory consultee to the Local Planning Authority in their determination of the planning application for the development.

Existing connections to combined sewers will be utilised with controls being fitted to the sewer outlets to enable discharges to be isolated in the event of a pollution incident within the site. The emission points to sewer, references S1, S2, S3 and S4 have been included in Table S3.2 of the permit.

The Applicant has confirmed that they will apply to the local sewerage undertaker for a trade effluent consent to discharge these effluents.

Based upon the information in the application we are satisfied that appropriate measures will be in place to 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 provided a risk assessment and management plan for fugitive emissions, which the Environment Agency considers to be satisfactory and should ensure compliance with permit conditions, specifically condition 3.2.

The facility includes a back up diesel generator to provide electrical power to safely shut down the incinerator in the event of the non availability of electrical power.

Each storage silo used for crushed limestone, hydrated lime, and activated carbon is fitted with filters to prevent fugitive releases from pneumatic conveyors. Other measures regarding the protection of land, surface water and groundwater at the site are recorded in section 4.2.2 above.

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

6.5.4 Odour

Odour emissions will be minimised by the following methods:

- waste accepted at the installation will be delivered in covered vehicles or within containers;
- bulk storage of waste will only occur within the waste reception / processing building;
- the waste reception / processing building will be kept under negative pressure by the operation of draught fans located in the fuel storage areas. These fans will extract some of the air, as combustion air within the gasification process. This is designed to draw air in to the reception area, either via mechanised louvres or via the doors if open. The air is drawn through to the fuel handling building and subsequently through to the storage pit. Air from the storage pit is utilised as combustion air in the gasification process, with the high combustion temperatures ensuring complete oxidation of odorous compounds arising in the building;
- self-closing doors will be provided for any potentially odorous indoor areas;
- fast acting roller shutter doors to minimise fugitive releases of odour from the waste fuel storage areas;
- the main doors used for the waste delivery vehicles will be kept closed except during vehicles coming in and leaving to maintain odour control during delivery times;
- outside of the operating delivery window, secondary doors will be closed to provide an additional barrier and surety against fugitive odorous emissions;
- during shutdown, doors will limit odour spread while still allowing vehicle access;
- waste storage management procedures and good mixing will avoid the development of anaerobic conditions within waste storage areas;
- at times when the gasification plant is not available such as during maintenance periods, effective management procedures will be put in place, including the use of odour handling units / deodorisers, and controlling access to the waste reception, treatment and storage areas; and

- procedures to divert waste away from the site during shutdowns if odour management is not effective.

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.

6.6 Setting ELVs and other Permit conditions

6.6.1 Translating BAT into Permit conditions

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 emission 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 by 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 destruction of 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 can commence the Operator is required by pre-operational condition PO4 to submit a commissioning plan to the Agency for approval. Commissioning can only begin and 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 CEMs in accordance with BS EN 14181 (a requirement in improvement condition IC7).
- Verification of furnace residence time, temperature and oxygen content (IC4).
- The plant in total conforms with the permit conditions and that satisfactory process control procedures for the plant have been developed (IC3).
- Abatement plant optimisation details (IC5).

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 establish data on the release of dioxin-like PCBs and PAHs from the incineration process 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 there will be a standby CEMS available which could be transferred in, if required, to ensure that there is continuous monitoring data available even if there is a problem with the duty CEMS system. The back-up CEMS will 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. A CEN committee has agreed Technical Specifications (EN TS 1948-5) for continuous sampling of dioxins. This specification will lead to a CEN standard following a validation exercise which is currently underway. According to IED Article 48(5), "As soon as appropriate measurement techniques are available within the Union, the Commission shall, by means of delegated acts in accordance with Article 76 and subject to the conditions laid down in Articles 77 and 78, set the date from which continuous measurements of emissions into the air of heavy metals and dioxins and furans are to be carried out. This is yet to happen. However, our extant 'dioxin enforcement policy' recommends continuous sampling of dioxins where multiple emission exceedances occur and no clear root cause can be identified. Therefore should continuous sampling be required at a later date during the operation of the installation, then sampling and analysis shall comply with the requirements of EN TS 1948

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 emission 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 5 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 decision of Hull City Council to grant planning permission on 20 October 20111.
- 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 take 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. A summary of the responses received to our consultation 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 2km 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 saved to our documents management system for audit purposes.

The CROW assessment is summarised in greater detail in section 5.4.3 of this document. A copy of the full Appendix 4 Assessment can be found on the public register.

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 concluded that there will be no likely significant effect on any European Site.

We recorded our decision by means of an Appendix 11 assessment, and sent this to Natural England for information only in accordance with our permitting guidance.

The habitat assessment is summarised in greater detail in section 5.4.2 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 hem 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 2.3.4(a) 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 2.3.4(a) 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.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1(a) in Schedule 3 of the Permit.
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 to 3.5.5 and Tables S3.1, S3.1(a), S3.2 and S3.3 in Schedule 3 of the Permit.
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 2.3.11 and 2.3.12.
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.	Condition 2.3.1 and Table S1.2 of Schedule 1 of the Permit.
46(2)	Emission into air shall not exceed the emission limit values set out in Part 3 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a.
46(5)	Prevention of unauthorised and accidental release of any polluting substances into soil, surface water	The application explains the measures to be in

IED Article	Requirement	Delivered by
	or groundwater. Adequate storage capacity for contaminated rainwater run-off from the site or for contaminated water from spillage or fire-fighting.	place for achieving the directive requirements
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance, and with a maximum cumulative limit of 60 hours per year. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	Conditions 2.3.11 and 2.3.12
47	In the event of breakdown, reduce or close down operations as soon as practicable. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	Condition 2.3.11
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 of the Permit.
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.	Condition 3.5.3, and Tables S3.1, S3.1(a), and S3.3
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Conditions 3.5.3 and 3.5.4
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, and Tables S4.1 and S4.4
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 and 3.1.2
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Condition 3.3.1 and Table S3.4

IED Article	Requirement	Delivered by
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Condition 2.3.7(a), Pre-operational condition PO6 and Improvement condition IC4 and Table S3.3
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 2.3.8
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.7
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.7
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 devices.	Condition 2.3.7
50(5)	Any heat generated from the process shall be recovered as far as practicable.	(a) The plant will generate electricity and will be 'CHP ready'. (b) Operator to review the available heat recovery options prior to commissioning. (Pre-operational condition PO2) and then every 2 years (Conditions 1.2.1 to 1.2.3)
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.
51(1)	Different conditions than those laid down in Article 50(1), (2) and (3) and, as regards the temperature Article 50(4) may be authorised, provided the other requirements of this chapter are met.	No such conditions have been allowed

IED Article	Requirement	Delivered by
51(2)	Changes in operating conditions do not cause more residues or residues with a higher content of organic polluting substances compared to those residues which could be expected under the conditions laid down in Articles 50(1), (2) and (3).	No such conditions have been allowed
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	Conditions 2.3.1, 2.3.3, 3.2, 3.3, 3.4 and 3.6.
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Condition 2.3.4(a) and Table S2.2 in Schedule 3 of the Permit.
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Conditions 1.4.1, 1.4.2 and 3.5.1 with Table S3.4
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 and Table S3.4 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.	Condition 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 send 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 – Getting the basics right. 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 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 and fly 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, including timelines for completion, for approval by the Environment Agency. The commissioning plan shall include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to the Environment Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.
PO5	Prior to the commencement of commissioning, the Operator shall submit a written report to the Environment Agency detailing the waste acceptance procedure to be used at the site. The waste acceptance procedure shall include the process and systems by which wastes unsuitable for treatment in the mechanical treatment plant and/or incineration at the site will be controlled. The procedure shall be implemented in accordance with the written approval from the Agency.
PO6	After completion of furnace design and at least three calendar months before any furnace operation; the operator shall submit a

Reference	Pre-operational measures
	written report to the Environment Agency of the details of the computational fluid dynamic (CFD) modelling. The report shall demonstrate whether the design combustion conditions comply with the residence time and temperature requirements as defined by Chapter IV and Annex VI of the IED.
PO7	Prior to the commencement of commissioning, the operator shall submit a written report to the Environment Agency for approval that includes 'as built' detailed site drainage plans (internal process water and external surface water) and the specific design detail of the containment infrastructure at the site, including all sub-surface structures and equipment. The report shall also include an inspection and maintenance programme for the containment infrastructure and equipment at the site.
PO8	Prior to the commencement of commissioning, the Operator shall submit to the Environment Agency 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.
PO9	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.
PO10	Prior to the commencement of operation, the Operator shall submit to the Environment Agency an updated Fire Prevention Plan (FPP). The plan shall include the following information, which was omitted from the FPP submitted as part of the permit application: (i) description of the measures in place to reduce the potential for hot exhausts to act as a source of ignition; (ii) details on whether bucket loaders are fitted with rubber strips to prevent sparks when the bucket comes in to contact with hard standing, etc. If not used then justification must be provided; and (iii) evidence of end use contracts for outgoing waste types. The updated FPP shall also include any other minor amendments deemed necessary following completion of detailed design and commissioning. All amendments to the FPP shall be clearly signposted by way of an accompanying cover letter.
PO11	Prior to the commencement of operation, the Operator shall submit to the Environment Agency for approval an updated Noise Management Plan (NMP) following completion of detailed

Reference	Pre-operational measures
	design and a program of commissioning noise testing. The NMP shall reflect the requirements of our guidance, H3 Part 2, Noise Assessment and Control, and set out how the Operator will use all appropriate measures to prevent, or where that is not practicable, to minimise noise at levels likely to cause pollution outside the site.

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 is 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	Improvement measure	Completion date
IC1	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 certification of the system by an external body or if appropriate submit a schedule by which the EMS will be certified.	Within 12 months of the date on which waste is first burnt.
IC2	The Operator shall submit a written proposal to the Environment Agency to carry out tests 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 proposal shall include a timetable for approval by the Environment Agency to carry out such tests and produce a report on the results. On receipt of written agreement by the Environment Agency to the proposal and the timetable, the Operator shall carry out the tests and submit to the Environment Agency a report on the results.	Within 6 months of the completion of commissioning.
IC3	The Operator shall submit a written report to the Environment Agency on the commissioning of the installation. The report shall summarise the environmental performance of the plant as installed against the design parameters set out in the Application. The report shall also include a review of the performance of the facility against the conditions of this permit and details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions. The report shall also summarise the results of the program of commissioning noise testing as referred to in PO11, and present the key findings from such testing.	Within 4 months of the completion of commissioning.
IC4	The Operator shall carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in	Within 4 months of the completion of commissioning.

Reference	Improvement measure	Completion date
	the furnace whilst operating under the anticipated most unfavourable operating conditions. The results shall be submitted in writing to the Environment Agency.	
IC5	The Operator shall submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NO_x) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report shall include an assessment of the level of NO_x and N_2O emissions that can be achieved under optimum operating conditions. The report shall also provide details of the optimisation (including dosing rates) for the control of acid gases and dioxins.	Within 4 months of the completion of commissioning.
IC6	The Operator shall carry out an assessment of the impact of emissions to air of the component metals subject to emission limit values, i.e. Arsenic and Chromium VI. A report on the assessment shall be made to the Environment Agency. Emissions monitoring data obtained during the first year of operation shall be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application. An assessment shall be made of the impact of each metal against the relevant EQS/EAL. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work.	15 months from commencement of operations
IC7	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 and Table S3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.	Initial calibration report to be submitted to the Agency within 3 months of the completion of commissioning. Full summary evidence compliance report to be submitted within 18 months of the completion of commissioning.

Reference	Improvement measure	Completion date
IC8	The Operator shall submit a comprehensive noise impact assessment report undertaken in accordance with the procedures given in BS4142:2014, *Methods for rating and assessing industrial and commercial sound.* The assessment shall include the identification and assessment of the impact of noise emissions upon surrounding sensitive receptors arising from the operation of the installation. In the event that the report indicates an adverse impact (or greater) at local residential receptors, the report shall include proposals for the further attenuation and/or management of noise and shall include a timescale, to be agreed with the Environment Agency, for the implementation of these proposed measures.	Within 12 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 draft 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 15/04/15/to 15/05/15.

The following statutory and non-statutory bodies were consulted:

- Local Authority Environmental Protection department
- Local sewerage undertaker
- Food Standards Agency
- Health & Safety Executive
- Public Health England and Director of Public Health
- Local Fire & Rescue Service
- National Grid

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Health & Safety Executive	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments	-

Response Received from Public Health England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
They acknowledge that the Applicant is proposing a site specific Environmental Management System (EMS) which will include an Accident Management Plan for prevention and emergency conditions. They state that this should be in place once the site is deemed operational due to the proximity of receptors and thrust that the Environment Agency will ensure that the proposed mitigation within the Accident Management Plan will prevent offsite impacts to the	As stated in section 4.3.4(a) of this document an Accident Management Plan will form part of the site Environmental Management System which must be in place prior to commissioning as required by pre-operational condition PO1.

Response Received from Public Health England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
residential properties for foreseeable abnormal events and start-up / shutdown.	

Response Received from Hull City Council	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Comments from the Public Health team were that they had no issues of concern from an epidemiological point of view.	No action required

We did not receive a response from the other statutory or non-statutory consultees listed above.

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

No responses received.