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/LP3536NX
The Applicant / Operator is:	Fortitude Environmental Limited
The Installation is located at:	Huntsman Drive, Billingham, Middlesbrough.

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/LP3536NX/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/LP3536NX. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 16/08/13.

The Applicant is Fortitude Environmental Limited. We refer to Fortitude Environmental Limited as “the **Applicant**” in this document. Where we are talking about what would happen after the Permit is granted (if that is our final decision), we call Fortitude Environmental Limited “the **Operator**”.

Fortitude Environmental Limited’s proposed facility is located at Huntsman Drive, Billingham, Middlesbrough TS2 1TT. 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
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
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
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
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
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
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
PTU	Primary Treatment Unit
PXDD	Poly-halogenated di-benzo-p-dioxins (e.g. PCDD – poly chlorinated di-benzo-dioxin)
PXB	Poly-halogenated biphenyls
PXDF	Poly-halogenated di-benzo furans (e.g. PCDF – poly chlorinated di-benzo-furan)
RGS	Regulatory Guidance Series
SAC	Special Area of Conservation
SCR	Selective catalytic reduction
SGN	Sector guidance note
SNCR	Selective non-catalytic reduction
SPA(s)	Special Protection Area(s)
SS	Sewage sludge
SSSI(s)	Site(s) of Special Scientific Interest
STU	Secondary Treatment Unit (Thermal Oxidiser)
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
VOC	Volatile Organic Compounds
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(a) Receipt of Application

The Application was duly made on 16/08/13. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

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

(b) Additional information

The Operator has provided the additional, amended and updated documentation for the installation in one consolidated document. This ensures the Environment Agency, the Operator and the public registers have one document to refer to and work with.

2.2 Consultation on the Application

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

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

We placed a paper copy of the Application and all other documents relevant to our determination (see below) on our Public Register at Tyneside House, Skinnerburn Road, Newcastle, NE4 7AR, and also sent a copy to Stockton-on-Tees Borough Council for its own Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made. The Applicant also provided a number of copies of the Application on CD which were also made accessible from the Public Registers

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

- Public Health England
- Director of Public Health, Middlesbrough Council
- Health and Safety Executive
- Food Standards Agency
- Environmental Health and Planning Department – Stockton-on-Tees Borough Council

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. This is discussed in section 5 of this document.
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Further details along with a summary of consultation comments and our response to the representations we received can be found in Annex 4. We have taken all relevant representations into consideration in reaching our determination.

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it. We requested this information by email and telephone calls. A copy of the information received has been placed on our public register and sent to Stockton on Tees' local authority for inclusion on its register when received.

In addition, we received additional information during the determination from the Applicant and these are listed below. We made a copy of this information available to the public register in the same way as the application.

- Report regarding Human Health Risk Assessment received on 23/12/13
- List of Waste codes received on 15/10/14
- Updated drawing of the plant components showing hot air feed received16/10/2014
- Abnormal Emissions Human Health Risk Assessment received on 29/10/2014
- Reagent specifications received on 16/10/14 and 27/11/14
- Abnormal emission report and calculations received on 25/11/14
- Additional report for abnormal emissions and calculations received on 04/12/14
- Additional modelling for abnormal emissions received on 07/12/14
- Additional report on HCl abnormal emissions received on 10/12/14
- Consolidated supporting documents received on 12/12/14

A summary of the consultation responses and how we have taken into account all relevant representations is shown in Annex 4.

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) (a) – The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.

The above activity includes the following:-

- Pre-treatment of waste – filter press, treatment with lime, shredding, size reduction, blending, metal removal, drying and screening prior to treatment in the Thermal Desorption Unit (Primary Treatment Unit (PTU)).
- Pre-treatment of waste – Thermal Desorption within the PTU, prior to incineration (thermal oxidation) in the Secondary Treatment Unit (STU).
- Recovery of materials – inorganic residue and metals
- Hazardous Waste Storage - From receipt of waste to despatch of recovered materials and disposal of waste arising. Waste types and quantities as specified in Table S2.2 of the permit.

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, (including storage and preparation of treatment chemicals e.g. lime slaking), and the waste storage facilities, along with the activities detailed above are therefore considered to be included in the listed activity description.

An installation may also comprise “directly associated activities”, which at this Installation includes a back up electricity generator for emergencies and a water treatment and recovery system to utilise storm water collected at the facility. 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 site is located on the north bank of the River Tees estuary and the centre of the site is approximately 3.5 km northeast from the centre of Middlesbrough. The NGR is 452492, 522590. The area of the site is approximately 1.1 hectares on Huntsman Drive, Seal Sands, Billingham, Middlesbrough.

The site is located in a heavily industrialised area and there are several separate industrial sites to the north, east and west of the site.

The closest residential properties and school are approximately 2 km southwest of the site.

There are the following Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites within 10 km of the site:

- Teesmouth & Cleveland Coast Ramsar
- Teesmouth & Cleveland Coast SPA (or proposed SPA)

There are the following SSSI within 2 km of the site:

- The Tees & Hartlepool Foreshore & Wetland SSSI covers a number of separate areas on the northern shore of the River Tees. The closest section of this SSSI is approximately 300 m southwest of the proposed installation.

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 Hazardous Waste Incinerator. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the installation is a waste incineration plant because, this plant will be designed to incinerate/thermally treat the organic fractions of various hazardous wastes.

The plant will mainly consist of a thermal desorption unit and an incineration unit for the treatment of waste materials. A directly heated rotary kiln is used to volatilise organic contaminants from hazardous wastes which are then oxidised in a directly fired combustion chamber, leaving an inorganic residue (which in some circumstances can be recovered). The resulting vapours are cooled by the action of a water spray prior to passing through bag filters to remove particulates. The gases are further cooled and then passed through a scrubber to remove acid gases.

There are no proposed process discharges from the site to surface waters, groundwater, drainage systems or sewers. The liquors from the gas handling processes are combined with the materials that are discharged from the kiln.

The four fuel storage tanks for diesel and RFO (each with a capacity of 19,000 litres) will be bunded, and the site will have an impermeable surface with gradients to a drainage sump. The resulting surface water will be directed to two water storage tanks (each with a capacity of $200m^3$) for in-process use and any excess tankered off site.

The installation has been designed to accept a large variety of hazardous wastes and to thermally treat them such that the organic fraction within the waste is destroyed by the thermal oxidation element of the incineration process. These will mainly be highly contaminated and complex organic waste materials, such as materials contaminated with chlorinated pesticides, polychlorinated biphenyls (PCBs), and poly aromatic hydrocarbons (PAHs).

The Operator will only accept waste listed in Table S2.2 of the permit, and has confirmed that they have in place robust and effective procedures to only allow into the installation waste that can be treated by the facility. This includes testing (both physical and chemical) at the enquiry stage and prior to the waste being accepted to the site. This is also important so that the waste can be stored safely and appropriately. Also, this pre-acceptance/treatability testing will determine the most efficient manner of pre-treating and thermally treating the waste, e.g. by optimising the treatment temperatures of the PTU and STU.

Additionally, the waste will be inspected and tested on receipt to make sure that the waste complies with its documentation and can be accepted into the site.

Once the waste has been accepted onto site, it will be unloaded in a designated area which is constructed with hardstanding and sealed drainage and stored in an assigned area in the building to await pre-treatment should it be necessary.

Pre-treatment will include any one or a combination of the following:-

- Reduction of moisture content (by mixing with lime or use of a filter press) or Drying (by air – extracted air is then fed back into the plant)
- Size reduction (shredding or crushing)
- Screening
- Blending with other wastes (after testing to ensure compatibility)

The above pre-treatment will be carried out in the presence of an inert gas atmosphere if pre-acceptance testing shows it to be necessary e.g. the flashpoint is less than 55ºC.

The upper moisture content of the waste going through the system is between 15% and 20%. Therefore, the waste will be pre-treated as detailed above to ensure that energy is not used unnecessarily to volatilise excess moisture within the thermal treatment elements of the plant.

Treating with lime may also assist in controlling any acid gases produced in the PTU.

A schematic drawing is shown in Figure 1 (page 16). This shows the main aspects of the plant.

After pre-treatment the waste is fed into the PTU in batches via a magnetic conveyor belt that segregates any metals from the waste. These metals and any screening wastes are sent off site to be recovered.

The PTU heats the waste to the temperature determined at the pre-acceptance stage (between ambient and 525^{o}C). The waste is agitated using paddles within the PTU kiln and heated to the appropriate temperature to volatilise the organic contaminants.

The waste gases produced in the PTU are drawn through to the multi-cyclone unit using negative pressure, which is created by the inductor draft fan. The multi-cyclone unit removes the coarse dust particles prior to the gases passing into the STU where the volatised waste gases are incinerated.

The inorganic residue from the PTU is cooled by air and water in the pug-mill. The residues are hydrated to reduce emissions of dust and particulates with water recovered from the wet scrubber. The inorganic residues are dispensed into a container to await testing. The dust and particulates from the multi–cyclone are also cooled in the pug-mill, but are to be kept separate from the treated inorganic waste residues.

The organic waste gases, on exiting the multi-cyclone, pass into the STU. These are agitated and heated to between 850°C and 1100°C for a minimum of 2 seconds incinerating the organic constituents of the gas. The temperature used to incinerate the gases is determined by the pre-acceptance/treatability testing conducted on a sample of the waste. The appropriate temperature will vary between 850°C and 1100°C, depending on the organic contaminant being incinerated. This is to ensure compliance with IED, which requires that hazardous halogenated waste that is greater than 1% (as chlorine) shall be incinerated at 1100°C. (The furnace design and temperatures are further discussed in section 6.1.1.)

Both the PTU and STU are fuelled by RFO and are equipped with 30MMBtu/hr (8.79 MW) auxiliary burners. The PTU and STU will be brought up to the required temperature using gas oil (low sulphur diesel).

The flue gases exiting the STU are further treated by the Selective Non Catalytic Reduction (SNCR) system, using urea as the reagent. This will reduce the NO_x component of the flue gases (further discussed in section 6.2.2).

The flue gases are then drawn through to the Evaporative Cooling Chamber (ECC), where the gases are cooled from approx 1000°C to 200°C by the injection of an air atomised water spray. At this point the water become vaporised during the cooling process, producing water vapour and process gases.

As the gases are drawn towards the baghouse, activated carbon is introduced to assist in the reduction of dioxins, furans and mercury (further discussed in section 6.2.5 and 6.2.6).

The baghouse, (working in combination with the wet scrubber), then removes the dust and particulates from the gases.

The gases are then treated by the packed wet alkali scrubber to remove the remaining acid gas components and halogens (see section 6.2.1 and 6.2.3). This is prior to the gases being quenched with fresh and recycled waters to cool them to the adiabatic saturation temperature (approx 85°C), before finally being discharged to air via a 21m exhaust stack.

A computerised plant interface system controls and optimises the various treatment stages and the automatic interruption of waste feed or shut down of the plant (further discussed in section 4.4.6).

a) <u>Treated Waste</u>

All the solid treated residues are stored in containers while waiting for the results of testing to inform the appropriate recovery or disposal route. All of the solid treated residues (including metals and screened inert waste, such as stones) are then exported to appropriate sites where it can be either recovered by further treatment off site, or disposed of to landfill.

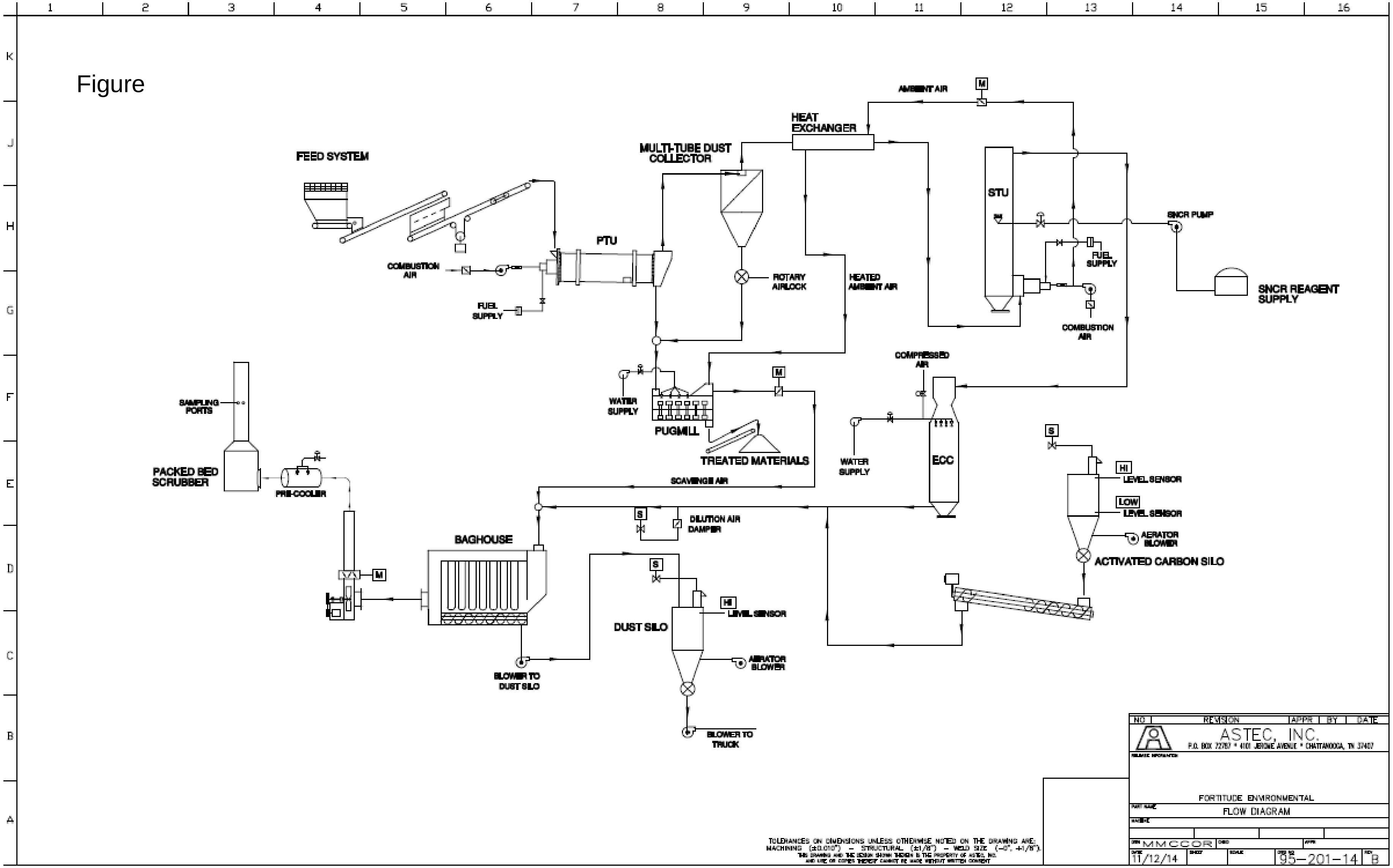
Some water from the process will be emitted from the stack as water vapour. Other effluents produced from the treatment of the process gases, e.g. from the wet scrubber and the ECC, will be collected, treated to reduce and remove the suspended solids and then recycled into the process again and used to rehydrate the residues as described in section 4.3.8.

b) Key Features

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

Key Features		
Waste throughput, Tonnes/line	60,000 tonnes/annum	8 tonnes/hour (average)
Waste processed	Hazardous Waste, highly contaminated with complex organic waste materials	
Number of lines	1	
Furnace technology	Rotary Kiln PTU with Volatilised Gases to Thermal Oxidiser	
Auxiliary Fuel	Gas Oil/Recovered Fuel Oil	
Acid gas abatement	Wet (Turbo scrubber)	Sodium Hydroxide
NOx abatement	SNCR	Urea
Reagent consumption	Auxiliary Fuel (Diesel) : 44 tonnes/annum Auxiliary Fuel : 5400 tonnes/annum Urea : 186 tonnes/annum Lime/Other : 600 tonnes/annum Sodium Hydroxide: 300 tonnes/annum Sodium Metabisulphite: 300 tonnes/annum Activated Carbon: 246 tonnes/annum Process water: 70,000 tonnes/annum	
Flue gas recirculation	No	
Dioxin abatement	• Fast temperature reduction within the Evaporative Cooling Chamber • Effective particulate control using activated carbon • Wet alkali scrubbing.	
Stack	Grid Reference 452455, 522628	
	Height 21.34 m	Diameter 1.52 m
Flue gas	Flow 34.2m^3/s	Velocity 18.8 m/s
	Temperature between 85°C and 93°C	

Figure 1



FEED SYSTEM
PTU
COMBUSTION AIR
FUEL SUPPLY
MULTI-TUBE DUST COLLECTOR
ROTARY AIRLOCK
HEAT EXCHANGER
AMBIENT AIR
HEATED AMBIENT AIR
STU
FUEL SUPPLY
COMBUSTION AIR
SNCR PUMP
SNCR REAGENT SUPPLY
WATER SUPPLY
PUGMILL
TREATED MATERIALS
COMPRESSED AIR
WATER SUPPLY
ECC
SCAVENGE AIR
DILUTION AIR DAMPER
SAMPLING PORTS
PACKED BED SCRUBBER
PRE-COOLER
BAGHOUSE
BLOWER TO DUST SILO
DUST SILO
LEVEL SENSOR
AERATOR BLOWER
BLOWER TO TRUCK
LEVEL SENSOR
LEVEL SENSOR
AERATOR BLOWER
ACTIVATED CARBON SILO
ASTEC, INC.
FORTITUDE ENVIRONMENTAL
FLOW DIAGRAM
MMCCOR
11/12/14
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4.1.4 Key Issues in the Determination

The key issues arising during this determination were waste acceptance and storage; site protection; plant design; emissions to air; emissions to water; energy efficiency; and efficient use of raw materials 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 Waste Acceptance and Storage

The Applicant has summarised the waste acceptance and storage in Section 12 of the Supporting Documents.

The Applicant has stated they have suitable a pre-acceptance, acceptance and testing regime to ensure that the specific requirements for the delivery and reception of waste, and a general duty to “take all necessary precautions” are addressed (Article 52 of the IED).

The pre-acceptance procedures and tests ensure that the Operator has sufficient information prior to receiving the waste, so that they can be safely offloaded and stored. Also, these tests will characterise the waste to ensure that it is suitable to be incinerated. These will include identifying the hazardous properties (‘H’ codes), and those waste with halogens above 1% (as chlorine), to ensure these can be stored and tracked. Additionally, the tests will determine what, if any, type of pre-treatment of the waste will require.

When the waste arrives at the site, checks of documentation, quantity, samples and acceptance testing shall be undertaken to ensure that they are compatible with waste already stored on site and before they are combined for pre-treatment.

All wastes will be stored in the building to ensure that odours are contained and where necessary the extracted air is extracted through the STU.

No liquid wastes will be accepted onto site. Sludges are stored in IBCs, in an area that is contained within the building until they can be tested and pre-treated.

Drummed waste shall be stored in the building where they are protected from heat and direct sunlight. They will be stored on an impervious surface which has a collection sump for run off or spills and leaks. They will not be stored more than 2 rows high and will be analysed and emptied as soon as practicable. Any air extracted from drum storage opening/transfer points should be extracted and put though the STU. Containers which have been emptied shall be stored and disposed of without giving rise to emissions to atmosphere and odours.

The Applicant will have a preventative maintenance programme that shall include assessment of all waste handling equipment to prevent fugitive releases.

We are satisfied that the Applicant has provided sufficient information regarding the control of incoming wastes and raw materials. We have also placed a pre-operational condition (PO9) to ensure that the Applicant have procedures and a management system that satisfy these requirements.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

a) Site Layout

The site will consist of a kerbed and bunded concrete slab with a sealed drainage system weighbridge, treatment building and plant. Further details are outlined below and fully described in Section 5 the Supporting Documents in the Application. Drawings illustrating the site layout can be found in Section 29 of the Supporting Documents in the Application.

The site will also have 2 x 200m^3 water tanks to collect rain and surface water and 4 x 19,000l bunded fuel tanks for diesel and RFO.

All bunding will conform to CIRIA guidance: Containment systems for the prevention of pollution (C736).

b) Site infrastructure

The site is secured by a boundary fence to prevent unauthorised access to the site.

Waste materials will enter the facility via the site weighbridge and then be transported to the reception and storage building where they will be quarantined in separate stockpiles or bays.

It is BAT to store, pre-treat and process waste in areas that have sealed and resistant surfaces and controlled drainage that prevents the release of substances either directly or by leaching from the waste.

The storage area is covered and bunded to prevent ingress of rainwater onto the untreated materials. Any wet waste sludge materials will be kept in containers such as IBCs and stored appropriately in the building. The Applicant has stated that they will store and control the waste and treated residues in line with Environment Agency and Health and Safety Executive guidance.

Water runoff from the hard standing will be collected via a sealed drainage system that leads to a constructed concrete sealed 2m deep sump. Water from the sump will be collected and stored in the water storage tanks and used in the process.

Also, rainwater runoff from the waste reception building will be collected via a separate system which will lead to the water storage tanks. The water collected in this system will be re-cycled and used in the plant.

c) Site Conditioning Report

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

The Applicant has submitted a site condition report which includes a report on the baseline conditions as required by Article 22. We have reviewed that report and consider that it adequately describes the condition of the soil and groundwater prior to the start of operations. It is summarised below.

(i) Geology

The geology comprises of mainly made ground (mostly blast furnace slag) over drift deposits over Mercia Mudstones.

(ii) Hydrology/Hydrogeology

The groundwater beneath the site is influence be the tidal flow of the Tees estuary. The Site Condition Report shows chemical contamination of the groundwater.

(iii) Flooding

The Flood Map indicates that the site is outside the Extreme Flood risk area and the Applicant has considered flooding in there Accident/Incident Risk Assessment and Management systems.

d) Site setting, history and background contamination

(i) Site Setting

The site is located on the north bank of the River Tees estuary and the centre of the site is approximately 3.5 km northeast from the centre of Middlesbrough. The NGR is 452492, 522590. The area of the site is approximately 1.1 hectares on Huntsman Drive, Billingham, Middlesbrough

(ii) History

A Desk Study was undertaken by the Applicant. This study looked at historical maps dating back to 1857 and revealed that the site is located on the area formally known as Seal Sands estuarine mudflats, which were reclaimed in the early part of the 20th Century using slag materials from local industry.

Historically, the area where the site is located has been used for a large number of heavy industrial uses. The area is largely made up of “made ground”. This largely consists of backfill/upfilling of slag materials from past industries.

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. We are satisfied that the Applicant has supplied sufficient information to provide adequate baseline reference data in the application. Also, the Applicant will be required to by pre-operational condition PO1 to gather additional data during construction to supplement the data in the Site Condition Report summarised above.

Additionally, there is a pre-operational condition PO7 and condition 3.2.4 to monitor the soils and groundwater at regular intervals as require by IED. This data will go towards the details and records required to be kept to surrender the site.

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 3.3.3 of the Supporting Documents of the Application. Pre-operational condition PO9 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 groundwaters, taking into account both the baseline conditions and the site’s current or approved future use. To do this, the Operator has to apply to us for surrender, which we will not grant unless and until we are satisfied that these requirements have been met.

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

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

The 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. A pre-operational condition (PO9) 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 as described above.

4.3.4 Accident management

The Applicant has submitted an Accident Management Plan. Having considered the Plan and other information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. An Accident Management Plan will form part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO9).

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
The Application	Application Form B2, Questions 3, 6, and 7. Application Form B3 Questions 1, 2, 3, 4, Appendix 5 Hazardous and Non hazardous Waste Recovery and Disposal and Appendix 6 relating to the Hazardous Waste Incineration Site.
Additional Information – Resubmitted Supporting documents	Supporting document Sections 5 to 29 relating to the design, construction, commissioning, operation and performance of the Hazardous Waste Incineration Site.

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.
RFO	< 1% sulphur content <10ppm cadmium content < 275ppm lead content	To minimise the amount of volatilised metals and acid gases emitted to the air
Sodium Hydroxide (NaOH)	<0.5% Mercury <2% sulphur dioxide	
Sodium Meta-bisulphite ($Na_2S_2O_5$)	<0.0001% Mercury and Arsenic <0.001% Heavy Metals	
Lime	0.5% Mercury <2% sulphur dioxide	

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

The list of wastes in Table S2.2 of the permit is considered appropriate for processing in the plant and has been refined and agreed with the Applicant during the determination period as detailed below:-

- all of the non-hazardous codes have been removed because the incinerator is only permitted to accept hazardous wastes. The Applicant has agreed and they have withdrawn these codes from the proposed list of wastes.

- the wastes codes in the list below have been removed from the Applicant's list. This is either because there are other treatment techniques that are regarded as more efficient and could result in reuse or recovery (for example biological treatment) or the Applicant has not demonstrated that they have the procedures in place to deal with waste designated under the code.

- the following controls have been applied to the Table S2.2 of the permit

    - no wastes with detectable asbestos
    - no wastes with Total Mercury content > 2mg/kg
    - no radioactive waste
    - no liquid waste
    - only wastes with a flashpoint >= 55ºC are to be pre-treated unless in the presence of an inert atmosphere
    - wastes with H1(explosives) and H9 (clinical waste) properties have not been permitted, as these could cause issues with storage, handling and processing
    - the amount of waste treated at the facility is limited to 60,000 tonnes per annum
    - the amount of waste stored on the site at any one time is limited to 10,000 tonnes

The following waste codes have been withdrawn from the Applicant's List:-

01 05	**Drilling muds and other drilling wastes**
01 05 05*	oil-containing drilling muds and wastes
06 09	**Wastes from the MFSU of phosphorous chemicals and phosphorous chemical processes**
06 09 03*	calcium-based reaction wastes containing or contaminated with dangerous substances
16 01	**End-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**
16 01 07*	oil filters
16 01 09*	components containing PCBs
16 01 21*	hazardous components other than those mentioned in 16 01 07 to

	16 01 11 and 16 01 13 and 16 01 14
16 02	**Wastes from electrical and electronic equipment**
16 02 09*	transformers and capacitors containing PCBs
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09
16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
16 02 15*	hazardous components removed from discarded equipment
20 01	**Separately collected fractions (except 15 01)**
20 01 13*	Solvents
20 01 14*	Acids
20 01 15*	Alkalines
20 01 17*	Photochemicals
20 01 23*	discarded equipment containing chlorofluorocarbons
20 01 26*	oil and fat other than those mentioned in 20 01 25
20 01 33*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries

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

(i) the wastes are all categorised as hazardous in the European Waste Catalogue and are capable of being safely treated, and incinerated at the installation

(ii) these wastes are likely to be within the design calorific value (CV) range for the plant

(iii) these wastes are unlikely to contain harmful components that cannot be safely processed at the Installation

(iv) the wastes contain harmful components that cannot be safely and effectively processed at other installations

(v) The operator has identified the hazardous properties for all the wastes listed in Table S2.2 of the permit and we consider that the plant is capable of dealing with all but the prohibited properties discussed above.

(vi) The Applicant has detailed storage, handling, testing and processing procedures.

The incineration plant will take hazardous waste, which has not been source-segregated or separately collected or otherwise recovered, recycled or composted. Waste codes for separately collected fractions of waste are not included in the list of permitted wastes, except that separately collected fractions which prove to be unsuitable for recovery may be included.

Waste codes are also limited by hazard code as defined by the Waste Framework Directive and we are not allowing wastes classified as H1 (explosives) nor H9 (Clinical Waste).

As required by the IED for HWI's, we have also specified the maximum and minimum calorific values, the maximum content of the pollutants and we have included a pre-operational condition (PO5) to establish the maximum and minimum mass flow of the hazardous wastes to be incinerated.

Also, we have placed a limit within Table S1.1 on the flashpoint of waste that can only be pre-treated if the flashpoint is greater than or equal to 55ºC to ensure that this does not result in an incident or unregulated emission.

We have limited the capacity of the Installation to 60,000 tonnes per annum. This is based on the installation operating 7,500 hours per year at a nominal capacity of 8 tonnes (average) per hour (i.e. working 24 hours a day for 42.85 weeks per year). This is the feasible amount time of the plant can process waste taking into consideration downtime for maintenance.

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. This begins by ensuring that the waste characterisation and treatability is accurately known at the pre-acceptance stage. This will include:-

- A thorough analysis of each waste stream, in terms of chemical, physical and geotechnical quantification.

- An assessment of the treatability, detailed mass and energy balance calculations will be conducted to establish optimum operating conditions. Such optimum conditions include:

  - Determination of minimum operating temperatures to ensure effective treatment without excessive heat energy being utilised;

  - Optimum gas flows;

  - Optimum feed rates;

  - Determination of optimum pre-treatment requirements including minimum raw material usage, most favourable moisture content and opportunities for recycling materials, whilst achieving successful treatment conditions;

  - Modelling of various characteristics to optimise the air flows and waste feed rates.

Process efficiency will be further achieved during the operation of the plant by the following measures:

- Heat retention is maximised and heat loss minimised throughout the plant where possible e.g. insulation of the baghouse

- Duct work is insulated and where refractory lining is required (in the STU and ECC), heat is additionally conserved as part of the refractory properties;

- Recovered fuel oil is used in the PTU and STU; low sulphur gas oil is used for start up and shut down.

The layout and configuration of the plant and ancillary equipment has been designed in such a way as to minimise the requirement for pumping and transfer of both raw and treated materials.

The Application states that the specific electrical energy consumption, a measure of electrical energy consumed per unit of waste processed, will be 0.08 MWh/tonne. The installation capacity is 60,000 tonnes/annum.

The WID BREF stated that the average installation electrical demand is 0.3-0.5 MWh/tonne[a] of waste processed. Therefore the installation is well within the BAT benchmark.

(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*".

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.

Heat recovery mechanisms have not been incorporated into the installation as the incineration of higher concentrations of halogenated waste streams, such as those to be treated at the installation, mean that primary environmental concerns are the thorough and efficient destruction of the waste and the required rapid cooling of gases to prevent de novo dioxin formation. However, the opportunity for heat recovery will considered in the future. We have included pre-operational condition PO2 in the permit for this to be reviewed prior to commissioning, and a condition 1.2.3 in the permit requires this to be further reviewed every 2 years.

We consider that, within the constraints of the location of the Installation and the risk of Dioxin and Furan formation explained above, the Installation will recover heat as far as practicable, and therefore that the requirements of Article 6(6) are met.

(iv) Choice of Cooling System

The Applicant is proposing to install an Evaporative Cooling System.

The flue gas is extracted from the STU (thermal oxidiser) into the cooling system via negative pressure provided by the induction fan and an atomised water spay is used to rapidly cool the flue gases from approximately a 1000^{o}C to 200^{o}C.

This is to ensure cooling is achieved as rapidly as possible, and does not provide the ideal temperature window for de novo synthesis dioxin and furan formation.

(v) Permit conditions concerning energy efficiency

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[a] Reference Document on the Best Available Techniques for Waste Incineration (Aug 2006), Section 5.4 Specific BAT for hazardous waste incineration, Page 452, Para 74.

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 hazardous waste burned per year, this will enable the Environment Agency to monitor energy recovery efficiency at the Installation and take action if at any stage the energy recovery efficiency is less than proposed.

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

4.3.8 Efficient use of raw materials

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

The Operator is required to report with respect to raw material usage under condition 4.2 and Schedule 4, including consumption of lime, sodium hydroxide, sodium meta-bisulphate, urea, activated carbon and water 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 in section 4.4). 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.

Water consumption is currently minimised:

- by the re-circulation of purge water from the scrubber for the re-hydration of residues exiting the pug-mill
- by gathering water from the building roof and hard-standing which is treated and recycled

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

This requirement addresses wastes produced at the Installation and does not apply to the waste being treated there. The principal waste streams the Installation will produce are treated waste residue (inorganic waste), residue from the pug-mill (i.e. particulates from the gas volatilised in the PTU), air pollution control (baghouse) residues, waste materials from pre-treatment and recovered metals.

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree removal of the organic contaminants in the PTU and oxidation in the STU, which may result in a material that is both reduced in volume (this will vary depending of the waste type) and in chemical reactivity. Condition 3.1.3 and associated Table S3.4 specify limits for total organic carbon (TOC) of <3% in treated waste residue. Compliance with this limit will demonstrate that good temperature control and waste treatment is being achieved in the furnaces and waste generation is being avoided where practicable.

The treated inorganic waste residue from the PTU could be classified as non-hazardous waste. However, treated waste residue is classified on the European List of Wastes as a “mirror entry”, which means treated waste residues are hazardous waste if they possess a hazardous property relating to the content of dangerous substances. Monitoring of treated waste residues will be carried out in accordance with the requirements of Article 53(3) of IED. Classification of treated waste residue for its subsequent use or disposal is controlled by other legislation and so is not duplicated within the permit. If they are hazardous they will be sent for disposal to a landfill site permitted to accept hazardous waste, or to an appropriately permitted facility for hazardous waste treatment.

As the solid residues from flue gas treatment may be hazardous waste, they will either be sent for disposal to a landfill site permitted to accept hazardous waste, or to an appropriately permitted facility for hazardous waste treatment.

The APC (baghouse) residues may also be hazardous; they will also be treated as detailed in the paragraph above. The amount of APC (baghouse) residues is minimised through optimising the performance of the air emissions abatement plant.

In order to ensure that the treated inorganic waste residues, multi-cyclone residues and APC (baghouse) residues are adequately characterised, pre-operational condition PO3 requires the Operator to provide a written plan for approval detailing all of the treated waste residues sampling protocols. Table S3.4 requires the Operator to carry out an ongoing programme of monitoring.

The Application states that any waste materials from pre-treatment and metal fractions will be recovered from the waste materials by the use of a screens and magnetic conveyer belt and sent for recycling.

The Application also proposes that, where possible, treated waste residue will be transported to a suitable recycling facility, from where it could be re-used in the construction industry as an aggregate, the waste industry for landfill cover, or restoration material (if shown to be non-hazardous).

All of the process residues will be kept separately and stored within the building in accordance with the Environment Agency and Health and Safety Executive guidance.

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.

4.4. Other Considerations

4.4.1 Incoming waste and raw material management

The Applicant has stated in the application that the site will maintain a high standard of housekeeping in all areas and provide and maintain suitable equipment to clean up spilled materials.

The Applicant has confirmed that waste will only be loaded and unloaded from vehicles in designated areas with proper hard standing and with sealed drainage.

The Applicant has confirmed that they will store fuels in bunded tanks. Treatment chemicals are supplied in drums or IBCs and will be stored in the building where odours from the reagents can be controlled.

As stated above in section 4.1.3 and 4.3.8, the Applicant will collect all drainage from the building and the site and use it in the process. If it is tested and found unsuitable for use in the process or, if the quantity is in excess of that required, it will be tankered off to an appropriate sewage treatment works.

The pre-acceptance testing and procedures will provide sufficient information prior to receiving the waste, to ensure that waste can be either safely offloaded for appropriate storage otherwise the load will be rejected.

Potentially odorous raw materials and all wastes will be stored in the building to ensure that odours are contained and where the air is extracted through the STU.

We are satisfied that the Applicant has provided sufficient information regarding the control of incoming wastes and raw materials. We have also placed a pre-operational condition (PO9) to ensure that the Applicant have procedures and a management system that satisfy these requirements.

4.4.2 Pre-treatment

The Applicant has procedures that ensure:

- they have conducted pre-acceptance testing and have information covering:
    - the physical and chemical composition
    - any other information necessary to assess its suitability for incineration
    - hazard characteristics
    - substances with which it cannot be mixed, and
    - handling precautions

- they have confirmed the information accompanying the waste by
    - checking that the quantity is as declared by the consignor
    - documentation checks
    - sampling if appropriate

Any samples shall be kept for at least 1 month after incineration. Small scale compatibility tests will be carried out with a sample of the contents to ensure that there are no reactions if combined in a tank or with other wastes (e.g. reactions which lead to heat release, gassing or other undesirable consequences).

The site will accept hazardous wastes that are heterogeneous and blending or pre-treatment may be necessary. The Operator will gather the above information via pre-acceptance testing and acceptance checking therefore they will have operating procedures to ensure that waste is treated and/or blended to give the most constant and/or appropriate combustion conditions possible.

Waste will be pre-treated to ensure the most complete combustion is achieved, to control emissions within ELVs and to prevent unnecessary waste production.

The waste will undergo screening and crushing to remove large items. The extraction of recyclable material and shredding of the remaining waste will be undertaken if necessary, if not carried out prior to delivery to the installation. Crushing or particle size reduction will be carried out as necessary to ensure high surface area to aid desorption of the organic pollutants. However, this type of pre-treatment should be carried out in the presence of an inert atmosphere if there is a risk of fire. This has been limited in Table S1.1.

We are satisfied that the Applicant has provided sufficient information regarding pre-treatment and the control of compatibility. We have also placed a pre-operational condition (PO9) to ensure that the Applicant have procedures and a management system that satisfy these requirements.

4.4.3 Waste Charging

The plant uses an automatic computerised system to prevent waste feed under the following scenarios:

- at start-up, until the required temperature has been reached;

- when the required temperature is not maintained;
- when the continuous monitors show that any emission limit value is exceeded due to disturbances or failures of the purification devices

The waste charging is interlocked with furnace conditions so that charging cannot take place when the temperatures and air-flows are inadequate, when any flue gas cleaning bypasses are open or where the continuous monitors show that the emission limit values are being exceeded for a period of time in excess of the limits set within IED.

We are satisfied that the waste charging procedure is appropriate and will ensure that the induction fan can maintain the negative pressure system and avoid escape of fumes or excess air flows.

The pre-acceptance and/or treatability testing will determine the charging rates to ensure they are within the limits of the plant design capacity and to ensure that they don't undermine environmental performance of the plant. The waste changing capacity will vary according to the CV of the waste feed. The Applicant will record throughput rates. The Applicant will alter mass throughput rates in order to ensure optimum combustion conditions are achieved, whilst ensuring that waste residence in the chamber is sufficient to secure necessary requirements.

We are satisfied that the Applicant has provided sufficient information regarding pre-treatment and the control of compatibility. We have also placed a pre-operational condition (PO9) to ensure that the Applicant have procedures and a management system that satisfy these requirements.

4.4.4 <u>Validation of combustion conditions</u>

The permit has pre-operational (PO6) to ensure that the final design:

- uses a representative Computerised Fluid Dynamics (CFD) model, where practical, to demonstrate that the residence time and temperature requirements will be met in the chosen design and to identify the ideal (or best practicable) locations for temperature monitoring for the purposes of validation measurements

- outlines the assumptions and inputs used in the CFD modelling and explains how these are representative of the chosen design

- identifies the qualifying zone over which the residence time and temperature will meet the residence time and temperature requirements

- uses a model that is representative of the real flow situation in the qualifying zone (this is most likely to be a combination of plug flow and stirred reactor flow rather than one extreme)

- takes into account the Environment Agency guidance[a] and BAT report and confirms the details of the method that will be used to validate temperature and residence time modelling, including identification of the worst case conditions under which the test(s) will be carried out including waste type etc

The permit has improvement conditions (IC3, IC4, IC5 and IC7) to ensure during the **operational stage,** validation techniques are under taken and agreed with the Environment Agency.

4.4.5 Cooling systems

The Applicant is proposing to install an Evaporative Cooling System described in section 4.1.3 and further discussed in section 4.3.7(iv).

We are satisfied that the Applicant has provided sufficient information regarding cooling systems and that it is BAT for this installation.

4.4.6 Control systems

The plant is controlled by a computer interface. This allows the plant to be controlled and data to be recorded. It is programmed with the appropriate setting or ranges. If the settings or ranges are breached, the plant will shut down automatically. Below is a list of process control settings that if the associated pre-programmed limit or range is breached, would trigger the shutdown process:

- Thermal Desorber Feed Rate
- Thermal Desorber Residue Exit Temp
- Thermal Desorber Pressure
- Thermal Desorber Burner Flame
- Thermal Desorber Rotation
- Thermal Oxidiser Exit Gas Temperature
- Thermal Oxidiser Burner Flame
- Evaporative Cooler Exit Temperature
- Baghouse Differential Pressure
- ID Fan Operation
- Quench Exit Gas Temperature
- Scrubber Water Pressure
- Scrubber Water Flow
- Scrubber Water pH
- Stack Gas Oxygen Concentration
- Stack Gas Carbon Monoxide Concentration
- Stack Gas Sulphur Dioxide Concentration
- Stack gas HCl content (given there is so much indicated halogen content in the incoming waste)

[a] How to comply with your environmental permit. Additional Guidance for The Incineration of Waste (EPR 5.01)

- Stack gas VOC content (given that the efficiency of the thermal oxidiser is a critical feature of the contaminant 'destruction' process)
- Stack Gas Nitrogen Dioxide Concentration
- Instrument Air Pressure

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 such as abstraction etc. Consideration may also have to be given to the effect of emissions being subsequently deposited onto land (where there are ecological receptors). All these factors are discussed in this and other sections of this document.

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

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

5.1 Assessment Methodology

5.1.1 Application of Environment Agency H1 Guidance

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

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

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

5.1.2 Use of Air Dispersion Modelling

For incineration applications, we normally require the Applicant to submit a full air dispersion model as part of their application. Air dispersion modelling enables the process contribution to be predicted at any environmental receptor that might be impacted by the plant.

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

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

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

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

For those pollutants which do not screen out as insignificant, we determine whether exceedances 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 exceedance 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 alternative proposals. Whether or not exceedances 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 Section 6 of the Application. The assessment comprises:

- An H1 screening assessment of emissions to air from the operation of the incinerator.
- Dispersion modelling of emissions to air from the operation of the incinerator.
- A study of the impact of emissions on nearby sensitive habitat 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. The impact on conservation sites is considered in section 5.4.

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS 5 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at the Loftus Weather Station, 22.5 km east of the site. The background data was collected between 2008 and 2012 around 3.5 km to the south-west of the installation within the grounds of Brekon Hill Community Centre, in a residential area approximately 1 km south-east of Middlesbrough town centre.

Hourly-varying background concentrations from a suitable monitoring station in Middlesbrough were available for the following contaminants:

- CO;
- PM10;
- NO2;
- NOx;
- O3; and
- SO2.

No suitable hourly-varying background concentrations were available for benzene, hydrogen chloride, mercury, and hydrogen fluoride, and average figures have been estimated from a variety of sources as outlined below:

- Annual mean concentrations of benzene for the year 2012 have been estimated based on Defra's background map data for the years 2001, 2003 and 2010 and UK Grid Reference 452500, 523500.
- Annual mean concentrations of hydrogen chloride for the year 2012 have been estimated based on the average of the periodic measurements which were undertaken at the High Muffles monitoring station in 2010.
- Annual mean concentrations of mercury for the year 2012 have been estimated based on the average of the periodic measurements which were undertaken at the Sheffield Centre5 (located 137 km to the south) and Eskdalemuir (located 152 km to the north-west) monitoring stations during 2012.
- The Applicant has assumed that the background concentration of hydrogen fluoride as zero. This is because limited data is available; we consider this to be satisfactory.

We have assessed the background data used in the air impact assessment and are satisfied that it is appropriate.

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

- First, they assumed that the ELVs in the Permit would be the maximum permitted by Article 46(2) of the IED. These substances are:

    - Oxides of nitrogen (NO_x), expressed as NO_2
    - Total dust
    - Carbon monoxide (CO)

- Sulphur dioxide (SO_2)
- Hydrogen chloride (HCl)
- Hydrogen fluoride (HF)
- Metals – Mercury (Hg)
- Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)
- Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC)

- Second, they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate

- Third, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically PCBs. Emission rates used in the modelling have been drawn from data in the Waste Incineration BREF and are considered further in section 5.2.1.

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

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

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

The Applicant's assessment of the impact from Carbon monoxide (CO), Sulphur dioxide (SO_2), Particulates (PM_{10}), Hydrogen fluoride (HF), Hydrogen chloride (HCl), VOCs (Benzene (C_6H_6)), Mercury (Hg), and Oxides of Nitrogen (NO_x), Dioxin, Furans and PCB's have all indicated that the Installation emissions screen out as insignificant; the assessment 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.

The Environment Agency conducted indicative check modelling and sensitivity analysis using air dispersion modelling software ADMS 5.

The Environment Agency obtained background data for the year 2010 for predictions of PEC for PM_{10}, NO_2 and benzene and to check the Applicant's predictions of PEC for SO_2 and CO. The Environment Agency also considered background data from diffusion tubes from 2008-2012 for NO_2, PM_{10} and SO_2.

The Environment Agency obtained background values for mercury from the Defra website for the years 2010-2012 at Sheffield Centre to compare with the consultant's values provided. We also obtained background values for HCl from the Defra website for the years 2010-2012 at High Muffles.

Our check modelling and sensitivity analysis indicates that, although our numerical values do not exactly match the consultant's, we agree with the consultant's conclusion that it is unlikely the proposed plant will result in an exceedance of the EQS for CO, SO_2, PM_{10}, VOCs (as benzene), HF, HCL and Hg. Also, we agree that the PC for NO_x is likely to be greater than the significance criteria of 1% of the EQS for NO_2, however as a PEC it is unlikely there will be any exceedances of 100% of the NO_2 EQS.

Additionally, we checked the other Annex VI metals (Cadmium (Cd), Thallium (Tl), Mercury (Hg), Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V)) and we consider that there will be no exceedances of the EQSs for the afore mentioned metals.

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 figures shown indicate the predicted peak ground level exposure to pollutants in ambient air. Whilst we have used the Applicant's modelling predictions in the table below, we have made our own simple verification calculation of the percentage process contribution and predicted environmental concentration. These are the numbers shown in the tables below and so may be very slightly different to those shown in the Application. Any such minor discrepancies do not materially impact on our conclusions.

Table 5.1: Assessment of Emissions to Air of pollutants (1)

Pollutant	EQS / EAL		Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m³	**Ref**	**µg/m³**	**µg/m³**	**% of EAL**	**µg/m³**	**% of EAL**
NO_2	40 200	1 2	16.46 72.38	3.04 24.82	7.60 12.4	19.5 97.2	48.8 48.6
PM_{10}	40 50	1 3	0 0	0.21 0.66	0.53 1.32	- -	- -
SO_2	266 350 125	4 5 6	0 0 0	1.36 1.26 0.85	0.5 0.36 0.7	- - -	- - -
HCl	750	7	0	2.91	0.388	-	-
HF	16 160	8 7	0 0	0.11 0.29	0.69 0.18125	- -	- -
CO	10000	9	134	1.3	0.01	-	-
VOC	5	1	0.46	0.19	3.80	0.650000	13.0
PCBs	0.2 6	1 10	2.42E-12 2.42E-12	5.5E-14 5.5E-14	<0.1 <0.1	- -	- -
Dioxins			1.72E-14	1.89E-14		3.61E-14	

VOC as benzene
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

Table 5.2: Assessment of Emissions to Air (2)

Pollutant	EQS / EAL		Back-ground	Process Contribution		Predicted Environmental Concentration	
	µg/m³		**µg/m³**	**µg/m³**	**% of EAL**	**µg/m³**	**% of EAL**
Hg	0.25 7.5	1 2	0.00001 0.00001	0.00063 0.00189	0.25 0.03	- -	- -

1 Annual Mean
2 1-hr Maximum

(i) Screening out emissions which are insignificant

From the tables above (Tables 5.1 and 5.2) 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:

- Carbon monoxide (CO)
- Sulphur dioxide (SO_2)
- Particulates (PM_{10})
- Hydrogen fluoride (HF) and
- Hydrogen chloride (HCl)
- PCB's
- Mercury

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

(ii) Emissions unlikely to give rise to significant pollution

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

- VOCs
- Oxides of Nitrogen (NO_x)

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.

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

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

Table 5.1 shows that the peak long term PC is greater than 1% of the EU EQS and therefore cannot be screened out as insignificant. Even so, from Table 5.1, the emission is not expected to result in the EU EQS being exceeded. The peak short term PC is above the level we would consider insignificant (>10% of the EU EQS). However it is not expected to result in the EU EQS being exceeded.

The short term and long term process contributions of NO_2 were screened out as insignificant, the short term and long term PEC's are 48.6% and 48.8% respectively of the air quality standards. As these predictions were derived from a detailed modelling assessment they can be compared directly with the standards as opposed to the 70% screening criteria. No exceedances of air quality standards are predicted.

(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 EU EQS 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 EU EQS 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 the EQS for PM_{10} is shown in the Table 5.1 above. The assessment assumes that **all** particulate emissions are present as PM_{10} for the PM_{10} assessment and the Environment Agency's assessment assumes 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 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.

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

The Environment Agency has reviewed the Applicant's particulate matter impact assessment for PM_{10} and is satisfied in the robustness of the Applicant's conclusions.

The Environment Agency's assessment for $PM_{2.5}$ also shows that the predicted process contribution for emissions of $PM_{2.5}$ is also below 1% of the Environmental Quality Objective. Therefore, we conclude 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.

(iii) Acid gases, SO_2, HCl and HF

From Table 5.1 above, emissions of HCl and HF can be screened out as insignificant in that the process contribution is <10% of the short term EQS/EAL. There is no long term EQS/EAL for HCl. HF has 2 assessment criteria – a 1-hr EAL and a monthly EAL – the process contribution is <1% of the monthly EAL and so the emission is insignificant if the monthly EAL is interpreted as representing a long term EAL.

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

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 EU EQS values. Therefore, generally, 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, TOC/VOCs, PCBs, and Dioxins

Table 5.1 above shows that for CO emissions, the peak long term PC is less than 1% of the EAL/EQS and can be screened out as insignificant. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

Table 5.1 shows that for TOC/VOC, the peak long term PC is greater than 1% of the EAL/EQS and therefore cannot be screened out as insignificant. For TOC/VOCs the resultant PC was 3.8% and could not be screened out as insignificant. The final maximum PEC is 13% of the relevant air quality standards. Even so, the emission is not expected to result in the EQS being exceeded.

The Applicant has used the EQS for benzene for their assessment of the impact of TOC/VOC, and given the nature of the input wastes this was likely to the most relevant surrogate for the TOC/VOC assessment. This is based on benzene having the lowest EQS of organic species likely to be present in VOCs (other than PCBs, dioxins and furans).

For PCBs the Table 5.1 shows that 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 can be screened out as insignificant. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

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.

From the tables above all the other 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.

The Applicant is required to prevent, minimise and control VOC emissions using the best available techniques, this is considered further in Section 6. We are satisfied that VOC emissions will not result in significant pollution.

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

5.2.3 Assessment of Emission of Metals

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

Annex VI of IED sets three limits for metal emissions:

- An emission limit value of 0.05 mg/m^3 for mercury and its compounds (formerly WID group 1 metal).
- An aggregate emission limit value of 0.05 mg/m^3 for cadmium and thallium and their compounds (formerly WID group 2 metals).
- An aggregate emission limit of 0.5 mg/m^3 for antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel and vanadium and their compounds (formerly WID group 3 metals).

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

The Applicant has only modelled Mercury (Hg). This is justified in the Application due to the type of process that is being employed i.e. waste is heated in the PTU up to 525°C, thus volatilising the organic content of the waste, but could also volatilise Hg. As all the other metals volatilise above 525°C they have been screened out.

The Environment Agency have assessed all the metals required by Annex VI of IED and consider that there will be no exceedances any of the relevant EU EQS. We checked the other Annex VI metals Cadmium (Cd), Thallium (Tl), Mercury (Hg), Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V). We consider that there will be no exceedances of the EQSs for these metals.

Additionally, to check this we have required the Operator under improvement condition (IC6) to check and validate this, by measuring all the Annex VI metals, for the first 12 months of operation.

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

- Mercury

The mercury emissions do not require further assessment. From this assessment the Applicant has concluded that exceedances of the EAL for this metal are not likely to occur. The installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document. The Environment Agency's experience of regulating incineration plant is that emissions of metals are in any event below the Annex VI limits set in IED. We, therefore agree with the Applicant's conclusions.

5.2.4 Consideration of Local Factors

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

No Air Quality Management Areas (AQMAs) have been declared within an area likely to be affected by emissions from the incinerator.

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

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

(i) Applying Statutory Controls

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

The main conditions in an EfW permit are based on the requirements of the IED. Specific conditions have been introduced to specifically ensure compliance with the requirements of Chapter IV. The aim of the IED is to prevent or, where that is not practicable, to reduce emissions to air, water and land and prevent the generation of waste, in order to achieve a high level of protection of the environment taken as a whole. IED achieves this aim by setting operational conditions, technical requirements and emission limit values to meet the requirements set out in Articles 11 and 18 of the IED. These requirements include the application of BAT, which may in some circumstances dictate tighter emission limits and controls than those set out in Chapter IV of IED on waste incineration and co-incineration plants. The assessment of BAT for this installation is detailed in section 6 of this document.

(ii) Environmental Impact Assessment

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

(iii) Expert Scientific Opinion

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

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

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

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

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

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

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

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

The **US National Research Council Committee on Health Effects of Waste Incineration (NRC) (NRC 2000)** reviewed evidence as part of a wide ranging report. The Committee view of the published evidence was summarised in a key conclusion: "Few epidemiological studies have attempted to assess whether adverse health effects have actually occurred near individual incinerators, and most of them have been unable to detect any effects. The studies of which the committee is aware that did report finding health effects had shortcomings and failed to provide convincing evidence. That result is not surprising given the small populations typically available for study and the fact that such effects, if any, might occur only infrequently or take many years to appear. Also, factors such as emissions from other pollution sources and variations in human activity patterns often decrease the likelihood of determining a relationship between small contributions of pollutants from incinerators and observed health effects. Lack of evidence of such relationships might mean that adverse health effects did not occur, but it could mean that such relationships might not be detectable using available methods and sources."

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

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

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

The Health Protection Scotland report referred to above says that "the authors of the Greenpeace review do not explain the basis for their conclusion that there is an association between incineration and adverse effects in terms of criteria used to assess the strength of evidence. The weighting factors used to derive the assessment are not detailed. The objectivity of the conclusion cannot therefore be easily tested."

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

(iv) Health Risk Models

Comparing the results of air dispersion modelling as part of the H1 Environmental Impact assessment against European and national air quality standards effectively makes a health risk assessment for those pollutants for which a standard has been derived. These air quality standards have been developed primarily in order to protect human health via known intake mechanisms, such as inhalation and ingestion. Some pollutants, such as dioxins, furans and dioxin like PCB's, 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. Either model can however be used to make comparisons with the TDI.

The TDI is the amount of a substance that can be ingested daily over a lifetime without appreciable health risk. It is expressed in relation to bodyweight in order to allow for different body size, such as for children of different ages. In the UK, the COT has set a TDI for dioxins, furans and dioxin like 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 and PCB's. 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 PCB's. Where an alternative approach is adopted for dioxins, we check the predictions ourselves.

(v) Consultations

As part of our normal procedures for the determination of a permit application, we would consult Director of Public Health, FSA and in some cases Public Health England (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 and Furans

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

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

The results of the Applicant's assessment of dioxin intake are detailed in Table 5.3 below (worst – case results for each category are shown). The results showed that the predicted daily intake of dioxins at all receptors, resulting from emissions from the proposed facility, were significantly below the recommended TDI levels.

The Applicant submitted health risk assessment that shows the results detailed in the Table 5.3 below. The Applicant made the following assumptions:

- The main exposure to dioxin, furan and dioxin-like PCB's will be from inhalation, soil ingestion, and consumption of locally produced food.

- The assumption that an adult would weigh 70kg and a child would weigh 15kg

- The model calculates ground level concentrations without deposition effects to ensure that the plume concentrations were not depleted

- As there is no farmland in the area that the land use around the site will be residential properties where home-grown produce and small livestock might be expected. Therefore the only food pathways considered was the consumption of fruit, vegetables, poultry and eggs

- The assessment also assumes a worst case scenario that 100% of all the fruit, vegetables, poultry and eggs consumed by the local population were produced locally

- The Applicant has also assumed that a child will consume that same amount of fruit, vegetables, poultry and eggs as an adult.

With the above main assumptions built into the modelling the Applicant considers that they have produced a very conservative assessment.

We have assessed the model and the report and are satisfied that there is a low risk of the installation having a significant impact on the local population.

Table 5.3: Summary of modelling results for the HHRA

Receptor	Adult	Child
Inhalation	0.0054	0.0065
Soil	0.0002	0.0002
Fruit and Vegetables	0.01	0.54
Poultry	0.000002	0.000008
Eggs	0.000002	0.000007

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

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

In 2010, FSA studied the levels of chlorinated, brominated and mixed (chlorinated-brominated) dioxins and dioxin-like PCBs in fish, shellfish, meat and eggs consumed in UK. It asked COT to consider the results and to advise on whether the measured levels of these PXDDs, PXDFs and PXBs indicated a health concern ('X' means a halogen). COT issued a statement in December 2010 and concluded that "The major contribution to the total dioxin toxic activity in the foods measured came from chlorinated compounds.

Brominated compounds made a much smaller contribution, and mixed halogenated compounds contributed even less (1% or less of TDI). Measured levels of PXDDs, PXDFs and dioxin-like PXBs do not indicate a health concern". COT recognised the lack of quantified TEFs for these compounds but said that "even if the TEFs for PXDDs, PXDFs and dioxin-like PXBs were up to four fold higher than assumed, their contribution to the total TEQ in the diet would still be small. Thus, further research on PXDDs, PXDFs and dioxin-like PXBs is not considered a priority."

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

5.3.3 Particulates smaller than 2.5 microns

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

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

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

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

The HPA (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 note that in a sample collected in a day at a typical urban area the proportion of $PM_{0.1}$ is around 5-10% of PM_{10}. It goes on to say that PM_{10} includes and exceeds $PM_{2.5}$ which in turn includes and exceeds $PM_{0.1}$.

This is consistent with the assessment of this application which shows emissions of PM_{10} to air to be insignificant. We have also checked the emissions of $PM_{2.5}$ to air. We assumed all the emissions of PM_{10} would be $PM_{2.5}$, rather than a smaller proportion and were found to screen out as insignificant as discussed above in Section 5.2.2.

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

5.3.4 Assessment of Health Effects from the Installation

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

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

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

The Applicant's assessment of the impact from Carbon monoxide (CO), Sulphur dioxide (SO_2), Particulates (PM_{10}), Hydrogen fluoride (HF), Hydrogen chloride (HCl), VOCs (Benzene (C_6H_6)), Mercury (Hg), and Oxides of Nitrogen ($NO_{x)}$, Dioxin, Furans and PCB's have all indicated that the Installation emissions screen out as insignificant; the assessment 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.

We used meteorological data which was observed at Leeming, 40 km from the site. We also used on site Numerical Weather Prediction (NWP) data for the year 2009. NWP forms the basis of most of the forecasting services provided by the United Kingdom Meteorological Office (Met Office).

Sensitivity checks included:

- Considering half hourly ELVs from the IED for comparison with all pollutants emitted that are included in the IED for half hourly assessment.
- Including meat and milk in the HHRA assessment.
- Considering life time exposure of dioxins and furans.
- Considering metals other than mercury – based on the emission rates calculated using the IED ELVs.
- Considering a higher deposition velocity based on a greater particle size for the HHRA.

The Environment Agency undertook HHRA check calculations using the United States (US) Environmental Protection Agency's (EPA) Human Health Risk Assessment Protocol (HHRAP) methodology to consider the PC of dioxins, furans and dioxin-like PCBs of the proposed facility against the TDI.

We have completed our checks based upon conservative intake assumptions from all pathways, including inhalation, and worst case dispersion modelling; we predict that the impact is not likely to contribute significantly to the COT-TDI.

We have used the maximum emission rate for PCBs from the IED compliant incinerators.

We were not able to replicate the consultant's values for each intake path. However, despite not being able to replicate the consultant's HHRA results, our modelling shows their values will be conservative and therefore can be used for permitting purposes.

Overall, taking into account the conservative nature of the impact assessment (i.e. that it is based upon an individual exposed for a life-time to the effects of the highest predicted airborne concentrations and consuming mostly locally grown food), it was concluded that the operation of the proposed facility will not pose a significant carcinogenic or non-carcinogenic risk to human health. PHE was consulted on the Application. The FSA was also consulted during the permit determination process. Details of the responses provided by PHE and the FSA to the consultation on this Application can be found in Annex 4.

The Environment Agency is therefore satisfied that the Applicant's conclusions presented above are soundly based and we conclude that the potential emissions of pollutants including dioxins, furans and metals from the proposed facility are unlikely to have an impact upon human health.

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

5.4.1 Sites Considered

The following Habitats (i.e. Special Areas of Conservation, Special Protection Areas and Ramsar) site is located within 10Km of the Installation the Teesmouth & Cleveland Coast SPA/ Ramsar which is approximately 0.3 km from the installation.

There are 2 Sites of Special Scientific Interest are located within 2 km of the Installation with a further four located within 12 km.

Table 5.4: Details of SSSI Sites in the Area

SSSI Unit Name	Type	Distance
Tees & Hartlepool foreshore & wetland	Littoral sediment	0.3 km
Seal Sands	Littoral sediment	1.7 km
Cowpen Marsh	Littoral sediment	3 km
Seaton Dunes & Common	Supralittoral sediment & Littoral sediment	4 km
South Gare & Coatham Sands	Supralittoral sediment & Littoral sediment	4 km
Tees & Hartlepool foreshore & wetland Crimdon Beach	Supralittoral sediment & Littoral sediment	12 km

The four SSSI beyond our 2 km screening distance have been included in the assessment because as they are part of the Teesmouth and Cleveland Coast SPA/Ramsar.

There are no non-statutory local wildlife and conservation sites within 2 km of the proposed Installation. No further assessment is required in respect of local wildlife and conservation sites.

5.4.2 Habitats Assessment

The features of the European site and the potential hazards to which it is sensitive have been identified. The releases of NO_x, SO_2, and PM_{10} have the potential to impact upon the European site through the mechanisms of acidification, nutrient enrichment, smothering and toxic contamination.

The following significance assessment has been conducted using the methods outlined in Technical Guidance Note H1, and Operational Instructions: 'Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation', 'Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation' and 'AQTAG02'.

(i) Air quality modelling carried out.

The Applicant used ADMS 5 dispersion modelling software to determine predicted atmospheric concentrations from the proposed facility. This modelling program is widely used and accepted by the Environment Agency as giving acceptable predictions of atmospheric pollution from point sources.

The modelling has considered the plant operating continuously 24 hours per day 7 days per week. This is a worst case representation as the plants normal operation will be for 6 days per week.

Meteorological data for the assessment comprises five years continuous monitoring from Loftus weather station located 22.5 km from the proposed site. The Applicant's assessment has also assumed a "worst case" scenario for conversion rates for NO_x using 35% in relation to short term impacts and 70% in relation to long term impacts. Both of these ratios are in accordance with Environment Agency recommendations.

The Teesmouth & Cleveland Coast SPA/Ramsar site is a large complex geographical unit, made up of several separate areas as shown on Figure 2 below. These areas are underlain by individual SSSIs. To reflect the potential complexity of impacts at the European designated sites and associated SSSIs, the modelling was carried out using several points within the SPA/Ramsar as discrete receptors to ensure full coverage.

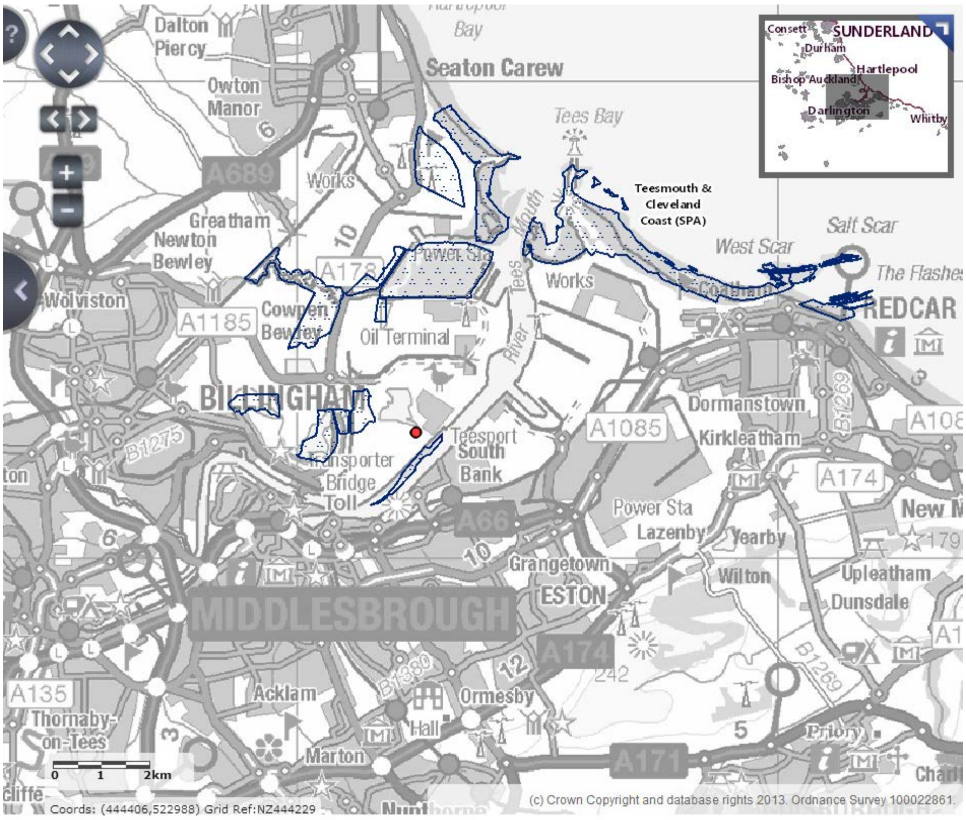
Table 5.5: Summary of modelling regarding European designated sites and associated SSSIs

Pollutant	EQS / EAL (µg/m³)	Back-ground (µg/m³)	Process Contribution (PC) (µg/m³)	PC as % of EQS / EAL	Predicted Environmental Concentration (PEC) (µg/m³)	PEC as % EQS / EAL
Direct Impacts[1]						
NO_x Annual	30	26.29	1.90	6.3%	5.19	94.0%
NO_x Daily Mean	75	26.29	24.01	32.0%	50.85	67.1%
SO2	10 (1)	-	0.04	0.2%	-	-
HF Weekly Mean	0.5	-	4.15×10^{-2}	8.3%	-	-
HF Daily Mean	5	-	0.08	1.6%	-	-
Deposition Impacts[1]						

Pollutant	EQS / EAL (µg/m³)	Back-ground (µg/m³)	Process Contribution (PC) (µg/m³)	PC as % of EQS / EAL	Predicted Environmental Concentration (PEC) (µg/m³)	PEC as % EQS / EAL
N Deposition (kg N/ha/yr)	8	-	0.13	1.6%	10.77	134.6%
N Deposition (kg N/ha/yr)	20	-	0.13	0.65%	-	-
Acidification - Nitrogen Dep (Keq/ha/yr)	1.998	-	$1.2x10^{-2}$	0.6%	-	-
Acidification Sulphur Dep (Keq/ha/yr)	1.56	-	$4.07x10^{-3}$	0.3%	-	-

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

Figure 2: Site position in relation to Teesmouth & Cleveland Coast (SPA) (red dot shows position of site stack emission point).



(ii) <u>Acidification</u>

The acidification sensitivity for the Teesmouth and Cleveland Coast were obtained from the APIS website as follows:-

Min $CL_{Max}N$ – 1.998 keq N/ha/year
Max $CL_{Max}N$ – 4.508 keq N/ha/year
Min $CL_{Max}S$ – 1.56 keq S/ha/year
Max $CL_{Max}S$ – 4.07 keq S/ha/year

The highest predicted PCs at the relevant sensitive receptors were in the range 6.9×10^{-4} to 1.2×10^{-2} keqN/ha/year for nitrogen and between 2.0×10^{-4} to 4.0×10^{-3} keqS/ha/year for sulphur.

The predicted total process contribution for nitrogen and sulphuric acid sensitivity reached a maximum of 0.9% of the lower critical load and can therefore be screened out as having no likely significant effect.

(iii) Nutrient Enrichment

The nitrogen deposition Critical Load values for the Teesmouth and Cleveland Coast SPA/Ramsar were obtained from the APIS website.

The most sensitive species to nutrient enrichment were the Sandwich tern and the Little Tern in supralittoral sediment with nitrogen critical loads in the range of 8-15 kg N/ha/yr with 8-10 kg N/ha/yr relevant for acid dunes.

Other nitrogen sensitive species, and/or the habitats upon which they are dependant at the Teesmouth & Cleveland Coast SPA/Ramsar sites, have critical loads in the range of 20-30 kg N/ha/yr.

The different areas and types of habitats that make up the Teesmouth and Cleveland Coast SPA/Ramsar site and distances from the installation are shown in the Table 5.4 above.

The modelling data provided by the Applicant shows maximum deposition rates for nitrogen of between 0.1% to 2.1% of the lower critical load value for the most sensitive species (8 kg N/ha/yr), leading to PEC's of between 133% and 135% of the lower critical load (using Minimum Total Deposition figure for background level) and 277% to 279% (using Maximum Total Deposition figure for background level). However the closest receptors are of a type that is less sensitive to nitrogen deposition. When compared to a more representative higher critical load of 20 kg N/ha/yr for the type of habitat the maximum PC is less than the 1% threshold which indicates possible significance.

The majority of the species cited are associated for non-breeding and waterbird assemblage, and these have higher critical loads associated with them. The species most sensitive to nitrogen enrichment is the Little Tern and is cited for breeding. The location of the Little Tern breeding site at Crimdon Beach is 12 km away from the proposed development site (beyond the distance screening criteria of 10km for this type of installation). The modelling showed no exceedances of the 1% screening threshold at this location, and it is assumed that the concentrations will then decrease with an increasing distance away from the proposed installation.

It can therefore be concluded that there will be no likely significant effect from nitrogen deposition on the Teesmouth and Cleveland Coast SPA and Ramsar.

(iv) Particulates

The proposal is to employ a multi-cyclone, atomised water spray in the cooling system, and an array of bag filters to remove the majority of dust produced from the combustion process. The gas stream is subsequently passed through a wet scrubber which will further reduce dust emissions. The modelling of particulate dispersion indicates both the long term and short term predicted ground level concentrations are below the screening criteria limits (less than 1% for long term – predicted maximum 0.55%, and less than 10% for short term – predicted maximum 1.3%). Where the concentration within the emission footprint in any part of the European site is less than 1% of the relevant long-term benchmark, the emission will not have a likely significant effect alone or in combination irrespective of background.

Using the above as a surrogate screening methodology, smothering is unlikely to be an issue at the designated sites.

Operating practices will be also employed to minimise the raising of dust associated with materials movements. These include sighting the main processing equipment in a covered structure and using collected water/ process liquors to dampen the processed material. These measures are expected to be sufficient to minimise dust generated to ensure no likely significant effect at Teesmouth and Cleveland Coast SPA and Ramsar.

We are therefore satisfied that there will be no likely significant effect from particulars on the Teesmouth and Cleveland Coast SPA and Ramsar.

(v) Toxic contamination

Modelling was undertaken for acid gases, VOCs and metals as well as the common oxides of nitrogen, sulphur and carbon.

No exceedances of air quality standards are predicted for any contaminant. Ground level concentrations for hydrogen fluoride, mercury, SO_2 and hydrogen chloride were screened out under all conditions. Ground level PCs of VOCs were not screened out, but the PEC's ranged between 10.6% and 13.0% of the air quality standard therefore we are satisfied that there will be no likely significant impact on the designated sites.

The short term and long term process contributions of NO_2 were not screened out as insignificant, the PEC's ranged between 45.1% and 67.1% of the air quality standards. As these predictions were derived from a detailed modelling assessment they can be compared directly with the standards as opposed to the 70% screening criteria. No exceedances of air quality standards are predicted.

We are therefore satisfied that that there will be no likely effect as a result of toxic contamination.

Our check modelling indicates that at habitat sites the PC for NO_x is likely to exceed the 1% significance criteria compared to the critical level at the Teesmouth and Cleveland Coast SPA (Specially Protected Areas) and at Tees and Hartlepool Foreshore and Wetlands SSSI (Site of Special Scientific Interest). As a PEC, exceedances of 100% of the critical level for NO_x at any sensitive receptors are unlikely. Exceedances of the critical level for SO_2 are unlikely.

We agree with the consultant's conclusions that exceedances of the critical load for nitrogen deposition are likely as both a PC and as a PEC at Teesmouth and Cleveland Coast. Our check modelling predicts that at some locations the PC may be greater than the 1% at which impacts can be screened out as insignificant compared to the acid deposition critical load but also as a PEC that exceedances of 100% of the acid critical load are unlikely.

The Applicant has opted to install Selective Non-Catalytic Reduction (SNCR) as a component part of the plant. This will reduce the emissions containing oxides of nitrogen significantly. This would be in the range of 60-80% potential reduction.

SNCR used in conjunction with the wet scrubber will significant reduced the NO_x emission to air therefore we are satisfied that there will be no likely significant impact on the designated sites.

5.5 <u>Impact of abnormal operations</u>

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

For incineration plant, IED sets backstop limits for particulates, CO and TOC which must continue to be met at all times. The CO and TOC limits are the same as for normal operation, and are intended to ensure that good combustion conditions are maintained. The backstop limit for particulates is 150 mg/m^3 (as a half hourly average) which is five times the limit in normal operation.

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

Given that these abnormal operations are limited to no more than a period of 4 hours continuous operation and no more than 60 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:

- Dioxin emissions of 0.45 ng/m^3 (4.5 x normal)
- Mercury emissions are 2.5 times those of normal operation
- NO_x emissions of 400 mg/m^3 (1.8 x normal)
- Particulate emissions of 150 mg/m^3 (15 x normal)
- Metal emissions other than mercury are 5 times those of normal operation
- SO_2 emissions of 428.6mg/m^3 (8 x normal)
- HCl emissions of 4900.6mg/m^3 (490 x normal)
- HF emissions 0f 4mg/m^3 (4 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 Table 5.6 below.

Table 5.6: Summary of Abnormal Emissions Modelling

Pollutant	EQS / EAL µg/m^3	Maximum Emission level mg/m^3	Back-ground Conc. µg/m^3	Process Contribution (PC) µg/m^3	PC as % of EQS / EAL	PEC µg/m^3	PEC as % of EQS / EAL
NO_2	200	400	56.20	41.02	20.51%	97.22	48.61%
PM_{10}	50	150	30.34	9.61	19.2%	39.95	79.9%
SO_2	266	428.6	-	1.16	0.7%	-	-
HCl	800	4900.6	0.61	1426.07	190.14 %	1426.69	190.2
HF	250	4	-	1.16	0.7%	-	-
Hg	7.5	0.05	-	$1.46x\ 10^{-2}$	0.19%	-	-
Dioxins	-	$4.5x10^{-7}$	$1.72x\ 10^{-14}$	-	-	$4.5x10^{-7}$	-
VOC	5	10	0.46	0.19	3.9	-	-

From Table 5.6 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.

- Sulphur dioxide (SO_2)
- Hydrogen Fluoride (HF)
- Mercury (Hg)

Also from the Table 5.6, 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.

- Oxides of nitrogen (NO_x)
- Particulates (PM_{10})

For HCl, the PEC is greater than the short term EQS. We should therefore consider whether additional measures are required. However, the Applicant has plotted where the PEC would exceed the short term EAL in the area around the site. One of the areas identified on the plot is accessible to the public, namely Huntsman Drive. They have argued that this is a road which is remote and usually only used by those who work in the area. It is therefore unlikely that a member of the public would spend more than an hour in this area. The Applicant also cites the Defra local authority technical guidance note TG09 in their conclusions. This is stated as follows:

"With respect to the offices and car park, which represent the greatest potential risk from the above-noted receptors, these occur at the outer edge of the area of exceedence, with a PEC of approximately 750 – 1,050 µg/m^3. Thus the magnitude of exceedence is relatively low. It is also worth noting:

- The panel which decided the 750 µg/m3 limit value actually decided that the no observed adverse effect level (NOAEL) was 1,500 µg/m^3, and incorporated a safety factor of 2 to account for more susceptible individuals[a], and

- The short term (i.e. 15 minute reference period) workplace exposure limit for hydrogen chloride is currently 8,000 µg/m^3, significantly above the maximum PEC noted above. The long term (i.e. 8 hour time weighted average reference period) workplace exposure limit for hydrogen chloride is currently 2,000 µg/m^3, significantly above the maximum PEC noted above[b]."

Considering the above noted data/information, and the generally conservative nature of the assessment (e.g. assumes abnormal emissions occur at same time as adverse meteorological conditions), the risk from abnormal hydrogen chloride emissions appears acceptable."

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. If dioxin emissions were at 10 ng/m^3 for the maximum period of abnormal operation, this would result in an increase of approximately 70% in the TDI reported in section 5.3.3. In these circumstances the TDI would be 0.027 pg (I-TEQ/ kg-BW/day), which is 1.33% of the COT TDI. The Applicant's report states that the maximum amount would be 0.45 ng/m^3 of dioxin emitted over the period of abnormal operation. At this level, emissions of dioxins will still not pose a risk to human health.

[a] http://webarchive.natioalarchives.gov.uk/20060715141954/http://www.defra.gov.uk/airquality/aqs/halogen/fullreport.pdf

[b] http://www.hse.gov.uk/pubns/priced/eh40.pdf

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 also have to consider the combustion efficiency and energy utilisation of different design options for the Installation, which are relevant considerations in the determination of BAT for the Installation, including the Global Warming Potential of the different options.

- Finally, the prevention and minimisation of Persistent Organic Pollutants (POPs) must be considered, as we explain below.

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

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

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

6.1.1 Consideration of Furnace Type

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

The Waste Incineration BREF elaborates the furnace selection criteria as:

- the use of a furnace (thermal desorption unit and thermal oxidiser) (including secondary combustion chamber) dimensions that are large enough to provide for an effective combination of gas residence time and temperature such that combustion reactions may approach completion and result in low and stable CO and TOC emissions to air and low TOC in residues.

- use of a combination of furnace design, operation and waste throughput rate that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures

- The use of furnace design that, as far as possible, physically retain the waste within the combustion chamber (e.g. grate bar spacing) to allow its complete combustion.

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

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

- nature/physical state of the waste and its variability

- proposed plant throughput which may affect the number of incineration lines

- preference and experience of chosen technology including plant availability

- nature and quantity/quality of residues produced

- emissions to air – usually NOx as the furnace choice could have an effect on the amount of unabated NOx produced

- energy consumption – whole plant, waste preparation, effect on GWP

- Need, if any, for further processing of residues to comply with TOC

- Costs

Table 6.1: Summary comparison of thermal treatment technologies **(reproduced from the Waste Incineration BREF)**

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash/residue Quality	Cost
Moving grate (air-cooled)	Low to medium heat values (LCV 5 – 16.5 GJ/t) Municipal and other heterogeneous solid wastes Can accept a proportion of sewage sludge and/or medical waste with municipal waste Applied at most modern MSW installations	1 to 50 t/h with most projects 5 to 30 t/h. Most industrial applications not below 2.5 or 3 t/h.	• Widely proven at large scales. • Robust • Low maintenance cost • Long operational history • Can take heterogeneous wastes without special preparation	- Generally not suited to powders, liquids or materials that melt through the grate	TOC 0.5 % to 3 %	High capacity reduces specific cost per tonne of waste
Moving grate (liquid Cooled)	Same as air-cooled grates except: LCV 10 – 20 GJ/t	Same as air-cooled grates	As air-cooled grates but: • higher heat value waste treatable better • Combustion control possible.	- As air-cooled grates but: risk of grate damaging leaks and higher complexity	TOC 0.5 % to 3 %	Slightly higher capital cost than air-cooled
Rotary Kiln	Can accept liquids and pastes solid feeds more	<10 t/h	• Very well proven with broad range	- Throughputs lower than	TOC <3 %	Higher specific cost due to

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash/residue Quality	Cost
	limited than grate (owing to refractory damage) often applied to hazardous Wastes		of wastes and good burn out even of HW	grates		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 maybe 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 maybe lower. Costs of preparation.
Oscillating furnace	MSW / heterogeneous wastes	1 – 10 t/h	• Robust • Low Maintenance • Long history • Low NOX level • Low LOI of bottom ash	- higher thermal loss than with grate furnace - LCV under 15 GJ/t	TOC 0.5 – 3 %	Similar to other technologies
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

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash/residue Quality	Cost
						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
Gasification - entrained flow	• mixed plastic wastes • other similar consistent streams • not suited to untreated MSW	To 10 t/h	• low leaching slag • reduced oxidation of recyclable metals	- limited waste feed - not full combustion - high skill level - less widely	low leaching slag	• High operation/maintenance costs • pre-

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash/residue Quality	Cost
	• gasification less widely used/proven than incineration			proven		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

Table 6.2: Summary of the design proposed by Applicant

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash/Residue Quality	Cost
Bespoke design of Thermal Desorption Unit (PTU) coupled to Thermal Oxidiser (STU) (Combustion unit)	▪ Can deal with various solid wastes ▪ Can deal with large variations of CV ▪ Refractory lined so can deal with high temps and is chemically resistant ▪ Rates of feed can be varied to ensure high degree of desorption and decomposition	~ 5 to 24 t/h average 16 t/h	• Waste can be pre-treated to optimum physical and chemical properties. • Contaminants being burned in the gaseous phase should give rise to more effective decomposition.	- Small amount of combustion in PTU - Only one line. - High raw materials usage	- Inorganic residues has the potentially of being recovered - TOC< 3% - APC residues dependent on waste type	No data as yet

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

- Directly fired Thermal Desorption Unit and Thermal Oxidiser
- Indirect fired Thermal Desorption Unit and Thermal Oxidiser
- Hazardous waste Incinerator

The Operator has done a qualitative and semi-quantitative assessment looking at the following items for each of above options.

- raw materials
- potential emissions performance
- energy consumption
- disposal avoidance and recovery options
- emission to water, and
- cost

These are summarised in the Table 6.3[5] below:

Table 6.3: Summary of Assessment

CRITERIA	DIRECT FIRED THERMAL DESORPTION	INDIRECT FIRED THERMAL DESORPTION	INCINERATION
Raw materials consumption	[amber]	[red]	[red]
Guaranteed emissions performance	[green]	[red]	[green]
Energy efficiency	[green]	[red]	[red]
Recovery	[green]	[green]	[red]
Emissions to water	[green]	[amber]	[red]
Throughput	[green]	[amber]	[amber]
Cost effectiveness	[green]	[red]	[red]

The Applicant has proposed to use a furnace technology comprising of a directly heated thermal desorption rotary kiln and a thermal oxidiser, which are not specifically identified in the Table 6.1 above as being considered BAT in the BREF or TGN for this type of waste feed. However, the Applicant has compared the furnace setup to hazardous waste incineration identified in the Table 6.1, as well as looking at both indirect and direct thermal desorption. The Applicant concluded that the combination of a thermal desorption rotary

[5] (red – worst option -> green - best option)

kiln and a thermal oxidation unit can be considered BAT for this type of waste feed. Further consideration of the unlisted techniques is made below:

(i) Raw Materials Consumption and Throughput

Actual data on the raw materials that are required for the processes to be assessed is difficult to obtain. Therefore the Applicant's assessment of how each of the above technologies compares on the consumption of raw materials has been based on assumptions around what is known to be required for the safe treatment of the main types of waste to be accepted at the installation.

Incineration has been shown as red above as it has been assumed that because the entire waste stream is heated to high temperature, larger quantities of fuel will be required to treat the larger volume of waste resulting from an entire waste stream treatment and therefore larger volumes of process gases will be created. As larger volumes of off-gas are likely to be created, larger quantities of reagents will be required for treatment of the process gases.

For indirect thermal desorption fuel consumption is considered to be high in order to reach the temperatures that are required for desorption of the contaminants expected within the types of waste to be treated at the installation. This is illustrated by the example given in Section 2.2 of the Environmental Permit Application Supporting Document which compares the energy requirements of the PTU of an indirect and direct fired thermal desorption unit. It is calculated that the energy requirements of an indirect unit PTU are approximately 1.3 times higher than those of a direct fired PTU due to the manner in which heat is transferred to the wastes to be treated.

Size constraints affect the achievable processing rates with both PTU designs. Typically a large indirect fired PTU is limited to being able to transfer about 16 MM BTU/hr (0.00469 kW) which decreases achievable production rates from those used by the direct unit. The direct fired PTU is not limited by heat transfer through the rotary kiln shell, and therefore can utilise the full capacity of the PTU burner - up to the limits of the off gas system components.

Additionally, it is assumed that high volumes of gas abatement reagents such as activated carbon would be required to treat process gases from chlorinated hydrocarbons. Activated carbon is known to be expensive and replacement when spent becomes more frequent when treating high concentrations of contaminants.

The technology to be utilised at the installation has been denoted amber in Table 6.3 above as even though this is the most efficient method, it is recognised that the safe thermal treatment of the types of waste to be treated at the installation will require relatively high raw material consumption.

We consider that for this installation that the Applicant's conclusions are satisfactory.

(ii) Emissions Performance

For guaranteed emissions performance using indirect thermal desorption it is considered that there would be ambiguity over the success of the treatment of dioxins and furans created from the thermal treatment of wastes containing chlorinated hydrocarbons. It is understood that there are currently no indirect thermal desorption plants in the UK that are treating the main types of waste to be accepted at the installation, therefore actual data on the success of treatment of chlorinated hydrocarbons using indirect thermal desorption is not available.

The use of a thermal oxidiser such as that used at the installation for the decomposition/combustion of vaporised contaminants achieves guaranteed emissions performance (particularly for dioxins and furans). Guaranteed emissions performance is also achieved by incineration plants by the very nature of the process.

We consider that for this installation that the Applicant's conclusions are satisfactory.

(iii) Energy Efficiency

Whilst neither indirect thermal desorption nor incineration are considered inefficient, they are considered less efficient than direct thermal desorption for the treatment of the main types of waste to be accepted at the installation. Indirect thermal desorption is considered less efficient than direct thermal desorption for the reason given above and Section 2.2 of the Supporting Document. The energy requirements of an indirect PTU for the treatment of the main waste types to be accepted at the installation are approximately 1.3 times higher than those of a direct fired PTU due to the manner in which heat is transferred to the wastes to be treated. Heat transfer inside a direct fired PTU is more efficient because the mode of heat transfer is predominately radiation and convection. The assessment that incineration is less energy efficient than direct thermal desorption is based on the indication that BAT is generally considered to be: "a reduction of installation energy demand and in general, to achieve an average installation electrical demand (excluding pre-treatment or residue treatment) of generally 0.3-0.5 MWh/tonne of waste processed." The installation will generally treat residues at an approximate (and conservative) rate of 15 tonnes/hr and uses approximately 1MW of electrical power when operating. This equates to an approximate installation electrical demand of 0.08MWh/tonne, which is considered to be well below the energy demand of most other hazardous waste incineration installations.

We consider that for this installation that the Applicant's conclusions are satisfactory.

(iv) Disposal Avoidance / Recovery Operations

For this key criteria, indirect thermal desorption is considered to offer the highest potential for recovery from certain waste streams, and for streams containing high concentrations of light to midrange hydrocarbons, indirect thermal desorption undoubtedly offers the greatest number of recovery options- i.e. the recovery of organic components of the waste and recovery of treated soils/sediments/sludges.

The direct thermal desorption (i.e. the PTU) is unable to treat waste streams with a high calorific value due the risk of explosion in the thermal oxidiser (STU). However, wastes of this nature are not targeted by the installation and are acknowledged to be more beneficially treated by indirect thermal desorption. Also, for the types of waste being treated at the installation there is no potential for the recovery of organic components of the waste, only recovery of treated inorganic residues/sediments/sludges. The thermal unit proposed for the installation offers this opportunity.

Incineration technology has been allocated a red ranking in Table 6.3 above as no recovery options are available.

We consider that for this installation that the Applicant's conclusions are satisfactory.

(v) Emissions to Water

The plant utilises a 'closed loop' water system whereby no excess water is discharged from the thermal unit. Water is circulated within the scrubber and the scrubber purge water is used to re-hydrate treated residues, multi-cyclone dust, and baghouse dust within the pug-mill. Steam that is generated in the pug-mill is captured in steam hood and ducted back into the inlet of the baghouse.

However, both indirect thermal desorption and incineration have emissions to water as part of the process:

1. Indirect thermal desorption creates liquids from condensed vapours that are discharged either to foul sewer or surface waters;

2. The environmental permit other HWIs shows that liquor arising from the gas cleaning process is treated in an effluent treatment plant to neutralise the pH and to remove soluble metals and suspended solids prior to discharge to Southampton Water.

We consider that for this installation that the Applicant's conclusions are satisfactory.

(vi) Cost Effectiveness

Reliable data concerning costs for each of the above options is very difficult to obtain. However, it is known that commercial rates for the incineration of the types of waste to be treated at the installation are approximately 1.6 times higher than those for the treatment of these wastes using the installation's thermal units.

The installation therefore potentially offers a more environmentally efficient and lower cost form of thermal treatment for certain waste streams than complete incineration, freeing capacity at incineration plants to handle waste streams that would not be suitable for a unit such as that proposed at the FE Installation.

The discussions above illustrate that, compared with the other options considered, direct fired thermal desorption coupled with thermal oxidiser technology provides reliability at a commercial scale, a cost effective option and improved environmental performance for the types of waste to be treated at the facility.

Raw material usage, most pertinently fuel usage, at the installation is acknowledged as the area where further assessment can be made of options that might be available. Fuel for the PTU and STU burners can be natural gas, propane, recycled fuel oil (RFO) or diesel. RFO has been used in all air emission calculations and as it is possible to reach air emissions targets with a recycled product, it is considered contrary to sustainability to utilise virgin products such as natural gas/ propane/ diesel. RFO will therefore be utilised as the main fuel for burners in the STU and PTU.

The Applicant proposes to use gasoil as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is based on it being a recovered waste that is capable of achieving the IED emissions criteria, thus not using a valuable and costly virgin raw material.

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

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.

Table 6.2 above summarises the Applicant proposed design.

6.2.1 Particulate Matter

Table 6.4: Summary of BAT for 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 Smaller plant.	May “blind” more than fabric filters		Small plant. High temperature gas cleaning required.

Particulate matter				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
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 in combination with wet scrubber 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. This, in series with the wet scrubber, offers a higher degree of effectiveness.

Emissions of particulate matter have been previously assessed as insignificant, and so the Environment Agency agrees that the Applicant's proposed technique is BAT for the installation.

In this case, it is not considered that any of the alternate techniques offer any advantage in comparison with the Applicant's preferred option of fabric filters and so we agree that the Applicant's proposed technique is BAT for the installation.

6.2.2 Oxides of Nitrogen

Table 6.5: Summary of BAT for NO_x treatment: Primary Measures

Oxides of Nitrogen : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Low NOx burners	Reduces NO_x 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	Reduces the consumption of	Some applications		All plant unless

Oxides of Nitrogen : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
(FGR)	reagents used for secondary NOx control. May increase overall energy recovery	experience corrosion problems.		impractical in design (needs to be demonstrated)

Table 6.6: Summary of BAT for NO_x treatment: Secondary Measures

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.

- The Applicant proposes to use SNCR as the secondary treatment for NO_x. They have committed to the limits in the permit and will ensure these are achieved

- A packed wet scrubber is also being used in series with any secondary abatement.

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 mg/m^3 and 180 mg/m^3; it relies on an optimum temperature of around $900^{o}C$ 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. Both reagents are 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.

As SNCR has been selected as the secondary treatment then the amount of urea for NO_x abatement will need to be optimised to maximise NO_x reduction and minimise ammonia (NH_3) slip and N_2O production. The location of the SNCR unit will need to be positioned and aligned in the final design. 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

Table 6.6: Summary of BAT for Acid Gas treatment: Primary Measures

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

Acid gases and halogens : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
(< 0.1%S gasoil or natural gas)			firing.	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

Table 6.7: Summary of BAT for Acid Gases treatment: Secondary Measures

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	Higher solid		All plant

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:**
	rates Reagent delivery may be varied by concentration and input rate	waste residues		
Reagent Type: Sodium Hydroxide	Highest removal rates Low solid waste production	Corrosive material ETP sludge for disposal		HWIs
Reagent Type: Lime	Very good removal rates Low leaching solid residue Temperature of reaction well suited to use with bag filters	Corrosive material May give greater residue volume if no in-plant recycle	Wide range of uses	MWIs, CWIs
Reagent Type: Sodium Bicarbonate	Good removal rates Easiest to handle Dry recycle systems proven	Efficient temperature range may be at upper end for use with bag filters – Leachable solid residues Bicarbonate more 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 its choice of gasoil as the support fuel on the basis stated above and we agree with that assessment.

- Management of heterogeneous wastes – Waste will be pre-treated to produce batches that are as uniform as possible.

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 is 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 proposes using wet scrubbing, and the Environment Agency agrees that wet scrubbing is appropriate in this case. The Applicant proposes that the effluent from the wet scrubber will be treated and reused in the system.

The Applicant has therefore considered wet scrubbing methods of secondary measures for acid gas abatement. This would be BAT for this type of facility, a Hazardous Waste Incinerator.

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. Both reagents are BAT, and the use of one over the other is not significant in environmental terms in this case.

The reagents used in the wet scrubber are sodium hydroxide and sodium meta-bisulphite. Sodium hydroxide would be considered BAT, however the Applicant proposes to use both as the sodium meta-bisulphite controls the pH, and has the added properties of acting as a fungicide, and displacing mercury and halogens.

In this case, the Applicant proposes to utilise a wet scrubber. 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.

Table 6.8: Summary of BAT for CO control: Primary Measures

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)

Table 6.9: Summary of BAT for Dioxin and Furan treatment

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 furnace and cooling chamber 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 furnace and FGT design;

- the effective removal of particulate matter, which has been considered in 6.2.1 above;

- effective use of the acid gas reagent. Effective control of acid gas emissions also assists in the control of dioxin releases as described in 6.2.3;

- 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 to optimise the combustion control, use effective particulate control, rapid cooling past the optimum temperature range for dioxin re-synthesis, activated carbon from a separate feed and effective control of the acid gases as described above.

In this case the Applicant proposes separate feed and we are satisfied their proposals are BAT.

6.2.6 Metals

Table 6.10: Summary of BAT for Metal treatment: Primary Measures

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. However, we have controlled the amount of Mercury in the waste input and reagent. Also, sodium meta-bisulphite is being used in scrubber media; this will displace Mercury from the flue gases.

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 Applicant has therefore included within its GWP calculations a CO_2 offset for the net amount of electricity exported from the Installation.

Taking this into account, the net emissions of CO_2 from the installation are estimated at 21,882 tonnes per annum. At this level emissions cannot be characterised as insignificant. The Installation is not subject to the Greenhouse Gas Emissions Trading Scheme Regulations 2003; therefore it is a requirement of IED to investigate how emissions of greenhouse gases emitted from the installation might be prevented or minimised.

The Applicant has considered GWP as part of its BAT options appraisal. There are a number of areas in which a difference can be made to the GWP of the Installation. The Applicant's BAT options appraisal compared indirect fired thermal desorption and direct fired thermal desorption to volatilise the organic contaminants within the waste. The Applicant has designed the abatement system to make sure that maximising the emission control effectiveness because of the types of waste that will be potentially treated and incinerated. The Applicant considers that this is the main priority and therefore there is not a lot of opportunity to recover or divert energy to other things. However, the Applicant is committed to reviewing this on a regular basis. If opportunities for energy being diverted or recovered become realistic without detriment to the effectiveness of the FGT, it will be proposed to the Environment Agency.

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

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 use of waste heat by displacement of drying of waste prior to treatment.

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.

The Applicant's assessment shows that the GWP of the plant is dominated by the emissions of carbon dioxide that are released as a result of RFO combustion. This is constant for all options considered in the BAT assessment.

The differences in the GWP of the options in the BAT appraisal arise from small differences in energy recovery and in the amount of N_2O emitted.

Taking all these factors into account, the Operator's assessment shows their preferred option is best in terms of GWP.

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 POP's should be controlled by imposing emission limits (e.g. 0.1 ng/m^3) 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°C or 1100ºC for halogenated materials above 1%(as Chlorine) 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°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. In support of the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs have been specified for monitoring and reporting purposes, to enable an evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. We specify monitoring of a range of PAHs and dioxin-like PCBs in waste incineration Permits at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs identified by Defra in their previous Environmental Permitting Guidance on the WID. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

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

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

Pentachlorobenzene (PeCB) is another of the POPs list to be considered under incineration. PeCB has been used as a fungicide or flame retardant, there is no data available however on production, recent or past, outside the UN-ECE region. PeCBs can be emitted from the same sources as for Polychlorinated dibenzodioxins and Polychlorinated dibenzofurans (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 direct discharge to water from the facility. As described above the site will collect the surface water from the concrete hardstanding and the roofs of the buildings. It will be cleaned, and stored in the water storage tanks. Process waters from steam (in the pug-mill and evaporative cooling chamber), and effluent from the bag-house and scrubber will be used for dust control and/or treated and recycled and used in the process again. Any excess water will be tankered off to a suitable treatment site.

The volume of water required per annum is reference above in Key Features table in Section 4.1.3

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

6.5.2 Emissions to sewer

There will be no direct discharge to sewer from the facility.

The process requires a large volume of water to treat the flue gases. The Applicant will recover the process effluent and recover rain water in a sealed sump, storing approximately $400m^3$ at any one time in water storage tanks, for use in the process.

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

6.5.3 Fugitive emissions

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

Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and /or minimise fugitive emissions. However, to refine and test the measures used on site, a pre-operational condition (PO8) has been placed in the permit to collect local background data and develop the site specific ambient air monitoring in line with the Environment Agency's monitoring guidance M17 - Monitoring Particulate Matter in Ambient Air around Waste Facilities.

6.5.4 Odour

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.

Waste accepted at the installation will be delivered in covered vehicles or within containers and bulk storage of waste will only occur in the installation's waste building. Extracted air will be drawn from above the waste storage area in order to prevent odours and airborne particulates from leaving the facility building and be passed through the STU.

6.5.5 Noise and vibration

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

The application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures.

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 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.

(vi) Commissioning

The Applicant has detailed the commissioning tests in Section 5 of the application and will include:

a. Commissioning tests – to check the electrical, instrumentation and control systems, interlocks, and CEM systems

b. Clean Soil Test – test of system when processing clean soil. The objective of this test is to check the mechanical components of the system. Clean soil will be processed for a minimum of 24 hours before contaminated soil is introduced into the system.

c. Shakedown Tests – a series of short duration tests (1-2 hours each) conducted at a range of material feed rate and treatment temperatures. The objectives of these tests are to confirm the optimum material treatment rate and material treatment temperature to meet the material cleanup objectives.

d. Proof of Performance (PoP) Test – testing will include sampling and analysis of feed materials, treated materials, wastewater, and stack gas streams. The objective of this test is to demonstrate compliance with regulatory requirements. During production operations, validation will include continuous emissions monitoring process data monitoring and recording, and chemical testing of treated material samples. Validation of the treated residues will be based on collecting and analysing one composite sample per 750 tonnes of treated materials. Chemical analyses will be conducted to ensure compliance with criteria to be derived for the re-use of materials as engineering material.

To ensure that the installation is commissioned appropriately, a pre-operational condition (PO4) to ensure that a commissioning plan based on the final design of the installation is submitted to and approved by the Environment Agency and The Operator follows the approved plan. We have also required the Applicant to report back to the Environment Agency via an improvement condition (IC3).

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 they will provide back-up CEMS. These will be switched into full operation within 48 hours in the event that there is any failure in the regular monitoring equipment. The back-up CEMS measure the same parameters as the operating CEMS. In the unlikely event that the back-up CEMS also fail Condition 2.3.12 and 2.3.13 of the permit requires that the abnormal operating conditions apply.

The plant will shut down in the event of a CEM's failure and the Operator would undertake the weekly maintenance during this downtime.

6.7.3 Continuous emissions monitoring for dioxins and heavy metals

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

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

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

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

For either continuous monitoring of mercury or continuous sampling of dioxins to be used for regulatory purposes, an emission limit value would need to be devised which is applicable to continuous monitoring. Such limits for mercury and dioxins have not been set by the European Commission. Use of a manual sample train is the only technique which fulfils the requirements of the IED. At the present time, it is considered that in view of the predicted low levels of mercury and dioxin emissions it is not justifiable to require the Operator to install additional continuous monitoring or sampling devices for these substances.

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

6.8 Reporting

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

- Article 5 of EIA Directive relates to the obligation on developers to supply the information set out in Annex IV of the Directive when making an application for development consent.

- Article 6(1) requires Member States to ensure that the authorities likely to be concerned by a development by reason of their specific environmental responsibilities are consulted on the Environmental Statement and the request for development consent.

- Article 6(2)-6(6) makes provision for public consultation on applications for development consent.

- Article 7 relates to projects with transboundary effects and consequential obligations to consult with affected Member States.

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

In determining the Application we have considered the following documents: -

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).

- The decision of the Stockton on Tees Council granted planning permission on 02/05/14.

- The report and decision notice of the local planning authority accompanying the granting of planning permission.

- 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 allow the mixing of hazardous waste so Article 18(2) is relevant.

The Applicant will undertake pre-treatment of wastes in the form of blending once testing has been undertaken as discussed in Section 4.4.2, to try and obtain the most optimised feed for treatment, so ensure the least amount of energy and raw materials are used. This is BAT for this installation.

This ensures that the provisions of Article 13 are still complied the adverse impact of the waste management on human health and the environment is not increased.

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.

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.

(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.

7.2.5 Natural Environment and Rural Communities Act 2006

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

7.3 National secondary legislation

7.3.1 The Conservation of Natural Habitats and Species Regulations 2010

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

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

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

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 2. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. In addition to meeting our consultation responsibilities, we have also taken account of our guidance in Environment Agency Guidance Note RGS6 and the Environment Agency's Building Trust with Communities toolkit.

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

IED Article	Requirement	Delivered by
45(1)(a)	The permit shall include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2000/532/EC, if possible, and containing information on the quantity of each type of waste, where appropriate.	Condition 2.3.3(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 2.3.3(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)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	Not applicable to this installation. No discharges to water or sewer.
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), 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 2.3.10 and 2.3.11.
45(2)(a)	The permit shall include a list of the quantities of the different categories of hazardous waste which may be treated.	Condition 2.3.3 and Table S2.2 of Schedule 2
45(2)(b)	The permit shall include the minimum and maximum mass flows for those hazardous wastes, their	Conditions 2.3.3, 2.3.4 and 2.3.7 and Pre-operational

IED Article	Requirement	Delivered by
	lowest and maximum calorific values and the maximum contents of polychlorinated biphenyls, pentachlorophenol, chlorine, fluorine, sulphur, heavy metals and other polluting substances.	condition PO4
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(a) 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 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a
46(2)	Emission into air shall not exceed the emission limit values set out in parts 4 or determined in accordance with part 4 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a
46(3)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(4)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(5)	Prevention of unauthorised and accidental release of any polluting substances into soil, surface water or groundwater. Adequate storage capacity for contaminated rainwater run-off from the site or for contaminated water from spillage or fire-fighting.	Condition 2.3.1(a) and Table S1.2 of Schedule 1 of the Permit.
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance, 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 2.3.10 and 2.3.11
47	In the event of breakdown, reduce	Condition 2.3.10

IED Article	Requirement	Delivered by
	or close down operations as soon as practicable. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	
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.	Conditions 3.5.2 and 3.5.3.
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Tables S3.1, S3.1(a) and S3.3
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Conditions 4.1.1 and 4.1.2
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	S3.1 and S3.1(a)
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Conditions 3.5.1 and Table S3.5
50(2)	Flue gas to be raised to a temperature of 850ºC or 1100ºC if the waste has greater than 1% halogenated organic substances (as chlorine (Cl)) content for two seconds, as measured at Condition 2.3.6 (a). Representative point of the combustion chamber.	Condition 2.3.9 , Pre-operational condition PO6 and Improvement Condition IC4.
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 2.3.10

IED Article	Requirement	Delivered by
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.9
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.9
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 2.3.9
50(5)	Any heat generated from the process shall be recovered as far as practicable.	The Operator is to review the available heat recovery options prior to commissioning (Condition PO2) and then every 2 years (Condition 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 fulfil this requirement
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 me.	No such conditions have been allowed
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
51(3)	Changes in operating conditions shall include emission limit values for CO and TOC set out in Part 3 of Annex VI.	No such conditions have been allowed
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	EPR require prevent or minimise pollution. Section 2.1.4 of the Application defines how this will be

IED Article	Requirement	Delivered by
		carried out. Conditions 2.3.1, 2.3.3, 3.2, 3.3 and 3.4
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Condition 4.2.2
52(3)	Prior to accepting hazardous waste, the operator shall collect available information about the waste for the purpose of compliance with the permit requirements specified in Article 45(2).	Conditions 3.5.1 and 1.4.1
52(4)	Prior to accepting hazardous waste, the operator shall carry out the procedures set out in Article 52(4).	Conditions 2.3.1 and 3.2.1
52(5)	Granting of exemptions from Article 52(2), (3) and (4).	No such conditions have been included
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Condition 1.4.1 and 1.4.2
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	Condition 1.4.1, 2.3.1(a) and 3.2.1
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1, Table S3.4 and pre-operational condition PO5.
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 submit a report on the baseline conditions of soil and groundwater at the installation. The report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for in Article 22(3) of the IED. The report shall contain information, supplementary to that already provided in application Site Condition Report, needed to meet the information requirements of Article 22(2) of the IED.
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 incinerator inorganic residues 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 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 incineration at the site will be rejected. For those wastes that are acceptable, the Operator shall submit details of the mass flow to the Environment Agency. The Operator shall submit a report for written approval. The procedure shall be implemented in accordance with the written approval from the Agency.

Reference	Pre-operational measures
PO6	After completion of furnace design and at least three calendar months before any furnace operation; the operator shall submit a written report to the 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 the Waste Incineration Directive.
PO7	Prior to construction of the facility, the Operator shall submit a report on the baseline conditions of soil and groundwater at the Installation. The report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for in Article 22(3) of the IED. The report shall contain information, supplementary to that already provided in application Site Condition Report, needed to meet the information requirements of Article 22(2) of the IED.
PO8	Prior to construction of the facility the Operator shall submit a written proposal for a ambient air monitoring system in line with M17 Monitoring Particulate Matter in Ambient Air around Waste Facilities, to ensure that the storage and handling of untreated and treated waste do not result in uncontrolled fugitive emissions. The proposal shall include but not be limited to:- • full details of the methodology to be utilised • installation details of selected measuring device • background sampling. Also, the Operator shall ensure that this is fully incorporated into the final design, commissioning plan and report referenced above. Installation ambient air monitoring shall be carried out in accordance with the final design, installation methodology and commissioning plans as approved.
PO9	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.

ANNEX 3: Improvement Conditions

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

Reference	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.	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 the furnace whilst operating under the anticipated most unfavourable operating conditions. The results shall be submitted in writing to the Environment Agency.	Within 4 months of the completion of commissioning.

Reference	Improvement measure	Completion date
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 following component metals subject to emission limit values, i.e. Cadmium (Cd), Thallium (Tl), Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt(Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V). 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 has been 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 completion of commissioning. Full summary evidence compliance report to be submitted within 18 months of commissioning.

ANNEX 4: Consultation Reponses

A) Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website from 29/08/13 to 26/09/13. Copies of the Application were placed in the Environment Public Register at Tyneside House and the Stockton-on-Tees Borough Council Public Register at 16 Church Road, Stockton-On-Tees, TS18 1TX.

The following statutory and non-statutory bodies were consulted: -

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Stockton on Tees Council	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No Comments to make	

Response Received from Public Health England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No response	

Response Received from Director of Public Health, Middlesbrough Council	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No response	

Response Received from Food Standards Agency	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No response	

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

Response Received from Natural England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
An Assessment was accepted and agreed. The site was screened out as not having a significant likely effect on the neighbouring SSSI's and Habitat sites.	Standard conditions and limits have been applied.