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

Our decision document recording our decision-making process

The Permit Number is:	EPR/KB3939RR
The Variation number is:	EPR/KB3939RR/V002
The Operator is:	Graphite Resources (DEP) Limited
The Facility is located at:	Derwenthaugh, Ecoparc, Derwenthaugh Road, Blaydon, Gateshead, NE16 3BJ

What this document is about

This is a decision document, which accompanies a variation notice.

It explains how we have considered the Operator's Application, and why we have included the specific conditions in the notice we are issuing to the Operator. 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 Operator'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/KB3939RR/V002. We refer to the application as "the **Application**" in this document in order to be consistent.

The permit number is EPR/KB3939RR, we refer to this as "the **Permit**" in this document.

The Application was duly made on 03/06/14.

The operator of the site is Graphite Resources (DEP) Limited. The site holds an existing permit covering a waste operation (autoclaving and waste transfer), and the operator Graphite Resources (DEP) Limited has applied to vary their permit in order to include a listed [A(1)] activity of 'co-incineration' covering a pyrolysis plant. . Graphite Resources (DEP) limited already have a permit so we refer to Graphite Resources (DEP) Limited as "the Operator" in this document.

Graphite Resources (DEP) Limited's current permit authorises waste activities. This variation will add an installation activity. We refer to this as "the Installation" in this document. The varied permit will authorise waste activities and an installation activity. The facility is located at Derwenthaugh Eco Parc, Derwenthaugh Road, Blaydon, Gateshead, Tyne and Wear, NE16 3BJ . We refer to this as "the **Facility"** 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
CHP	Combined heat and power
COMEAP	Committee on the Medical Effects of Air Pollutants
CROW	Countryside and rights of way Act 2000
CV	Calorific value
CW	Clinical waste
CWI	Clinical waste incinerator
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
IBA	Incinerator Bottom Ash
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
I-TEF	Toxic Equivalent Factors set out in Annex VI Part 2 of IED
I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
LCPD	Large Combustion Plant Directive (2001/80/EC) – now superseded by IED
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
LADPH	Local Authority Director(s) of Public Health
LHB	Local Health Board
LOI	Loss on Ignition
MBT	Mechanical biological treatment
MRF	Materials Recovery Facility
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
POP(s)	Persistent organic pollutant(s)
PPS	Public participation statement
PR	Public register
PXDD	Poly-halogenated di-benzo-p-dioxins
PXB	Poly-halogenated biphenyls
PXDF	Poly-halogenated di-benzo furans
RDF	Refuse derived fuel
RGS	Regulatory Guidance Series
SAC	Special Area of Conservation

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

1 Our decision

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

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 03/06/14. 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 Operator made no claim for commercial confidentiality. We have not received any information in relation to the Application that appears to be confidential in relation to any party.

2.2 Consultation on the Application

We carried out consultation on the Application in accordance with the EPR, our statutory PPS and our own RGS Note 6 for Determinations involving Sites of High Public Interest. We consider that this process satisfies, and frequently goes beyond the requirements of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, which are directly incorporated into the IED, which applies to the Installation and the Application. We have also taken into account our obligations under the Local Democracy, Economic Development

and Construction Act 2009 (particularly Section 23). This requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of representatives of interested persons in the exercise of our functions, by providing them with information, consulting them or involving them in any other way. In this case, our consultation already satisfies the Act's requirements.

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

The Application and all other documents relevant to our determination (see below) were made available to view on our Public Register at Tyneside House, Skinnerburn Road, Newcastle Business Park, Newcastle Upon Tyne NE4 7AR. Anyone wishing to see these documents could do so and arrange for copies to be made.

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

- Gateshead Council
- Newcastle city council
- Food standards agency
- Public Health England
- Director of public health – Gateshead
- Director of public health – Newcastle
- Health and safety executive
- Local fire service
- Animal Health
- Northumbrian Water

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

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it, and issued information notices on 11/08/14, 14/10/14, 06/03/15 and 21/06/15. A copy of each information notice was placed on our public register as was the response when received.

3 The legal framework

The notice is issued under Regulation 20 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 co-incineration plant* as described by the IED;
- an *operation* covered by the WFD, and
- subject to aspects of other relevant legislation which also have to be addressed.

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

We consider that, in issuing the notice, 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 Facility

4.1 Description of the Facility and related issues

4.1.1 The permitted activities

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

- Section 5.1 Part A(1)(a) – incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day
- Section 5.4 Part A(1)(a) – pre-treatment of waste for incineration

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

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

Many activities which would normally be categorised as “directly associated activities” for EPR purposes (see below), such as air pollution control plant and waste pre-treatment, are therefore included in the listed activity description. The operation of the autoclaves and sorting of the waste is considered to be waste pre-treatment in order to improve its properties before pyrolysis. The 5.4 activity listed above covers export of autoclaved material for off—site incineration

An installation may also comprise “directly associated activities”, which at this Installation includes the generation of electricity using gas engines. These activities comprise one installation, because they are successive steps in an integrated activity. The gas engines are not part of the co-incineration plant because the syngas is of a quality where it is no longer considered a waste and can cause emissions no higher than those resulting from combustion of natural gas.

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

The current permit also includes waste activities and these are carried through into this varied permit. These activities cover the autoclaving of waste for subsequent off-site recovery and also for the operation of a waste transfer station.

4.1.2 The Site

The site is located in Derwenthaugh, near Gateshead. The surrounding area is mainly commercial. The nearest residential area is ~ 600m away to the south west. There are no European habitat sites within 10km. There are two sites of special scientific interest within 2km and several other ecological sites within 2km

The boundary of the site has not changed through this variation.

Further information on the site is addressed below at 4.3.

4.1.3 What the Facility does

The site is currently permitted for a waste operation to receive mixed wastes, treat them by autoclaving and then transfer off-site. There is also a waste transfer station permitted. This variation is to add pyrolysis equipment to pyrolyse the autoclaved waste. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the pyrolysis process is a waste co-incineration plant because it’s main purpose is to produce a gaseous product (syngas) for subsequent combustion to generate electricity.

The process used to thermally treat the waste is pyrolysis. The Applicant submitted details of the syngas specification. We agreed that the syngas can be classed as non waste and that it can cause emissions no higher than those

arising from the combustion of natural gas. Therefore chapter IV of IED does not apply to the combustion of the syngas. Char combustion is subject to IED chapter IV. The purpose of the char combustion unit is to provide heat to the pyrolysers and the purpose of the pyrolysis plant is to generate a syngas that will be cleaned up to be classed as a product (rather than classification as a waste).

We have permitted the pyrolysis units and thermal oxidisers together as a 5.1 Part A(1)(b) activity, and applied IED chapter IV limits to the char thermal oxidisers. The varied permit includes the existing waste operations for the waste treatment by autoclaving for subsequent transfer off site and for the waste transfer station.

Wastes are received into a storage bay in the waste reception building. The waste is loaded into a hydraulic hopper and lift transfer system for delivery into the autoclaves. Wastes destined for direct pyrolysis will be shredded and blended within the building.

The three existing autoclaves are sealed immediately after loading. The units are rotated and steam is added. Steam is provided from a gas fired boiler in the existing system. Steam will be provided from a heat recovery system connected to the pyrolysis units, once the pyrolysis units are in operation.

Once the autoclaving is complete the units are depressurised. The exhaust steam is condensed as waste heat following recovery within a heat exchanger. The condensate is treated through the water treatment plant and discharged to sewer. Once the steam is exhausted the autoclave doors are opened and the waste removed. Hoods above the autoclaves vent to a scrubbing system to control odour.

The waste is transported to the recovery area. Recyclable materials are removed using process separation, a trommel including a star screen, ferrous magnet, eddy current separator and plastic separation by picking.

After sorting, the waste will be shredded and dried to a moisture content of 10% to make it suitable for pyrolysis. Waste heat from the pyrolysis units will be used to dry the waste. The autoclaved waste will be blended with other wastes before delivery to a supply hopper for the pyrolysis units.

The two pyrolysis units will be a rotary kiln type. A feed system will compact the waste to remove oxygen and then feed into the pyrolysis units through a hopper. The units will have rotating chambers and will operate at about 700^{o}C. The waste will be thermally decomposed and form a gas (syngas) and leave a residue (char).

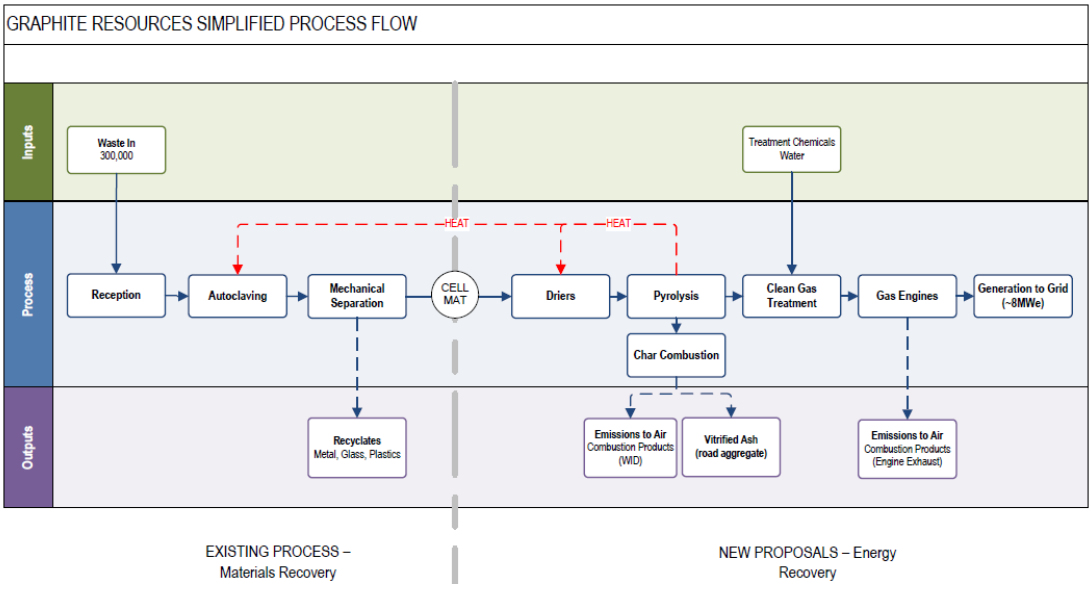
The syngas will be cleaned using a wet scrubbing system that will consist of a quench, washtower, absorption tower, separation tank, centrifuge and carbon filter. The syngas will be cleaned to the extent where it will no longer be considered a waste in that it can cause emissions no higher than those resulting from the burning of natural gas. The char is collected and burned in

one of two thermal oxidisers to provide heat to the pyrolysis units. The thermal oxidisers will achieve 1100^{o}C for 2 seconds. A heat recovery steam generator will recover heat for use in the waste feed dryer and to supply steam to the autoclaves.

Four gas engines (thermal input of ~ 19.5MW) will be used to burn the syngas to generate ~ 8MW of electricity. The combustion of the syngas will not be subject to IED chapter IV limits as specified in IED article 42, paragraph 1. The gas engines will emit from emission points A4-A6. A flare (emission point A3) will be available for emergency use and for start-up and shut-down.

Ceramic filters will be used to remove particulate matter from the thermal oxidiser exhaust gases. Acid gases will be removed using lime injection. Emissions will be subject to IED chapter IV requirements. The oxidisers will emit from emission points A1 and A2.

A process flow diagram is shown below



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

Waste throughput, Tonnes/line	320,000 tonne /annum for autoclaving 52,800 tonnes per hour of treated waste for pyrolysis	
Waste processed	Commercial waste, municipal waste, waste wood, hazardous waste	
Number of lines	2 pyrolysis retorts and two char burner units.	
Furnace technology	Pyrolysis	
Auxiliary Fuel	Gas Oil	

Acid gas abatement	Dry	Lime
NOx abatement	Water injection on char burners and engine management for gas engines	
Reagent consumption	Auxiliary Fuel 2000 l/annum Process water: 50,000 m^3/annum	
Thermal oxidisers	2 in total	
Thermal oxidiser Stacks	Height 35 m	Diameter 0.62 m
Gas Engines	4 in total	
Gas engine stacks	Height 35 m	Diameter 1.6 m
Flue gas	Flow 3.3Nm^3/s	Velocity 17.4 m/s
Electricity generated	7.8 MWe	
Waste heat use	Heat for dryers and steam for autoclaves	

4.1.4 Key Issues in the Determination

The key issues arising during this determination were the assessment of air quality impacts and assessment of the proposed techniques against BAT and we therefore describe how we determined these issues in most detail in this document.

4.2 The site and its protection

4.2.1 Site setting, layout and history

The site is located in Derwenthaugh, near Gateshead. The surrounding area is mainly commercial. The nearest residential area is ~ 600m away to the south west. There are no European habitat sites within 10km. There are two sites of special scientific interest within 2km and several other ecological sites within 2km.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The entire site is located on impermeable hardstanding. New tanks will have level gauges and alarms and will have secondary containment that will comply with Environment Agency guidance PPG2. Chemicals stored in IBCs will be in a bunded area. An inspection programme will be in place. Delivery area will be within a sealed drainage area.

Any minor spills will be cleaned up immediately using sand or other absorbent. In the event of a major spillage action would be taken to prevent liquid reaching drains or land.

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

The permitted area is not increasing through this variation so a site condition report was not required -although the Operator provided an updated site condition report as part of the application.

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. Pre-operational condition PO1 requires the Operator to have an Environmental Management System in place before the Installation is operational, and this will include a site closure plan.

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

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Operator is the sole Operator of the Facility.

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

We checked the OPRA score through this determination and updated it as required, the revised OPRA score was 186.

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 Operator has stated in the Application that they will implement an Environmental Management System (EMS) that will meet the requirements of ISO14001. A pre-operational condition (PO1) is included requiring the Operator to provide a summary of the EMS prior to commissioning of the plant and to make available for inspection all EMS documentation. *This was not a requirement for the waste operation – prior to this variation application.*

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.

Operator competence for the waste activities was assessed as part of the original permit determination and subsequent transfer of that permit. However it is reiterated in this Application that a full time site manager qualified to WAMITAB CoTC level 4.

4.3.3 Site security

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

4.3.4 Accident management

The Operator has submitted a draft 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 (PO1).

The Operator stated that autoclaved waste (Cellmat) would be produced for pyrolysis. However they wished to retain the option in the permit to export Cellmat for off-site uses. The Operator stated that any excess Cellmat (over and above the requirement for pyrolysis) would only be produced if a market was available for it. We incorporated this into the permit through table S1.2. In addition we have set a maximum storage amount in the permit of 1000 tonnes at any one time. This is based on the amount stated in the application that the Operator would need to store in order to feed the pyrolyser units at capacity for 72 hours.

We also requested that Operator supply a fire prevention plan to cover the storage of Cellmat. The fire prevention plan stated that cellmat would comprise a moisture rate of ~40%, thus posing a low fire risk. Despite this, storage arrangements have been considered and the plan contained a commitment to only store waste material for a maximum of 5 days. The fire prevention plan requirements have been incorporated by table S1.2. We have also set pre-operational condition PO9 for an updated plan to be submitted after the detailed design stage of the plant.

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 Operator must operate the Facility in accordance with the following documents contained in the Application:

Description	Parts Included	Justification
Variation application EPR/KB3939RR/V002	The response to question 3a of application form C3 Response to not duly made letter (dated 25/03/14):	These sections describe operation of the autoclaves and the pyrolysis

	question 6 Response to not duly made letter (dated 07/04/14): Questions 1 to 5	plant. These measures supersede the measures listed in table S1.2 of the original permit
Application EPR/DP3639LD/A001 transferred to the operator as EPR/KB3939RR/T001	Environmental Permit Compliance Plan November 2008 (received with application) Accident Management Plan November 2008 (received with application) Site Specific Risk Assessment November 2008 (received with application) Technical Guidance Note: Getting The Basics Right	These measures apply to the waste transfer station and are unchanged from the original application, except the OMP is now referred to through permit condition 3.2.1
Response to schedule 5 notice issued on 11/08/14	Response to questions 4, 6, 34, 36, 37, 38,	
Response to schedule 5 notice issued on 14/10/14	Response to questions 13, 15, 17, 19.	
Response to schedule 5 notice issued on 06/03/14	Response to questions 3, 5, 6, 10, 11, 13(ii)	
Response to schedule 5 notice issued on 02/06/15	Fire prevention plan	

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.

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

The current permit specified waste types that can be accepted for treatment by the autoclaves and subsequent removal of recyclables. This variation adds five new waste codes to the Permit. These are shown below.

Waste code	Description
15 01 10*	packaging containing residues of or contaminated by dangerous substances
15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
20 01 27*	paint, inks, adhesives and resins containing dangerous substances
20 01 29*	detergents containing dangerous substances

Four of the above wastes are hazardous wastes. These wastes will be shredded and blended with the processed autoclaved waste.

We are satisfied that the Operator can accept the wastes contained in Tables S2.2 and S2.4of the varied Permit. The Operator states that the aim is to form a refined pyrolysis feedstock – in order to produce a clean syngas. Blending wastes with selected hazardous wastes will increase the CV and quality of the syngas.

Blending in hazardous wastes means that the entire pyrolysis feedstock needs to be treated as a hazardous waste. The Operator has applied to operate a hazardous waste co-incineration plant. The Permit includes the requirements for co-incineration plants for hazardous waste contained within Article 45(2) of the IED, consisting of:

a) a list of the quantities of the different categories of hazardous waste which may be treated; and
b) the minimum and maximum mass flows of those hazardous wastes, their lowest and maximum calorific values and their maximum contents of polychlorinated biphenyls, pentachlorophenol, chlorine, fluorine, sulphur, heavy metals and other polluting substances.

Limits are set in table S2.5 and pre-operational condition PO7 requires the submission of some additional information.

The co-incineration plant will take municipal 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.

We have limited the capacity of the pyrolysis plant to 52,800 tonnes per annum. This is based on the installation operating 8,000 hours per year. The risk assessments in the Application are based on this throughput.

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:

- The parasitic load of the plant will be provided by electricity generated by the Installation
- Lagging and insulation will be used to minimise heat losses
- At the time of making the application the Operator claimed that the CHP engines were class leaders for efficiency.
- Fans and motors will be high efficiency
- Plant control by PLC and optimised for efficiency
- Energy key performance indicators will be used to monitor and identify improvements

The Application states that the parasitic electrical demand of the pyrolysis process will be 400 kWe and that 2000 MW of heat will be required for the pyrolysis process. This gives a total of specific energy consumption, a measure of total energy consumed per unit of waste processed, of 2400 KW or will be ~363 kWh/tonne. The pyrolysis capacity is 52,800 tonnes per year.

Data from the BREF for Municipal Waste Incinerators shows that the range of specific energy consumptions is as in the table below. Although this data is not for pyrolysis plants it is still useful as a guide to energy efficiency.

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

The BREF says that it is BAT to reduce the average installation electrical demand to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. The LCV in this case is expected to be 16 MJ/kg. Taking account of the difference in LCV, the specific energy consumption in the Application is in line with that set out above.

Thermal energy from the pyrolysis process will also be used to heat the autoclaves and for the dryers. The energy efficiency of the waste pre-treatment is considered in the BAT assessment in section 6 of this decision document.

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

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

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

The BREF says that where a plant generates electricity only, it is BAT to recover 0.4 – 0.65 MWh/ tonne of waste (based on LCV of 10.4 MJ/kg) for raw waste inputs or 0.6 – 1.0 MWh/tonne of waste (based on LCV of 15.2 MJ/kg) for pre-treated wastes. Our technical guidance note, SGN EPR S5.01, states that where electricity only is generated, 5-9 MW of electricity should be recoverable per 100,000 tonnes/annum of waste (which equates to 0.4 – 0.72 MWh/tonne of waste).

The Installation will generate electricity and heat will be re-usedwithin the process for the autoclaves and driers. The energy balance diagram of the Application shows 7.8 MW of electricity produced for an annual waste throughput in the pyrolysis units of 52,800 tonnes, which represents 1.18 MWh/tonne of treated waste (CV of 16 MJ/kg) or 14.7 MW per 100,000 tonnes/yr of waste Although the range quoted above from the BREF is for municipal waste incineration plants it is still a useful guide and the proposed installation compares well to this range.

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

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. There is provision within the design to export heat should a suitable source be found.

Our CHP guidance also states that opportunities to maximise the potential for heat recovery should be considered at the early planning stage, when sites are being identified for incineration facilities.

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

(iv) The DEFRA Good Quality CHP Scheme

The Operator has accreditation under the DEFRA Good Quality CHP Scheme. This process does not form part of the matters relevant to our determination, but forms part of financial aspects of the project drawing down funding through Renewable Obligation Credits (ROCs). Gaining accreditation under the scheme is however an indication of achieving a high level of energy recovery. Our consideration of energy recovery is described in the preceding paragraphs and we are satisfied that the level of recovery being achieved meets all the statutory requirements.

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

(vii) Permit conditions concerning energy efficiency

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

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

The Operator is required to report energy usage and energy generated under condition 4.2 and Schedule 5. The following parameters are required to be reported: total electrical energy generated; electrical energy exported; total energy usage and energy exported as heat (if any). Together with the total MSW burned per year, this will enable the Environment Agency to monitor energy recovery efficiency at the Installation and take action if at any stage the energy recovery efficiency is less than proposed.

There are no site-specific considerations that require the imposition of standards beyond indicative BAT, and so the Environment Agency accepts that the Operator'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 5, for consumption of lime 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. This is the most significant raw materials that will be used at the Installation, other than the waste feed itself (addressed elsewhere). The efficiency of the use of auxiliary fuel will be tracked separately as part of the energy reporting requirement under condition 4.2.1. Optimising reagent dosage for air abatement systems and minimising the use of auxiliary fuels is further considered in the section on BAT.

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

This requirement addresses wastes produced at the Installation and does not apply to the waste being treated there. The principal waste streams the Installation will produce are recyclables removed from the autoclaved waste, residue from char combustion, air pollution control residues collected by the ceramic filtration plant, and scrubber wastes.

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree of burnout in the char combustors, which will result in a material that is both reduced in volume and in chemical reactivity. Condition 3.1.5 and associated Table S3.6 specify limits for total organic carbon (TOC) of <3% in the vitrified slag. Compliance with this limit will demonstrate that good combustion control and waste burnout is being achieved in the furnace and waste generation is being avoided where practicable.

Metals, plastics and glass will be removed from the autoclaved waste and sent for off-site recovery.

The char combustion residue is likely to be classified as non-hazardous waste under code 19 01 12. However, it is classified on the European List of Wastes as a “mirror entry”, which means it is a hazardous waste if it possesses a hazardous property relating to the content of dangerous substances. Monitoring of the residue will be carried out in accordance with the requirements of Article 53(3) of IED. Classification of the residue for its subsequent use or disposal is controlled by other legislation and so is not duplicated within the permit. The Operator proposed to send the material for off-site recovery for use as an aggregate material.

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

In order to ensure that residues are adequately characterised, pre-operational condition PO3 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.6 requires the Operator to carry out an ongoing programme of monitoring.

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

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

5. Minimising the Installation's environmental impact

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

For the installation activity being added through this variation of, the principal emissions are those to air, although we also consider those to land and water.

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

5.1 Assessment Methodology

5.1.1 Application of Environment Agency H1 Guidance

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

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

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

5.1.2 Use of Air Dispersion Modelling

For incineration applications, we normally require the Operator 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 Operator's proposals for the prevention and control of the emission to be BAT. That is because if the impact of the emission is already insignificant, it follows that any further reduction in this emission will also be insignificant.

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

For those pollutants which do not screen out as insignificant, we determine whether exceedences of the relevant EQS are likely. This is done through detailed audit and review of the Operator's air dispersion modelling taking background concentrations and modelling uncertainties into account. Where an exceedence of an EU EQS is identified, we may require the Operator to go beyond what would normally be considered BAT for the Installation or we may refuse the application if the Operator is unable to provide suitable proposals. Whether or not exceedences are considered likely, the application is subject to the requirement to operate in accordance with BAT.

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

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

5.2 Assessment of Impact on Air Quality

The Operator's assessment of the impact of air quality for this variation is set out in Annex C of the Application. The assessment comprises:

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

This section of the decision document deals, primarily, with the dispersion modelling of emissions to air from the thermal oxidiser and gas engine stacks and the impact on local air quality. The impact on conservation sites is considered in section 5.4.

The Operator 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 Breeze AERMOD 7 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 Newcastle airport between 2008 and 2012. Newcastle airport is ~8km from the Installation and the Operator stated that this is the most representative data available.

The air impact assessments, and the dispersion modelling upon which they were based, employed the following assumptions.
<u>For the char combustion units:</u>

- First, they assumed that the ELVs in the Permit would be the maximum permitted by Article 46(2) and Annex VI of the IED. These substances are:
    - Oxides of nitrogen (NO_x), expressed as NO_2
    - Total dust
    - Carbon monoxide (CO)
    - Sulphur dioxide (SO_2)
    - Hydrogen chloride (HCl)
    - Hydrogen fluoride (HF)
    - Metals (Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium)
    - Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)
    - Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC)
- Second, they assumed that the Installation operates continuously at the relevant long-term emission limit values, i.e. the maximum permitted emission rate.
- Chromium was assumed to be in a ratio of 80% Cr(II) and (II) with 20% as Cr (IV). Metals are also considered further in section 5.2.3 of this decision document.
- Third, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically Polycyclic Aromatic Hydrocarbons (PAH). Emission rates used in the modelling was conservatively assumed to be higher than the value quoted in the Waste Incineration BREF. It is considered further in section 5.2.5.

For the gas engines expected emissions of oxides of nitrogen and carbon monoxide were modelled with all four gas engines operating continually at full load.

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

The Operator has reviewed local background air quality monitoring and DEFRA background maps. This is summarised in the Application and has been used by the Operator to establish the background (or existing) air quality against which to measure the potential impact of the Installation.

The Operator has modelled the concentration of key pollutants at a number of specified locations within the surrounding area.

The way in which the Operator 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 Operator's air impact assessment. The output from the model has then been used to inform further assessment of health impacts and impact on habitats and conservation sites.

Our review of the Operator's assessment leads us to agree with the Operator'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 Operator's modelling predictions are summarised in the following sections.

5.2.1 Assessment of Air Dispersion Modelling Outputs

The Operator's modelling predicted pollutant concentrations at discreet receptors. The tables below show the ground level concentrations at the most impacted receptor.

The Operator's modelling predictions are summarised in the tables below. The figures shown indicate the predicted peak ground level exposure at a relevant receptor to pollutants in ambient air. Whilst we have used the Operator'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.

Non metals

Pollutant	EQS / EAL		Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m³		µg/m³	µg/m³	% of EAL	µg/m³	% of EAL
NO_2	40	1	26.7	3.2	8.00	29.9	74.8
	200	2	53.4	14.6	7.3	68	34.0
PM_{10}	40	1	14.5	0.09	0.22	14.6	36.5
	50	3	17.1	0.40	0.80	17.5	35.0
$PM_{2.5}$	25	1	9.5	0.09	0.35	9.59	38.4
SO_2							
	266	4	8	6.9	2.6	14.9	5.6
	350	5	6.9	4.9	1.40	11.8	3.4
	125	6	3.5	1.9	1.5	5.375	4.3
HCl	750	7	0.23	1.05	0.14	1.3	0.17
HF	16	8	0.5	0.009	0.06	0.509	3.18
	160	7	1	0.107	0.067	1.11	0.7
CO	10000	9	189	77.0	0.77	266	2.7
	30000	10	270	129	0.43	399	1.3
TOC	5	1	0.38	0.09	1.70	0.465	9.30
PAH	0.00025	1	-	0.0000001	0.044	-	-
	0.2	1	-	0.00044	0.22	-	-
PCB	6	2	-	0.0054	0.09	-	-

TOC as benzene
PAH as benzo[a]pyrene

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

Note: The results presented below are at the highest impacted receptor as shown in the Operator's modelling report. This receptor was a hotel. Although

relevant for short term exposure this is not a relevant receptor for long term (annual) impacts. The highest long term impacts at a relevant receptor are lower, for example the NO_2 long term PC is predicted to be 1.4% of the EQS

Metals

Pollutant	EQS / EAL		Back-ground	Process Contribution		Predicted Environmental Concentration	
	µg/m³		µg/m³	µg/m³	% of EAL	µg/m³	% of EAL
Cd	0.005	1	0.0003	0.000435	8.7	0.00074	14.7
Tl				0.0054		0.0054	
Hg	0.25	1	0.002	0.000425	0.17	0.00243	0.97
	7.5	2	0.004	0.0054	0.07	0.00940	0.125
Sb	5	1		0.00435	0.09	0.00435	0.09
	150	2		0.054	0.04	0.05400	0.036
Pb	0.25	1	0.0139	0.0085	3.40	0.02240	8.96
Co			0.00021	0.022		0.02221	
Cu	10	1	0.0168	0.0044	0.04	0.0212	0.212
	200	2	0.0336	0.054	0.03	0.08760	0.044
Mn	0.15	1	0.0132	0.00435	2.90	0.01755	11.70
	1500	2	0.0264	0.054	0.004	0.08040	0.0054
V	5	1	0.0017	0.00435	0.09	0.00605	0.12
	1	3	0.0034	0.024	2.40	0.02740	2.74
As	0.003	1	0.00068	0.00438	146.00	0.00506	168.7
Cr (II)(III)	5	1	0.0034	0.0035	0.07	0.00690	0.138
	150	2	0.0068	0.0435	0.03	0.05030	0.0335
Cr (VI)	0.0002	1	0.00085	0.000874	437.00	0.00172	862.0
Ni	0.02	1	0.0038	0.0044	22.00	0.00820	41.0

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

(i) Screening out emissions which are insignificant

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

- PM10, PM2.5, SO_2, HCl, HF, CO, Hg, Sb, Cu, V, Cr(II) &(III)

Short term impacts from operation of the flare were modelled and shown to be insignificant. Therefore we consider the Operator'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

- NO_2, VOCs (TOC), Cd, Pb, Mn, Ni

For these emissions, we have carefully scrutinised the Operator's proposals to ensure that they are applying the Best Available Techniques to prevent and minimise emissions of these substances. This is reported in section 6 of this document.

(iii) Emissions requiring further assessment

All emissions except As and Cr(VI) either screen out as insignificant or where they do not screen out as insignificant are considered unlikely to give rise to significant pollution. As and Cr (VI) are considered in more detail in section 5.2.3.

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

The impact on air quality from NO_2 emissions has been assessed against the 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.

The above tables show that the peak long term PC is greater than 1% of the EUEQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EUEQS being exceeded. The maximum long term PC at a receptor shown in the table is 8%. This is predicted to occur at a hotel, the maximum impact at a residential receptor is 1.4% of the EQS. The short term PC is below the level we would consider insignificant (<10% of the EUEQS).

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

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

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

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

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

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

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 we consider the Operator's proposals for preventing and minimising the emissions of particulates to be BAT for the Installation.

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

There is currently no emission limit prescribed nor any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition (IC6) has been included that will require a full analysis of particle size distribution in the flue gas, and hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions, as explained in section 5.3.3.

(iii) Acid gases, SO_2, HCl and HF

From the tables above, emissions of HCl and HF can be screened out as insignificant in that the process contribution is <10% of the short term EQS/EAL. There is no long term EQS/EAL for HCl. HF has 2 assessment criteria – a 1-hr EAL and a monthly EAL – the process contribution is <1% of the monthly EAL and so the emission 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 EUEQS values. Therefore we consider the Operator's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

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

The above tables show that for CO emissions, the peak long term PC is less than 1% of the EAL/EQS and the peak short term PC is less than 10% of the EAL/EQS and so can be screened out as insignificant. Therefore we consider the Operator's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

The above tables show that for VOC emissions, the peak long term PC is marginally greater than 1% of the EAL/EQS. However the assessment assumes that all VOC emissions are benzene. This is highly unlikely to occur in practice and in reality VOC emissions are likely to be insignificant.

The above tables show that for PAH and PCB emissions, the peak long term PC is less than 1% of the EAL/EQS and the peak short term PC is less than 10% of the EAL/EQS for PCB's and so can be screened out as insignificant. Therefore we consider the Operator's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

The Operator has also used the EQS for benzo[a]pyrene (BaP) for their assessment of the impact of PAH. We agree that the use of the BaP EQS is sufficiently precautionary.

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

(V) Summary

For the above emissions to air, for those emissions that do not screen out, we have carefully scrutinised the Operator's proposals to ensure that they are applying the BAT to prevent and minimise emissions of these substances. This is reported in section 6 of this document. Therefore we consider the Operator's proposals for preventing and minimising emissions to be BAT for the Installation. Dioxins and furans are considered further in section 5.3.2.

5.2.3 Assessment of Emission of Metals

The Operator 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.

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

- Hg, Sb, Cu, V, Cr (II) and Cr (III)

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

- Cd, Pb, Mn and Ni

This left emissions of As and Cr(VI) requiring further assessment. For all other metals, the Operator has concluded that exceedences of the EAL for all metals are not likely to occur.

Where Annex VI of the IED sets an aggregate limit, the Operator's assessment assumes that each metal is emitted individually at the relevant aggregate emission limit value. This is a something which can never actually occur in practice as it would inevitably result in a breach of the said limit, and so represents a very much worst case scenario. For Cr the Operator assumed that 20% of it was Cr(VI). The results presented in section 5.2.1 are based on these assumptions.

For metals As and Cr (VI) the Operator then used a two step approach:

- Each metal is emitted as the proportion of metals in its group (i.e. one ninth of the limit for each of the group 3 metals). Historical data for Municipal Waste Incinerators indicates that 1/9th of the limit is an over estimate of actual emissions, and so we are satisfied that the Operator's proposal is reasonable in this context. The Operator also assumed Cr (VI) to be 20% of total Cr.

Then for metals that had not screened out (Cr(VI);

- Used representative emissions data from other municipal waste incinerators using our guidance note Please refer to "Guidance to Operators on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012".

Based on the above, the following emissions of metals were screened out as insignificant:

- Cr (VI)

The following emissions of metals whilst not screened out as insignificant were assessed as being unlikely to give rise to significant pollution:

- As

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

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

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

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

There is little data available on the background levels of Cr(VI). Taking a precautionary approach we have assumed that the background level already exceeds the EAL.

The Operator has used the above data to model the predicted Cr(VI) impact. The PC is predicted as 0.6% of the EAL. Although this is not a municipal waste incinerator the Operator claimed that the above data would represent a worst case assessment and that actual emissions from this Installation would be even lower. Improvement condition (IC3) has been set for Cr(VI) and As impacts to be confirmed with monitoring data.

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

5.2.4 Consideration of Local Factors

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

Newcastle City Council has declared Air Quality Management Areas (AQMAs) with respect to nitrogen dioxide. The nearest to the installation is ~4km away. At this distance it is unlikely to be affected by emissions from the incinerator. The contour plots provide with the application show that the PC of nitrogen dioxide will be insignificant at the AQMA.

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 air quality directive (AQD).

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

Policy Advice from Government also points out that the minimal risk from modern incinerators. Paragraph 22 (Chapter 5) of WS2007 says that "research carried out to date has revealed no credible evidence of adverse health outcomes for those living near incinerators." It points out that "the

relevant health effects, mainly cancers, have long incubation times. But the research that is available shows an absence of symptoms relating to exposures twenty or more years ago when emissions from incinerators were much greater than is now the case." **Paragraph 30 of PPS10** explains that "modern, appropriately located, well run and well regulated waste management facilities should pose little risk to public health."

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

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

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

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

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

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

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

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

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

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

iv) Health Risk Models

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

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

HHRAP has been developed by the US EPA to calculate the human body intake of a range of carcinogenic pollutants and to determine the mathematic quantitative risk in probabilistic terms. In the UK, in common with other European Countries, we consider a threshold dose below which the likelihood of an adverse effect is regarded as being very low or effectively zero. The HMIP model uses a similar approach to the HHRAP model, but does not attempt to predict probabilistic risk. 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 in addition". COMEAP has issued a statement expressing some reservations about the applicability of applying its methodology to small affected areas. Those concerns generally relate to the fact that the exposure-response coefficients used in the COMEAP report derive from studies of whole urban populations where the air pollution climate may differ from that around a new industrial installation. COMEAP identified a number of factors and assumptions that would contribute to the uncertainty of the estimates. These were summarised in the Defra review as below:

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

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

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

v) Consultations

As part of our normal procedures for the determination of a permit application, we consult with Local Authorities, Local Authority Directors of Public Health, FSA and PHE. We also consult the local communities who may raise health related issues. All issues raised by these consultations are considered in determining the application as described in Annex 4 of this document.

5.3.2 Assessment of Intake of Dioxins, Furans and Dioxin like PCBs

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

The human health risk assessment calculates the dose of dioxins and furans that would be received by local receptors if 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 Operator's assessment of dioxin intake are detailed in the table below (worst – case results for each category are shown). The Operator included dioxins and dioxin like PCBs in their assessment.

Receptor	adult	child
Farmer	0.00018	0.00026
Resident	0.000027	0.000081

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

The results above show that the predicted intake will be no more than 0.013% of the TDI. The Operator's assessment was based on a dioxin emission of 0.01ng/m^3. The Operator based this on their achievable emission level. We have set this as a limit in the permit.

The FSA has reported that dietary studies have shown that estimated total dietary intakes of dioxins and dioxin-like PCBs from all sources by all age groups fell by around 50% between 1997 and 2001 and are expected to continue to fall. A report in 2012 showed that Dioxin and PCB levels in food have fallen slightly since 2001. In 2001, the average daily intake by adults in the UK from diet was 0.9 pg WHO-TEQ/kg bodyweight. The additional daily intake predicted by the modelling as shown in the table above is substantially below this figure.

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

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

5.3.3 Particulates smaller than 2.5 microns

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

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

The HPA addresses the issue of the health effects of particulates in their September 2009 statement 'The Impact on Health of Emissions to Air from Municipal Incinerators'. It refers to the coefficients linking PM_{10} and $PM_{2.5}$ with effects on health derived by COMEAP and goes on to say that if these coefficients are applied to small increases in concentrations produced, locally,

by incinerators; the estimated effects on health are likely to be small. The HPA notes that the coefficients that allow the use of number concentrations in impact calculations have not yet been defined because the national experts have not judged that the evidence is sufficient to do so. This is an area being kept under review by COMEAP.

In December 2010, COMEAP published a report on The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. It says that "a policy which aims to reduce the annual average concentration of $PM_{2.5}$ by 1 $\mu g/m^3$ 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 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 (now PHE) that "While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable."

In carrying out air dispersion modelling as part of the H1 Environmental Impact assessment and comparing the predicted environmental concentrations with European and national air quality standards, the Operator 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 Operator's assessment of the impact from PM10, PM2.5, SO_2, HCl, HF, CO, Hg, Sb, Cu, V and Cr have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions NO_2, VOCs (TOC), Cd, Pb, Mn, Ni, As have not been screened out as insignificant, the assessment still shows that the predicted environmental concentrations are well within air quality standards or environmental action levels.

The Environment Agency has reviewed the methodology employed by the Operator to carry out the health impact assessment and agree with the Operator's conclusions.

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

Public Health England and the Local Authority Director of Public Health were consulted on the Application. Public Health England concluded that they had no significant concerns regarding the risk to the health of humans from the installation. The Food Standards Agency was also consulted during the permit determination process and did not raise any concern of the effects on the human food chain as a result of the operations at the Installation. Details of the consultation responses can be found in Annex 2.

The Environment Agency is therefore satisfied that the Operator'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, and other conservation sites.

5.4.1 Sites Considered

There are no Habitats (i.e. Special Areas of Conservation, Special Protection Areas and Ramsar) sites within 10Km of the proposed Installation.

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

- Shibdon Pond
- Lower Derwent Meadows

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

- Benwell Nature Park
- Shibdon Pond
- Denton Dene
- Sugely Lane
- Axwell Lake/Park
- Damhead Wood
- Swalwell Meadow
- Scotswood Road, Paradise
- Cross Lane Meadows
- River Tyne, Intertidal Mud
- Lemington Gut
- River Tyne, Tidal Mud
- Shibdon Meadow
- River Derwent Metro Radio
- Shibdon Landfill
- Blaydon Burn
- Derwent Walk Country Park

5.4.2 SSSI Assessment

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

Where the long term PC is <1% and the short term PC is <10% the impact is insignificant and the background levels are not considered further.

Where the PC are not insignificant the background levels are taken from the APIS website.

Site	Pollutant	EQS / EAL	Back-ground Conc	Process Contribution (PC)	PC as % of EQS / EAL	Predicted Environmental Concentration (PEC)	PEC as % EQS / EAL
Shibdon Pond	NOx (annual mean)	30	14.6	0.84	2.8	15.5	51.5
	NOx (daily mean)	75	27	12.2	16.2	29.4	39.2
	SO_2 (annual mean)	20	-	0.12	0.58	-	-
	HF (weekly	0.5	-	0.0023	0.46		

	mean)						
	HF (daily mean)	5	-	0.0295	0.59		
Lower Derwent Meadows	NOx (annual mean)	30	-	0.13	0.43	-	-
	NOx (daily mean)	75	-	2.33	3.1	-	-
	SO_2 (annual mean)	20	-	0.008	0.04	-	-
	HF (weekly mean)	0.5	-	0.000165	0.033	-	-
	HF (daily mean)	5	-	0.00275	0.055	-	-

Note 1 All the above concentration figures are in $\mu g/m^3$
Note 2 – All of the above concentrations are in kgN/ha/yr
Note 3- background concentrations were taken from apis

b) Assessment of pollutant concentrations against critical loads

Nitrogen deposition

Site	Critical load (CLo)	Process Contribution (PC)	PC as % of CLo
Shibdon Pond	15	0.12	0.82
Lower Derwent Meadows	20	0.02	0.09

All of the above concentrations are in kgN/ha/yr

eAcid deposition

Site	Critical loads	PC as % of CLo
Shibdon Pond	CLMaxN 4.7, CL MaxS 3.8	0.77
Lower Derwent Meadows	CLMaxN 5.1, CL MaxS 4	0.045

All of the above concentrations are in keq/ha/yr

c) Conclusion

The tables above show that the process contributions from the installation are either insignificant (<1% of long term, <10% short term) or where above the insignificance criteria the PEC is <70%. We are therefore satisfied that the installation is not likely to damage the SSSI. There are no changes in emissions to water due to this variation.

The NOx background data was taken from APIS. However the DEFRA background maps suggest that the background could be higher than 30 µg/m3 at Shibdon Pond. The citation indicates that the SSSI is primarily an open body of water with some surrounding wetland vegetation, and the APIS website also identifies the SSSI as purely aquatic. There are therefore no applicable critical loads to assess against and it will not be sensitive to impacts from aerial emissions.

5.4.3 Assessment of other conservation sites

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

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

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

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

The Operator assessed the impact of pollutants against critical loads and critical levels.
The highest impacts were at the local wildlife site Shibdon Meadows

Site	Pollutant	EQS / EAL	Process Contribution (PC)	PC as % of EQS / EAL
Shibdon meadow	NOx (annual mean)	30	14.8	49.3
	NOx (daily mean)	75	74.85	99.8
	SO_2 (annual mean)	20	1.56	19.8
	HF (weekly mean)	0.5	0.031	6.2
	HF (daily mean)	5	0.0028	0.055

All the above concentration figures are in $\mu g/m^3$

Nitrogen deposition

Site	Critical load (CLo)	Process Contribution (PC)	PC as % of CLo
Shibdon Meadow	20	2.12	10.6

All of the above concentrations are in kgN/ha/yr

Acid deposition

Site	Critical loads	PC as % of CLo
Shibdon Meadow	CLMaxN 4.7, CL MaxS 3.8	7.2

All of the above concentrations are in keq/ha/yr

The tables above show that the PCs are below the critical levels or loads. We are satisfied that the Installation will not cause significant pollution at the sites. The Operator is required to prevent, minimise and control emissions using BAT, this is considered further in Section 6.

There are no changes in emissions to water due to this variation.

The above tables show that the PC for NOx daily mean is below, but close to the 100% threshold. Due to modelling uncertainty we have further considered

the impacts. The Application shows that the highest concentrations of NOx are predicted to be in the northern part of the LWS. This is away from the more species diverse area of the LWS in the south west that is described in the citation. The north east part of the LWS is in less favourable condition due to overgrazing. Although the daily mean NO_X PC is close to the critical level, there would be more concern if the long-term NOx was closer to the 100% (rather than short term as N deposition - which is more likely to contribute to species richness than direct short-term toxic effects).

5.5 Impact of abnormal operations

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

The Operator stated that they did not wish to take advantage of the abnormal operation conditions. Therefore the permit requires waste feed to cease in the event of an emission limit failure and abnormal operation is limit to failure of the measurement devices.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

- The first issue we address is the fundamental choice of co-incineration technology. There are a number of alternatives, and the Operator has explained why it has chosen one particular kind for this Installation.

- We then consider the chosen waste pre-treatment option

- We also consider the method chosen to generate electricity.

- We then consider control measures for the emissions.

- 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.

- We also consider measures to ensure that the syngas meets the end of waste specification.

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

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

Even if the Chapter IV limits are appropriate, operational controls complement the emission limits and should 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 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 co-incineration technology

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

The Waste Incineration BREF elaborates the furnace selection criteria as:

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

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

Overall, any of the furnace technologies listed below would be considered as BAT provided the Operator 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

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 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: 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

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Rotary Kiln	Can accept liquids and pastes more limited than grate (owing to refractory damage) applied to hazardous Wastes	<10 t/h	Very well proven with broad range of wastes and out even of HW	Throughputs lower than grates	TOC <3 %	Higher specific cost due to reduced capacity
Fluid bed - bubbling	Only finely divided consistent wastes. Limited use for raw MSW often applied to sludges	1 to 10 t/h	Good mixing Fly ashes of good leaching quality	Careful operation required to avoid clogging bed. Higher fly ash quantities.	TOC <3 %	FGT cost may be lower. Costs of waste preparation
Fluid bed - circulating	Only finely divided consistent wastes. Limited use for raw MSW, often applied to sludges / RDF.	1 to 20 t/h most used above 10 t/h	Greater fuel flexibility than BFB Fly ashes of good leaching quality	Cyclone required to conserve bed material Higher fly ash quantities	TOC <3 %	FGT cost may be lower. Costs of preparation.
Oscillating furnace	MSW / wastes	1 – 10 t/h	Robust Low maintenance Long history Low NOX level Low LOI of bottom ash	-higher thermal loss than with grate furnace - LCV under 15 GJ/t	TOC 0.5 – 3 %	Similar to other technologies

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Pulsed hearth	Only higher CV waste (LCV >20 GJ/t) □ used for clinical wastes	<7 t/h	can deal with liquids and powders	bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Stepped and static hearths	Only higher CV waste (LCV >20 GJ/t) Mainly used for clinical wastes	No information	Can deal with liquids and powders	Bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Spreader - stoker combustor	- RDF and other particle feeds □□ poultry manure □□ wood wastes	No information	- simple grate construction □□ less sensitive to particle size than FB	only for well defined mono-streams	No information	No information
Gasification - fixed bed	- mixed plastic wastes □□ other similar consistent streams □□ gasification less widely used/proven than incineration	1 to 20 t/h	-low leaching residue □□□ good burnout i oxygen blown □□ syngas available -Reduced oxidation of recyclable metals	- limited waste feed - not full combustion - high skill level □□ tar in raw gas - less widely proven	-Low leaching bottom ash □□ good burnout with oxygen	High operation/ maintenance costs

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Gasification - entrained flow	- mixed plastic wastes - other similar consistent streams □□□ not suited to untreated MSW □□□ gasification less widely used/proven than incineration	To 10 t/h	- low leaching slag □□ reduced oxidation of recyclable metals	- limited waste feed □□ not full combustion □□ high skill level □□ less widely proven	low leaching slag	High operation/ maintenance costs pre-treatment costs high
Gasification - fluid bed	- mixed plastic wastes □□ shredded MSW □□ shredder residues □□□ sludges □□metal rich wastes □□ other similar consistent streams □less widely used/proven than incineration	5 – 20 t/h	-temperatures e.g. for Al recovery □□ separation of non-combustibles -can be combined with ash melting - reduced oxidation of recyclable metals	-limited waste size (<30cm) - tar in raw gas - higher UHV raw gas - less widely proven	If Combined with ash melting chamber ash is vitrified	Lower than other gasifiers
Pyrolysis	□□pre-treated MSW □□ high metal inert streams □□ shredder residues/plastics □□pyrolysis is less widely used/proven than incineration	~ 5 t/h (short drum) 5 – 10 t/h (medium drum)	□no oxidation of metals □□ no combustion energy for metals/inert □□ in reactor acid neutralisation possible □□ syngas available	- limited wastes □□ processcontrol and engineering critical □□ high skill req. □not widely proven □□ need market for syngas	- dependent on process temperature □- residue produced requires further processing e.g. combustion	High pre-treatment, operation and capital costs

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

- Moving Grate Furnace
- Plasma system
- Steam reformation
- Pyrolysis / Gasification
- Autoclave with downstream pyrolysis systems

The Operator claimed that autoclaving followed by pyrolysis is BAT based on the specific setting of the proposed facility, with consideration for the following:

- Energy conversion that is comparable to or higher than the alternative techniques considered. A conversion efficiency of 25-33% was quoted;
- Higher amounts of recyclables recovered
- Better quality recyclates
- Less flue gas cleaning than mass burn incineration
- Lower amounts of fly ash
- Waste mass reduction comparable with alternatives
- Energy use recoverable from within the process – this is looked at in more detail below
- Lower capital costs than alternatives
- Small plant footprint
- Low water use of 0.5 m^3 per tonne of waste

The Operator has proposed to use a furnace technology comprising pyrolysis which is identified in the tables above as being considered BAT in the BREF or TGN for this type of waste feed.

The Operator proposes to use gas as support fuel for start-up, shut down and to maintain the temperature in the char oxidisers if required. We are satisfied that this is BAT.

Boiler Design

The Operator has confirmed that the boiler design (HRSG) will include all of the measures set out in our Technical Guidance Note, S5.01 to minimise the potential for reformation of dioxins within the de-novo synthesis range.

Summary

Any of the options listed in the BREF and summarised in the table above can be BAT. The Operator has chosen a furnace technique that is listed in the BREF and we are satisfied that the Operator has provided sufficient justification to show that their technique is BAT. This is not to say that the other techniques could not also be BAT, but that the Operator has shown that their chosen technique is at least comparable with the other BAT options. We believe that, based on the information gathered by the BREF process, the chosen technology will achieve the requirements of Chapter IV of the IED for the air emission of TOC/CO and the TOC on bottom ash.

6.1.2 Waste pre-treatment option

The Operator's current permit includes provision for waste treatment by autoclaves followed by removal of recyclables to produce a treated waste that they call Cellmat. The Operator proposes to dry the Cellmat and use it as a feed for the pyrolysis units. The Operator provided a BAT assessment of their chosen pre-treatment option against alternatives, this included looking at the energy requirements of the autoclave process against a MRF. The Operator's assessment is summarised below:

- Pyrolysis plants require pre-treated waste and effective pre-treatment is a fundamental requirement for reliable operation. Autoclaving provides the most effective method of generating a homogeneous feedstock for the pyrolysis process.
- The amount of recyclable materials that can be recovered is maximised.
- Autoclaving provides cleaned recyclable materials. Labels are removed from glass and plastic. Contaminated packaging is made suitable for recovery. Plastic film separated is from paper.
- Removal of recyclable materials, such as plastics, makes it suitable for pyrolysis.
- The energy demand of the autoclave process was compared to a MRF. Although the autoclave process has a higher energy demand, the MRF will require higher electricity usage to power the shredder. When this is converted to primary energy the energy demand of the autoclave process and the MRF are similar.
- The waste from autoclaving has a high biomass content (~80%) compared to ~50% from an MRF and contains very little plastic material.
- The existing autoclave process has the potential for higher odours, but will be controlled through the current scrubbing system. Odour control will be expanded upon with the addition of char oxidisers.
- Other environmental impacts are similar to an MRF plant.
- The autoclaves are in place at the site and are already permitted. Replacing them entail significant costs, estimated at £3 million.
- Water use will be higher for the autoclave process, but this will be minimised by recovering steam condensate.

6.1.3 Electricity generation

We also consider the method chosen to generate electricity.

The Operator compared their preferred method of syngas combustion in gas engines to the use of a steam cycle system and to the use of gas turbines. As part of this assessment the Operator considered whether a steam cycle plant would allow reduced syngas cleaning and hence improved energy recovery. The Operator's assessment is summarised below:

- Reduced syngas cleaning would result in boiler fouling and reduced performance.

- The use of a steam turbine in a steam cycle plant will result in lower efficiency. The highest efficiency high steam pressure turbines are not considered cost effective at the proposed site (considering the scale or the facility) and would only increase efficiency by ~5% with considerable extra cost. Heat recovery will also be low at this scale.
- Steam cycle plants have higher water, chemical and maintenance requirements.
- Manufacturers will not provide plant guarantees for gas turbines running on waste derived syngas.

The Operator's proposed method has achieved good quality CHP certification.

6.2 BAT and emissions control

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

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

- type of waste, its composition and variation
- type of combustion process, and its size
- flue-gas flow and temperature
- flue-gas content, size and rate of fluctuations in composition
- target emission limit values
- restrictions on discharge of aqueous effluents
- plume visibility requirements
- land and space availability
- availability and cost of outlets for residues accumulated/recovered
- compatibility with any existing process components (existing plants)
- availability and cost of water and other reagents
- energy supply possibilities (e.g. supply of heat from condensing scrubbers)
- reduction of emissions by primary methods
- release of noise.

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

6.2.1 Particulate Matter

Particulate matter				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Bag / Fabric filters (BF)	Reliable abatement of particulate	Max temp 250°C	Multiple compartments	Most plants

	matter to below 5mg/m^3		Bag burst detectors	
Wet scrubbing	May reduce acid gases simultaneously.	Not normally BAT. Liquid effluent produced	Require reheat to prevent visible plume and dew point problems.	Where scrubbing required for other pollutants
Ceramic filters	High temperature applications Smaller plant.	May "blind" more than fabric filters		Small plant. High temperature gas cleaning required.
Electrostatic precipitators	Low pressure gradient. Use with BF may reduce the energy consumption of the induced draft fan.	Not normally BAT.		When used with other particulate abatement plant

The Operator proposes to use Ceramic Filters and justified their use as follows:

The internal temperature of the combustion chamber can exceed 1200^{o}C and as such requires a high temperature filtration system. The plant under normal operation will be operated with the Heat Recovery Steam Generator Boilers, however this plant may be required to bypass (for whatever reason) and as such the baghouse plant may be subject to higher temperatures than the 300^{o}C normal operating temperatures. The use of a conventional cloth baghouse plant would have the potential to catch fire under such circumstances. Furthermore it is possible to achieve much higher removal efficiencies of finer particulates. As such, the use of conventional cloth construction baghouse plant is not considered BAT for this application and a high efficiency ceramic filtration system has been selected accordingly.

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

6.2.2 Oxides of Nitrogen

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

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

Reagent Type: Urea	Likely to be BAT			All plant

The Operator proposes to implement the following primary measures:

- Highly turbulent combustion conditions used in the char burners.
- Combustion temperatures minimises thermal NOx
- Low N content in fuel minimises fuel NOx
- Engine management for the gas engines

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

SCR can reduce NO_x levels to below 70 mg/m^3 and can be applied to all plant, it is generally more expensive than SNCR and requires reheating of the waste gas stream which reduces energy efficiency, periodic replacement of the catalysts also produces a hazardous waste. SNCR can typically reduce NO_x levels to between 150 and 180 mg/m^3, it relies on an optimum temperature of around 900^{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. Either reagent is BAT, and the use of one over the other is not normally significant in environmental terms.

The Operator has not proposed secondary abatement for the char burners or the gas engines. The Operator submitted a cost benefit BAT assessment. The assessment identified that the gas engines were the most significant source of NOx emissions (the char burners only account for ~13% of the total NO_X emissions) and that the only available technology that could be used is SCR. The Operator's assessment showed that the equivalent cost per tonne of NOx abated would be £2120. This was based on a ~60% reduction to reduce all impacts at receptors to <1% of the EQS.

Based on this Operator considers that the additional cost of SCR is not justified by the reduction in environmental impact. The Environment Agency agrees with this assessment given that the maximum impact at a relevant long term receptor is predicted to be 1.4% of the EQS.

6.2.3 Acid Gases, SO_x, HCl and HF

Acid gases and halogens : Primary Measures				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Low sulphur fuel, (< 0.1%S gasoil or natural gas)	Reduces SOx at source		Start-up, supplementary firing.	Where auxiliary fuel required.
Management of waste streams	Disperses sources of acid gases (e.g. PVC) through feed.	Requires closer control of waste management		All plant with heterogeneous waste feed

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Wet	High reaction rates Low solid residues production Reagent delivery may be optimised by concentration and flow rate	Large effluent disposal and water consumption if not fully treated for re-cycle Effluent treatment plant required May result in wet plume Energy required for effluent treatment and plume reheat		Plants with high acid gas and metal components in exhaust gas – HWIs
Dry	Low water use Reagent consumption may be reduced by recycling in	Higher solid residue production Reagent consumption controlled only by input rate		All plant

	plant Lower energy use Higher reliability			
Semi-dry	Medium reaction rates Reagent delivery may be varied by concentration and input rate	Higher solid waste residues		All plant
Reagent Type: Sodium Hydroxide	Highest removal rates Low solid waste production	Corrosive material ETP sludge for disposal		HWIs
Reagent Type: Lime	Very good removal rates Low leaching solid residue Temperature of reaction well suited to use with bag filters	Corrosive material May give greater residue volume if no in-plant recycle	Wide range of uses	MWIs, CWIs
Reagent Type: Sodium Bicarbonate	Good removal rates Easiest to handle Dry recycle systems proven	Efficient temperature range may be at upper end for use with bag filters – Leachable solid residues Bicarbonate more expensive	Not proven at large plant	CWIs

The Operator 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 SOx at source. The Operator has justified its choice of gas / gasoil as the support fuel on the basis that duel fuel burners will be used with the choice dependent on whether a min gas supply connection can be made to the site and we agree with that assessment.
- Management of heterogeneous wastes – this will disperse problem wastes such as PVC by ensuring a homogeneous waste feed. The pre-treatment will help to ensure a homogeneous waste feed.
- Removal of plastics in the pre-treatment steps.

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

The Operator has therefore considered the use of anhydrous lime or similar materials for acid gas abatement.

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

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

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

6.2.4 Carbon monoxide and volatile organic compounds (VOCs)

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

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

6.2.5 Dioxins and furans (and Other POPs)

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

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

- Syngas is produced which has been shown to meet the end of waste test and no more polluting than natural gas
- The char that is combusted in the oxidisers is free of chlorinated compounds.
- combustion in the thermal oxidisers will meet the required combustion temperature and residence time;
- avoidance of de novo synthesis;

- the effective removal of particulate matter, which has been considered in 6.2.1 above;
- Effective control of acid gas emissions also assists in the control of dioxin releases.

We are satisfied that the Operator's proposals are BAT.

6.2.6 Metals

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

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

Unlike other metals however, mercury if present will be in the vapour phase and hence will be present in the syngas. The Operator proposes to clean the syngas before combustion. Limits in the permit require metals to be no higher than those in natural gas.

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 Operator will therefore be required to optimise the performance of the secondary NO_x abatement system to ensure its GWP impact is minimised.

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

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

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

Factors influencing GWP and CO_2 emissions from the Installation are:
On the debit side

- CO_2 emissions from the burning of the waste;
- CO_2 emissions from burning auxiliary or supplementary fuels;
- CO_2 emissions associated with electrical energy used;
- N_2O from the de-NOx process.

On the credit side

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

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

The Operator considered energy efficiency and provided a justification for not using SNCR or SCR for NOx abatement. BAT assessment. This is set out in sections 4.3.7 and 6 of this decision document.

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

Taking all these factors into account, the Operator's assessment shows that the choice of thermal treatment option is best in terms of GWP and that the difference in global warming potential between the best option for pre-treatment in terms of GWP and the Operator's preferred option is minor. The

purpose of a BAT appraisal is to determine which option minimises the impact on the environment as a whole. In this context the small benefit in terms of GWP of the other options is considered to be more than offset by the other benefits of the preferred option.

The Environment Agency agrees with this assessment and that the chosen option is BAT for the installation.

6.4 Syngas Clean-up and end of waste

The Operator provided a specification for their syngas as shown below at a CV of 20 MJ/kg. We have added a column to show the concentration when converted to the CV of natural gas.

Substance	Proposed syngas specification (based on CV	Proposed syngas specification (based on CV of
Sulphur containing compounds		
Total Sulphur	50 mg/m^3	50 mg/m^3
Hydrogen Sulphide (H_2S)	5 mg/m^3	5 mg/m^3
Halogenated Hydrocarbons		
Total Halogenated Hydrocarbons	1.5 mg/m^3	1.5 mg/m^3
Aromatic Hydrocarbons		
Xylenes (all isomers)	100 mg/m^3	100 mg/m^3
Metals		
Total heavy metals		0.03 mg/m^3

The levels of total sulphur, hydrogen sulphide, aromatic hydrocarbons and halogenated hydrocarbons are in line with the levels for natural gas set out in our briefing note (Briefing on classifying syngas as a waste).

For metals the Operator used data from a report by the European Environment Agency (EEA) on emission factors from combustion units. The Operator claimed that 0.035 mg/m^3 is the 95%ile figure for total metals shown in this report. In the same report updated figures are presented later in the report. Total heavy metals in this section (table 3-24 of the report) are given as 0.030 mg/m^3. However these are based on a CV of 37 MJ/kg rather than at a CV of 20 MJ/kg as the Operator has claimed. In addition natural gas analysis for another similar permit application showed total heavy metals at ~ 0.03 mg/m^3. Therefore we have set the limit in the permit at 0.03 mg/m^3. The Operator confirmed that they could meet this limit. We have also set an improvement condition (IC 5) for the Operator to report on syngas monitoring and also to carry out natural gas analysis to confirm the information provided in the Application.

Based on the above specification we are satisfied that the syngas would be no more polluting than natural gas when burned.

We have set monitoring requirements to ensure that syngas is monitored against this specification. This is covered in section 6.9 of this decision document.

Syngas clean up will consist of gas quench to cool the syngas to 70°C, a gas wash tower and a gas absorption tower . The system is designed to remove acid gases, tars and oils. The system will be monitored using a SCADA system to ensure that it operates within the required parameters.

6.5 BAT and POPs

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

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

The unintentionally-produced POPs addressed by the Convention are:

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

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

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

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

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

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

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

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

The release of **dioxins and furans** to air is required by the IED to be assessed against the I-TEQ (International Toxic Equivalence) limit of 0.1ng/m^3. Further development of the understanding of the harm caused by dioxins has resulted in the World Health Organisation (WHO) producing updated factors to calculate the WHO-TEQ value. Certain **PCBs** have structures which make them behave like dioxins (dioxin-like PCBs), and these also have toxic equivalence factors defined by WHO to make them capable of being considered together with dioxins. The UK's independent health advisory committee, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has adopted WHO-TEQ values for both dioxins and dioxin-like PCBs in their review of Tolerable Daily Intake (TDI) criteria. The Permit requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should

be monitored for reporting purposes, to enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. The Permit also requires monitoring of a range of PAHs and dioxin-like PCBs at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs as listed in the Permit. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2.1 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health.

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

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

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

We have assessed the control techniques proposed for dioxins by the Operator 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.

6.6 Other Emissions to the Environment

6.6.1 Emissions to water

The only discharge to controlled water will be off uncontaminated rainwater run-off via an interceptor. The water will discharge to a ditch that runs along the southern boundary of the site.

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.

6.6.2 Emissions to sewer

The current site has a waste water treatment plant and a trade effluent consent is in place for the discharge to sewer. The pyrolysis plant will have its own effluent treatment plant to treat effluent from the syngas cleaning system. The treatment will consist of a separation tank and centrifuge. Liquors will be recycled back to the syngas scrubber with a bleed off to the existing autoclave treatment plant. The Operator provided an H1 impact assessment for this additional discharge that showed all impacts to be insignificant. We have not set ELVs for the discharge. The Operator will need a trade effluent discharge consent. We have not set ELVs for the discharge to prevent double regulation of the discharge.

6.6.3 Fugitive emissions

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

The entire site is located on impermeable hardstanding. New tanks will have level gauges and alarms and will have secondary containment that will comply with Environment Agency guidance PPG2. Chemicals stored in IBCs will be in a bunded area. An inspection programme will be in place. Delivery area will be within a sealed drainage area.

Any minor spills will be cleaned up immediately using sand or other absorbent. In the event of a major spillage action would be taken to prevent liquid reaching drains or land.

Fugitive emissions to air are controlled through the measures designed to control odour and are discussed in more detail in section 6.5.4 of this decision document.

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

6.6.4 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.

The Operator provided an odour management plan (OMP). We are satisfied if the plant is operated in accordance with the OMP that odour nuisance is unlikely. However we have not fully approved the OMP until it has been shown that the proposed measures work in practice. Permit condition 2.3.1 (b) can require a revised plan to be submitted if needed.

The key measures described in the OMP are:

- Waste will be delivered in covered, enclosed vehicle into the reception hall.
- Vehicles will enter the reception hall via roller shutter doors.
- The reception area will be maintained under negative pressure.
- The reception hall will be cleared of waste by the end of each working shift.
- The site has an existing scrubber system. The autoclaves have hoods which extract to this scrubber system.
- The addition of the pyrolysis units will provide an additional extraction capacity through the use of combustion air in the char burner units.

The OMP included contingency measures in the event of equipment failure. These are summarised below:

- The autoclave process will not operate if the pyrolysis units are not operating.
- The scrubbing system operates at all times. In the event of failure the autoclave plant would be shut down. The pyrolyser char burners would provide residual extraction.
- If the char burners fail the plant will be shut down with the scrubbing system maintaining extraction.
- If the scrubber and char burners are down then incoming waste would be diverted and the building sealed until odour control is re-established. If this occurred for a protracted period waste would be removed from the site.
- If the autoclaves are not operational for greater than a day waste deliveries would be diverted away from site to prevent waste build up in the reception hall.

6.6.5 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 existing site was designed to achieve an internal noise level of no greater than 85dB. The pyrolysis plant will be housed in a dedicated internal plant room and will be designed to an internal noise specification of 65dB(A). The room will be constructed with acoustic panels. Gas engines will be located outside the building on the western side. They will be enclosed inside acoustic enclosures and will be guaranteed to meet a specification of 65dB(A). New stacks will be fitted with stack attenuators.

We are satisfied that the new equipment will not cause any increase in noise impacts. The total noise level of the four gas engines is 71dB(A). The nearest residential properties are ~600m away, at this distance the noise level from the gas engines will only be ~15dB(A) and highly unlikely to be audible. A hotel is located 220m away. The noise level due to the gas engines at this distance will be ~ 25dB(A) and highly unlikely to be significant.

6.7 Setting ELVs and other Permit conditions

6.7.1 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 Operator'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 following information:

The location of receptors was considered in the dispersion modelling. This is discussed in section 6. No conditions above those required by BAT were need

(ii) National and European EQSs

Relevant EQSs were considered in the dispersion modelling. This is discussed in section 6. No conditions above those required by BAT were needed.

(iii) Global Warming

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

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

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

Factors influencing GWP and CO_2 emissions from the Installation are:
On the debit side

- CO_2 emissions from the burning of the waste
- CO_2 emissions associated with electrical energy used

On the credit side

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

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

The Operator considered energy efficiency in their BAT assessment. This is set out in sections 4.3.7 and 6 of this decision document.

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

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

The Environment Agency agrees with this assessment and that the chosen option is BAT for the installation.

(iv) Commissioning

Pre-operational condition (PO4) has been set for a commissioning plan to be agreed.

6.8 Monitoring

6.8.1 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 establish data on the release of dioxin-like PCBs and PAHs from the incineration process, to monitor syngas quality against limits 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.

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

The Operator will use CEMS to monitor emissions as set out in table S3.1. If the CEMS fail Condition 2.3.9 of the permit requires that the abnormal operating conditions apply.

6.8.3 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 emission it is not justifiable to require the Operator to install additionally continuous monitoring or sampling devices for these substances.

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

6.9 Reporting

We have specified the reporting requirements in Schedule 5 of the Permit either to meet the reporting requirements set out in the IED, or to ensure data is reported to enable timely review by the Environment Agency to ensure compliance with permit conditions and to monitor the efficiency of material use and energy recovery at the installation.

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

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

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

In this case the planning authority (Gateshead Council) did not require an EIA to be submitted. In any event we have considered all environmental impacts relevant to the permit determination through the EPR application.

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 allows hazardous waste to be added to the autoclaved waste prior to pyrolysis. The provisions of Article 13 are still complied with and the adverse impact of the waste management on human health and the environment is not increased; and the mixing operation conforms to best available techniques.

We consider that the intended method of waste treatment is acceptable from the point of view of environmental protection so Article 23(3) does not apply. Energy efficiency is dealt with elsewhere in this document but we consider the conditions of the permit ensure that the recovery of energy take place with a high level of energy efficiency in accordance with Article 23(4).

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

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

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

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

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

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

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

Our decision in this case has been reached following public consultation. The way in which this has been done is set out in Section 2. A summary of the responses received to our consultations and our consideration of them is set out in Annex 4.

7.2 National primary legislation

7.2.1 **Environment Act 1995**

(i) Section 4 (Pursuit of Sustainable Development)

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

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

In respect of regulation of industrial pollution through the EPR, the Guidance refers in particular to the objective of setting permit conditions "*in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters…*". The Environment Agency considers that it has pursued the objectives set out in the Government's guidance, where

relevant, and that there are no additional conditions that should be included in this Permit to take account of the Section 4 duty.

(ii) Section 7 (Pursuit of Conservation Objectives)

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

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

(iii) Section 81 (National Air Quality Strategy)

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

7.2.2 **Human Rights Act 1998**

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

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

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

7.2.4 **Wildlife and Countryside Act 1981**

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

We assessed the Application and concluded that the Installation will not damage the special features of any SSSI.

The CROW assessment is summarised in greater detail in section 5.4 of this document.

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. There are no European sites within 10km of the Installation.

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2 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 and Tables S2.3 and S2.4 in Schedule 3 of the Permit
45(1)(b)	The permit shall include the total waste incinerating or co-incinerating capacity of the plant.	Condition 2.3.3 and Tables S2.3 and S2.4 in Schedule
45(1)(c)	The permit shall include the limit values for emissions into air and water.	Table S3.1
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	There are no such discharges of gas cleaning effluent
45(1)(e)	The permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Conditions 3.5.1 and Tables S3.1, S3.2, S3.3, S3.4 and S3.5. also compliance with Articles 10 and 11
45(1)(f)	The permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.9 to 2.3.15
45(2)(a)	The permit shall include a list of the quantities of the different categories of hazardous waste which may be treated.	Table S2.4 and S2.5
45(2)(b)	The permit shall include the minimum and maximum mass flows of those hazardous waste, their lowest and maximum calorific values and the maximum contents of polychlorinated biphenyls, pentachlorophenol, chlorine,	Table S2.5 and pre-operational condition PO7

IED Article	Requirement	Delivered by
	fluorine, sulphur, heavy metals and other polluting substances.	
46(1)	Waste gases shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Emissions and their ground-level impacts are discussed in the body of this document
46(2)	Emission into air shall not exceed the emission limit values set out in part of Annex VI.	Conditions 3.1.1 and 3.1.2 and Table S3.1
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.	The application explains the measures to be in place for achieving the directive requirements
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance, and with a maximum cumulative limit of 60 hours per year.	Conditions 2.3.9 to 2.3.15
47	In the event of breakdown, reduce or close down operations as soon as practicable.	condition 2.3.13
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Schedule 7 details this standardisation requirement
48(2)	Installation and functioning of the automated measurement systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	condition 3.5.3, and tables S3.1, and S3.4
48(3)	The competent authority shall	tables S3.1 and S3.4

IED Article	Requirement	Delivered by
	determine the location of sampling or measurement points to be used for monitoring of emissions.	
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.	Reporting requirements are set out in schedule 4 of the permit
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.	Condition 3.5.5 and table S3.1
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Conditions 3.5.1 and Table S3.6
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Pre-operational condition PO5 and improvement condition IC2. The application specifies measurement point
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.	(a) The plant will generate electricity and heat will be used back in the process (b)Operator to review the available heat recovery options prior to commissioning (Condition PO2) and then every 2 years (Condition 1.3. 3)
50(6)	Relates to the feeding of infectious clinical waste into the furnace.	No infectious clinical waste will be burnt

IED Article	Requirement	Delivered by
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
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	- EPR require prevent or minimise pollution. - the Application defines how this will be carried out. - conditions 2.3.1 to 2.3.8
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	The application describes procedures for the reception and monitoring of incoming waste
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).	Permit condition 2.3.7
52(4)	Prior to accepting hazardous waste, the operator shall carry out the procedures set out in Article 52(4).	Permit condition 2.3.8
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	conditions 3.5.1 and 1.5.1
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	conditions 1.5.1, 2.3.1 and 3.2.1
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1 and pre-operational condition PO3.
55(1)	Application, decision and permit to be publicly available.	These are available on our 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

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 pyrolysis plant.

Reference	Pre-operational measures
PO1	Prior to the commencement of commissioning, the Operator shall send a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with the requirements set out in Section 1 of How to comply with your environmental permit – Getting the basics right. The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.
PO2	Prior to the commencement of commissioning, the Operator shall send a report to the Environment Agency which will contain a comprehensive review of the options available for utilising the heat generated by the waste co- incineration process in order to ensure that it is recovered as far as practicable. The review shall detail any identified proposals for improving the recovery and utilisation of waste heat and shall provide a timetable for their implementation.
PO3	Prior to the commencement of commissioning, the Operator shall submit to the Environment Agency for approval a protocol for the sampling and testing of thermal oxidiser residue 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	After completion of furnace design of the thermal oxidisers and at least three calendar months before any furnace operation; the operator shall submit a written report to the Environment Agency of the details of the computational fluid dynamic (CFD) modelling. The report shall demonstrate whether the design combustion conditions comply with the residence time and temperature requirements as defined by the Waste Incineration Directive.
PO6	At least three months before operation, the Operator shall submit a written report to the Environment Agency specifying arrangements for continuous and periodic monitoring of emissions to air to comply with Environment Agency guidance notes M1 and M2. The report shall include the following: • Plant and equipment details, including accreditation to MCERTS • Methods and standards for sampling and analysis • Details of monitoring locations, access and working platforms
PO7	Prior to the commencement of commissioning, the Operator shall submit the following details regarding the composition of blended hazardous waste that is to be charged to the pyrolyser:

	(i) The minimum calorific value; (ii) The maximum concentrations of; • Polychlorinated biphenyls; • Pentachlorophenol; and • Fluorine. (vi) Confirmation of other parameters in table S2.5.
PO8	The Operator shall submit the written protocol referenced in condition 3.2.4 for the monitoring of soil and groundwater for approval by the Environment Agency. The protocol shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The procedure shall be implemented in accordance with the written approval from the Environment Agency.
PO9	Prior to the commencement of commissioning, the Operator shall send an updated Fire Prevention Plan to the Environment Agency for approval. The plan shall provide any updates made to the plan submitted with variation application EPR KB3939RR/V002. The plan shall be in accordance with Environment Agency guidance on Fire Prevention Plans.

ANNEX 3: Improvement Conditions

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

Reference	Improvement measure	Completion date
IC1	The Operator shall submit a written report to the Environment Agency on the 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.
IC2	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.
IC3	The Operator shall carry out an assessment of the impact of emissions to air of the following component metals subject to emission limit values, As, and Cr(VI). A report on the assessment shall be submitted to the Environment Agency. Emissions monitoring data obtained during the first year of operation shall be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application. An assessment shall be made of the impact of each metal against the relevant EQS/EAL. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work.	15 months from commencement of operations
IC4	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.
IC5	The Operator shall carry out analysis of at least 3 sample of natural gas for the substances specified	Within 6 months of the start of operation

	in table S3.5. The operator shall submit a written report to the Environment Agency containing the results of syngas testing carried out under condition 3.5.5 and compare this to the natural gas analysis and the limits specified in table S3.5. The report shall include but not be limited to: • A description of the waste types that were pyrolysed to generate the syngas • Details of how the samples were taken • Details of the methods used to analyse the samples including the limits of detection The report shall be submitted to the Environment Agency in writing.	
IC6	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 PM10, and PM2.5 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.

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 19/06/14 to 17/07/14 and in the Newcastle Chronicle on 19/06/14. The Application was made available to view in the Environment Agency Public Register at Tyneside House, Newcastle.

The following bodies were consulted: -

- Gateshead Council
- Newcastle city council
- Food standards agency
- Public Health England
- Director of public health – Gateshead
- Director of public health – Newcastle
- Health and safety executive
- Local fire service
- Animal Health
- Northumbrian Water

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from **Gateshead Council**	
Brief summary of issues raised:	Summary of action taken / how this has been covered
There are no planning issues relating to noise	No action required

Response Received from **Public Health England (PHE)**	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No significant concerns on public health, based on the information received. Assumes that appropriate measures will be taken to control pollution in line with sector guidance and best practice.	Measures to control pollution are covered in the application and discussed in this decision document

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

No comments were received