Determination of an Application for an Environmental Permit under the Environmental Permitting (England & Wales) Regulations 2016

The Permit Number is:	EPR/HP3735AE
The Applicant / Operator is:	Falcon Waste Development Land Company Limited
The Installation is located at:	Clay Cross Energy Recovery Facility Land Off Bridge Street Clay Cross Derbyshire S45 9NY

What this document is about

This is a decision document, which accompanies a permit.

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

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

Preliminary information and use of terms

We gave the application the reference number EPR/HP3735AE/A001. We refer to the application as "the **Application**" in this document in order to be consistent.

The number we have given to the permit is EPR/HP3735AE. We refer to the proposed permit as "the **Permit**" in this document.

The Application was duly made on 11/3/16.

The Applicant is Falcon Waste Development Land Company Limited. We refer to Falcon Waste Development Land Company Limited as “the Applicant” in this document. Where we talk about what would happen after the Permit is granted, we call Falcon Waste Development Land Company Limited “the **Operator**”.

Falcon Waste Development Land Company Limited proposed facility is located at:

Clay Cross Energy Recovery Facility
Land Off Bridge Street
Clay Cross
Derbyshire
S45 9NY.

We refer to this as “the Installation” in this document.

How this document is structured

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Glossary of acronyms used in this document

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

AAD	Ambient Air Directive (2008/50/EC)
APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BREF	BAT Reference Note
CEM	Continuous emissions monitor
CHP	Combined heat and power
COMEAP	Committee on the Medical Effects of Air Pollutants
CROW	Countryside and rights of way Act 2000
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
EAL	Environmental assessment level
EIAD	Environmental Impact Assessment Directive (85/337/EEC)
ELV	Emission limit value
EMAS	EU Eco Management and Audit Scheme
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No. 1154) 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)
I-TEF	Toxic Equivalent Factors set out in Annex VI Part 2 of IED
I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
LADPH	Local Authority Director(s) of Public Health
LOI	Loss on Ignition
MBT	Mechanical biological treatment
MSW	Municipal Solid Waste
MWI	Municipal waste incinerator
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
Opra	Operator Performance Risk Appraisal
PAH	Polycyclic aromatic hydrocarbons
PC	Process Contribution
PCB	Polychlorinated biphenyls
PEC	Predicted Environmental Concentration
PHE	Public Health England
POP(s)	Persistent organic pollutant(s)
PPS	Public participation statement
PR	Public register
PXDD	Poly-halogenated di-benzo-p-dioxins
PXB	Poly-halogenated biphenyls
PXDF	Poly-halogenated di-benzo furans
RDF	Refuse derived fuel
RGS	Regulatory Guidance Series
SAC	Special Area of Conservation
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 the IED

1 Our decision

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

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

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

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

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 11/3/16. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

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

2.2 Consultation on the Application

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

We advertised the Application by a notice placed on our website, which contained all the information required by the IED, including telling people where and when they could see a copy of the Application. We also placed an advertisement in the Derbyshire Times on 31/3/16.

We made a copy of the Application and all other documents relevant to our determination (see below) available to view on our Public Register at:

Environment Agency
Trentside Offices
Trentside North
West Bridgford
Nottingham
NG2 5FA.

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":

- Director of Public Health, Derbyshire County Council
- Public Health England
- Environmental Health, North East Derbyshire District Council
- Food Standards Agency
- Health and Safety Executive
- Derbyshire Fire and Rescue Service
- National Grid
- Natural England

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

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

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it, and issued information notices on 25/05/16, 21/10/16, and 28/2/17. A copy of each information notice was placed on our public register.

In addition to our information notices, we received additional information during the determination from the Applicant on 16/12/16 regarding the fate of bottom ash and ashes from syngas cleaning, and on 27/4/17 confirming the quality of the feedstock. We made a copy of this information available to the public in the same way as the responses to our information notices.

3 The legal framework

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

- an *installation* and a *waste 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 the Permit, it will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

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

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

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

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

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

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

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

An installation may also comprise "directly associated activities", which at this Installation includes a small backup diesel electricity generator for emergencies and the cooling system.

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

4.1.2 The Site

The site is roughly rectangular in shape and currently disused. The site was until recently a waste transfer station for dry recyclables and a metal recycling facility. It is for the most part unsurfaced, although a small section of the site in the south-western corner contains hard surfacing (approximately 30% of total site area).

The site is accessed directly off Bridge Street and is bounded by industrial development to the west, south and east, and open land to the northwest. To the north lies the now restored former Egstow Quarry landfill site, whilst the redeveloped former Biwaters site is to the northeast.

A new housing development onto Furnace Hill Road (and centred on Dewley Way) is located 110m from the nearest point from the site's environmental permit boundary. Further residential properties are located off Brassington Street, approximately 160m and off Egstow Street 165m from the site's environmental permit boundary. Between the site and these properties are industrial premises. Residential properties on John Street are located around 200m from the site's environmental permit boundary.

The South Pennine Moors SAC and Peak District Moors SPA are located approximately 8km away. There are also 11 local wildlife sites or ancient woodlands within 2km of the site, the nearest being St Lawrences Churchyard local wildlife site which is approximately 850m away.

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

Further information on the site is addressed below at 4.3.

4.1.3 <u>What the Installation does</u>

The Applicant has described the facility as Energy Recovery. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the installation is a waste co-incineration plant because:

Notwithstanding the fact that waste will be thermally treated by the process; the process is never the less 'co-incineration' because it is considered that main purpose of this plant is the generation of energy. The applicant states that it expects the gross electrical output at minimum plant load will be 0.83MWhe/tonne, which is above the threshold of 0.8 MWhe/tonne that we consider to be co-incineration in our guidance note RGN2 appendix 2.

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

Process Summary,

The proposed ERF building will comprise the following:

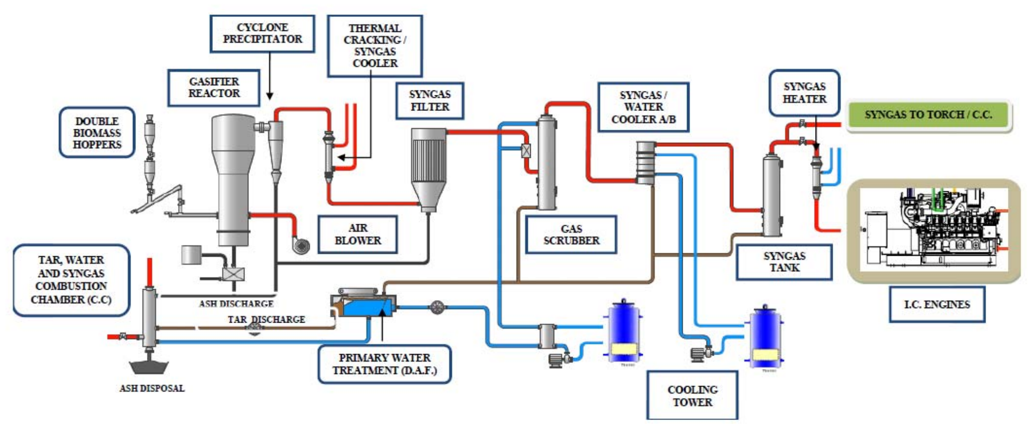
- waste reception hall with fuel feedstock storage areas;

- feedstock preparation area;
- feedstock infeed rakes and conveyors;
- gasifier units and associated equipment;
- six gas engines and associated fans and flue stack; and
- MCC/control room and MV substation.

Outside of the main building, the following features will be required;
- weighbridge;
- storage tanks (including water, nitrogen, lube oil and tar);
- tar and liquor combustion chamber;
- electrical substation;
- cooling tower and dry cooler;
- site access roads; and
- surfaced storage areas for plant and equipment

The gasification of the feedstock will take place on a bubbling fluidized bed, at a temperature between 750 – 850°C. In order to carry out annual maintenance and servicing the gasification plant is anticipated to operate between 7,800 and 8,200 hours per year. Each biomass line has a design capacity of 3.3 tonnes per hour. This will equate to 80,000 tonnes per annum throughput. The energy produced will be used to generate approximately 10.5MWe net for export to the National Grid, equating to between 81,900 and 86,100 MWhr per year.

The process summary for the facility is illustrated in Figure 1 below:



Fuel Receiving System,

Feedstock will be loaded onto a walking floor consisting of a series of heavy duty in-feed rakes, from which the feedstock is advanced into the system by the action of the rakes. A dust suppression system will cover the reception building to minimise fire risk.

Fuel will be conveyed to the disc screen which will allow for material less than 35mm in two dimensions to pass through. The accepted material will drop onto a screen undersize conveyor and the oversized material will spill over the end of the screen into a chute feeding a skip underneath.

Ferrous material will be removed from the feedstock by a drum magnet whilst non-ferrous material will be removed by an eddy current separator. Pre-screening and metals removal will be performed as a mitigation measure against contrary material in order to reduce downtime due to out of specification material.

Following sorting and separation, feedstock will be conveyed to the metering bins which will control the flow rate of fuel into the associated gasifier unit. When the system is not in operation, a hydraulically actuated feedstock isolation gate valve at the outlet of the metering bin will prevent air flow through the fuel metering system.

Gasification System,

The biomass gasification plant will have three gasifier lines, each one will contain the following elements of equipment;-

- gasifier reactor;
- air blower;
- cyclone precipitator;
- thermal cracking reactor
- syngas cooler;
- syngas filter;
- syngas washing and scrubber section;
- syngas / water cooler (two units A/B);
- syngas homogenizer tank;
- syngas heater;
- primary water treatment;

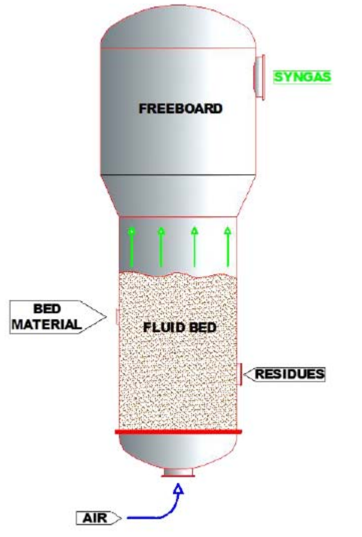
The plant will also feature a number of elements common to the three gasifier lines as follows:

- tar & residual liquor combustion chamber; and
- monitoring and control system.

Gasifier reactor,

The gasifier will consist of a steel cylinder, thermally insulated internally with refractory materials. Gasification of biomass will take place on a bubbling fluidized bed, at a temperature in between 750 - 850 ºC. An air blower will introduce the gasification air into the gasifier base and the biomass will be introduced around 1 meter higher than the air distribution plate.

Fluidised bed Gasifier



The gasifier requires air to fluidize the bed and to have the necessary oxygen for gasification reactions. The fluidisation air will be supplied by a compressor and will be uniformly distributed at the bottom of the reactor by an air distribution grill with nozzle type diffusers.

Gas Cleanup System,

The gas cleanup system will be comprised of the following items of equipment:

Cyclonic precipitator,
The hot synthesis gas that leaves the reactor will pass through a conventional cyclone followed by another high efficiency cyclone, where the majority of the particles suspended in the gas will be removed. The decelerating hoppers (usually referred to as vortex breakers) joined to the back of each cyclone will help capture the particles.

Thermal cracking reactor,
Thermal cracking and reforming reactor, preheated oxygen is added to react with the combustible species and as a result a temperature increase of a gas fraction is obtained. This temperature increase creates the conditions necessary for the decomposition of hydrocarbons (tars) to become in gas. Furthermore, a water quench is added to reduce the temperature and promote reforming reactions.

Syngas cooler,
Syngas will be cooled down in a shell and tube heat exchanger. Tubes will be made of high temperature corrosion resistant stainless steel.

Syngas filter,
Residual ashes contained in the syngas will be collected in a dry type filter.
Ashes will be extracted out of the filter by means of a screw conveyor

Gas scrubber,

The presence of the pollutants ammonia (NH_3), chlorine (Cl), sulphur (S) and hydrogen chloride (HCl) in the syngas is likely to exceed the internal combustion engine manufacturer limits, therefore a gas scrubber will be installed. The scrubber sprays water through the syngas, cooling it further, and causing any entrained contaminants and droplets to be washed out of the gas stream. The liquid effluent from this process firstly passes through a Dissolved Air Flotation (DAF) separator, which separates the oily fraction from the water. The water is recirculated through the scrubber, and the oily fraction is sent to the combustion chamber for oils and tars.

Syngas/water cooler A/B,
Syngas will be cooled down in a gas/water heat exchanger, in order to reduce syngas temperature to 40 ºC. Two units in parallel will be installed, one running and one stand-by to allow maintenance and cleaning of each unit without causing plant downtime.

The heat exchanger will be an indirect type, without mass transfer, therefore there is no water consumption. Syngas temperature will drop below dew point, thus moisture will be contained in syngas condensates. Condensate water will be pumped to the water/oil separation system.

Gas tank
In order to avoid gas pressure fluctuations and provide a gas residence time, to maintain stable pressure in the syngas line to the gas engines, one syngas tank with capacity of one minute of gas production will be installed.

Gas heater
Syngas will be heated in a gas/water heat exchanger, in order to increase the syngas temperature to 60 ºC, this ensures the gas is sufficiently dry to enter the gas engines without causing any condensation in the engine fuel injection system. The heat exchanger will be a closed circuit indirect type, without mass transfer, and thus there will be no water consumption.

Engines,

The power plant will consist of six Jenbacher generator sets, model number E0620GM, each set will produce up to 2MW of electrical output to the grid. The total gross electrical power will be approximately 12MW, of which approximately 1.5MW will be required to operate the remainder of the facility, leaving a net electrical output from the plant of 10.5MW.

Gas engine cooling system,
The gas engine will have two water cooling circuits (high and low temperature). The high temperature cooling circuit will cool the engine block, the first stage of the engine aftercooler and the engine oil. Heat from this primary water circuit will be removed by a plate heat exchanger to a secondary water circuit. The high temperature circuit will have an electrical pump and a thermostatic valve to regulate water temperature. The secondary water circuit will have an air-cooled water cooler (or cooling tower) to dissipate the heat removed.

The low temperature cooling circuit will cool down the second stage of the engine aftercooler. Heat will be removed by a plate heat exchanger to a secondary water circuit. The low temperature circuit will have an electrical pump and a thermostatic valve to regulate water temperature. The secondary water circuit will have a cooling tower to dissipate the heat removed.

Residue Handling,

The residues from the gasification and gas cleanup process are as follows:

- Liquors and tars condensed from the syngas stream;
- Waste water from syngas scrubbing; and
- Ash residue from the gasifiers and collected in the syngas filter.

These residues are treated as follows:

Primary water treatment,
Liquor condensate from the gas scrubber and syngas cooler will contain a quantity of oil, which will be recovered in a Dissolved Air Flotation (DAF) type water/oil separator. Oil and water purge will be stored in tanks for combustion in the tar/liquor combustion chamber.

Tar, liquor and syngas combustion chamber,
Tars (hydrocarbons) and liquor condensates from the syngas will be burned in a combustion chamber. This chamber will also be used to oxidize the syngas on transient periods for example during start up, shut down and commissioning. The combustion chamber will be equipped with a low-NOx dual fuel burner (Natural Gas/LPG and syngas) in order to ensure a minimum temperature inside the chamber of 850ºC for 2 seconds.

Ash Handling,
The char produced in the gasifiers and that collected in the syngas filter will be conveyed by screw conveyer into the tar/water combustion chamber, where any residual carbon remaining will be combusted in order to produce an ash with a suitably low carbon content for compliance with Waste Acceptance Criteria (WAC) and for use as a secondary aggregate. Once this final combustion has taken place the ash will be conveyed to a storage bunker for removal from site.

Flue Gas Treatment (Emissions Control System),

As a result of the syngas cleaning prior to the engines, the engine exhaust gas is clean enough to achieve required emissions standards, with the possible exception of carbon monoxide, which is to be dealt with using a selective catalytic conversion process. This process uses a converter, made of a matrix of noble metals (palladium, platinum) which are catalysts, enabling any CO present to be oxidised to CO_2 before exhaust.

The Applicant considers that syngas clean-up prior to combustion and waste pre-acceptance procedures are sufficient to control acid gases, and no further clean up of the exhaust gases are required. This is further discussed in section 6.2.3 of this document.

The syngas clean-up system will remove pollutants such as Ammonia (NH_3) in the syngas that would lead to the generation of fuel NOx. The six CHP engines will employ the Jenbacher LEANOX® combustion control system. This system operates the engines in a lean burn mode, meaning that combustion takes place in conditions of excess air. This leads to higher engine efficiency and reductions in thermal NOx formation due to lower combustion temperatures. Consequently the Applicant considers that secondary abatement measures are not required. This is further discussed in section 6.2.2 of this document.

Stack,
The facility will have two stacks in total. One stack is for the tar/liquor combustion chamber and the second one is a common stack for the six gas engines. The emissions from the stacks will be monitored via a single Continuous Emissions Monitoring System (CEMS), which will feature sampling and analysis probes into both stacks. A silencer will also be fitted to the engine stack to reduce noise levels.

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

Waste throughput, Tonnes/line	80,000tonnes/annum Total	3.3tonnes/hour per line
Waste processed	Wood	
Number of lines	3 gasifiers, 6 engines	
Furnace technology	Gasification	
Auxiliary Fuel	Natural Gas	
Acid gas abatement	None	
NOx abatement	None	
Reagent consumption	Auxiliary Fuel 115 te/annum (natural gas/LNG) Process water: 100,000 te/annum	
Flue gas recirculation	No	
Dioxin abatement	None	
Stack A1 (engine exhaust)	439496,364071	
	Height, 40 m	Diameter, 2m
Flue gas	18.9, Nm^3/s	8.1, m/s
	Temperature 180°C	
Stack A2 (combustion chamber)	439425,364085	
	Height, 30 m	Diameter, 4m
Flue gas	18.4, Nm^3/s (3% O_2)	11.4, m/s
Electricity generated	11.8 MWe	94,800 MWh
Electricity exported	10.7 MWe	85,300 MWh
Waste heat use	Sankey diagram shows maximum of 12.0MW waste heat may be available to export. The applicant has prepared a potential design for the use of heat produced by the ERF for the adjoining	

	development, and provided this design to the developers of the Biwaters site. Discussions with the developers of the Biwaters site and other nearby premises/businesses that could potentially benefit from the use of heat are ongoing

4.1.4 Key Issues in the Determination

The key issues arising during this determination were:

- Emissions to air and their potential impacts;
- Combine heat and power, and the supply of waste heat to offsite users;
- Fire Prevention Plan, and it's compliance with our guidance

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 on the northern fringe of Clay Cross, within North East Derbyshire. Clay Cross is located approximately 8km to the south of Chesterfield, and 27km north of Derby. The settlements of Alfreton and Matlock lie around 7.6km and 9.7km to the south and west-southwest respectively. The site borders the northwest side of Bridge Street, approximately 0.45km to the north of Clay Cross town centre in North East Derbyshire.

The National Grid Reference (NGR) at the entrance of the site is SK 39567 64077

The site covers 2.44 ha and is currently unoccupied and comprises a typically flat topography which is predominantly unsurfaced, with some hardstandings in the southwest site. The site has recently been occupied as a scrap yard and a waste transfer station. Prior to that the application site is recorded as a Historic Local Authority Landfill which accepted commercial waste.

To the south, west and east of the site are established industrial areas and rough ground. A wooded area and steep borders slopes to the north and northwest. To the northwest of the application site is open countryside, whilst to the northeast is a large area of brownfield land. The Clay Cross Railway tunnel borders the eastern part of the site.

The site is roughly rectangular in shape and currently disused. The site was until recently a waste transfer station for dry recyclables and a metal recycling facility. It is for the most part unsurfaced, although a small section of the site in the southwestern corner contains hard surfacing (approximately 30% of total site area). A dense belt of trees/shrubs marks the northern/northwestern boundary. The northern boundary of the site slopes steeply down towards a public footpath and small watercourse/pond.

The majority of the site forms a gently sloping area of land. At its highest point, located at the southeastern corner, levels are in the order of 133.59m AOD. Levels fall towards the north and west, reaching an elevation of around 129m AOD at the northern edge of the plateau and 131m AOD at the western edge. The topography then falls away steeply from the edge of the plateau towards the site boundary and a stream. These slopes are covered with dense vegetation and trees. At the base of the slope, levels range from 122m AOD at the western edge to 119.4m AOD at the northern edge.

The Site is underlain by the Pennine Lower Coal Measures Formation (Carboniferous), comprising interbedded mudstone, siltstone and sandstone, with numerous and thicker coal seams in the upper part. The formation is weathered to clay or gravel near the ground surface. The formation is underlain by the Rossendale Formation. A fault is recorded along the northern site boundary, striking west-northwest to east-southeast.

The bedrock is overlain by made ground which is associated with the sites historical uses, initially spoil from tunnelling/mining activities and in the 1970s as a refuse tip. The thickness of the made ground is unknown, however, a review of the site's topographical survey indicates that the levels of the site are 7m to 13m above the surrounding land to the north and west, indicating a potentially significant extent of made ground beneath the application site.

An intrusive site investigation by Ground Sense Ltd found ground conditions comprising made ground to depths of between 10.3 to 11.7mbgl (meters below ground level) across most of the site, with made ground to depths of 4.7 to 5mbgl in the southwest corner of the site. The made ground comprised colliery spoil, construction waste, industrial and domestic waste - including mudstone, brick, concrete, clay, ash, slag, textiles, carpet, paper, wood, foundry sand, metal, plastic, ceramics, tyres, beds, mattresses, glass, rubber foam, cans, magazines, cable, and further domestic type waste considered typical of putrescible municipal solid waste (MSW). These deposits were interpreted as mixed wastes from the former stockpiles, backfilled pond and refuse tip.

The made ground overlays highly weathered Pennine Lower Coal Measures Formation, comprising stiff to very stiff clays and weathered mudstone/siltstone, proven to a maximum depth of 14.1m bgl.

The Ground Sense Limited report indicates following a review of mine plans that "*we can confirm that there are two mine shafts beneath the site. However, one of these is apparently a "staple pit" (that is to say a shaft that only extends between various working levels underground) between the Cannel (aka the Yard) and Blackshale coal seams and did not extend to surface. Consequently, of the two, only the one shaft extends up to the surface poses a direct risk of collapse subsidence to the site*".

There are no existing surface water features within the site's environmental permit boundary.

The nearest surface water feature to the application site is a small drainage channel which runs adjacent to the north/northwest of the area of woodland and a pond which together form the northern boundary of the application site. The watercourse rises on the boundary with the industrial units to the northwest and flows towards the pond, which extends to the north of the application site. The stream and pond are likely to be in hydraulic continuity with perched water in the made ground.

Based on a review of the topographical survey and Ordnance Survey mapping there appears to be no outfall from the pond, indicating that it is likely to be in hydraulic continuity with the surrounding groundwater within the underlying Coal Measures. At present, incidental rainfall onto the application site will infiltrate into the made ground deposits, with some surface water run-off in a north easterly direction towards the woodland and drainage ditch/pond beyond.

It is anticipated, based on the known site history that elevated anthropogenic inorganic and organic contaminant concentrations (metals, metalloids, petroleum hydrocarbons and polycyclic aromatic hydrocarbons), perhaps of significant concentrations, will be present within the made ground/landfill waste soils and perched water at the site. Significantly elevated ground gas/landfill gas/mine gas levels have also been proven.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The waste storage area located within the building will have concrete surfacing and a sealed drainage system.

The enclosed waste reception building will have impermeable concrete surfacing and a sealed drainage system preventing any potentially contaminated run off from escaping the site.
All water required in the gasifier process will be re-circulated in the enclosed system. When process water needs to be replaced, it will be stored in tanks before removal off site to a suitably licensed facility.

The site will ultimately drain to a pond to the north of the site via an existing sewer. Development of the facility will create an increase in the impermeable coverage at the site and, therefore, rates and volumes of runoff will be increased. This change in the surface water runoff regime will be managed and will also take into account the potential increase in rainfall intensity resulting from climate change. Attenuation is required in order to control runoff from the site and this will be provided through the incorporation of a series of lined attenuation pond within the development layout.

The drainage strategy detailed in this report will manage surface water runoff from the Clay Cross ERF for all events up to the 1% annual probability (1 in 100 chance) event, including an allowance for climate change. Runoff from events in excess of this will pass to the attenuation ponds which will fill to a point where water overtops the embankment of the northern pond at a designated low point in the landscaping. This spill will allow additional runoff to pass overland into vegetation to the north of the pond and follow topographical grades north away from the site. Flows will ultimately pass overland into the existing pond feature to the north of the site.

This spill of flows from the site in extreme events will mimic the existing flow regime on site where flows during heavy rainfall follow topographical profiles and drain downslope to the north, towards the pond feature.

There will be only a limited volume of oils and greases on site, which will be stored in appropriate and dedicated storage areas in small containers with suitable segregation. All fuel storage tanks will be bunded and spill kits will be kept on site.

The following measures will act to prevent hazards associated with fire at the installation:

- the fuel feedstock storage area will be constructed from reinforced waterproof concrete and fire-retardant and non-flammable materials;
- fire water generated will be retained in the surface water attenuation ponds;
- and meetings will be held with the Local Fire Officer when necessary prior to signing off detail design drawings to ensure local requirements are taken fully into account.

Falcon Waste will carry out a programme of Planned Preventative Maintenance (PPM). All items of plant and equipment will be regularly inspected and maintained in accordance with Falcon Waste 's EMS and / or the Manufacturer's specification of programme of plant maintenance. In addition, all vehicles used on site as part of the operations will be kept in good working order, will be refuelled in accordance with site operational procedures to prevent any fuel spillage and will be driven only by suitably qualified members of staff.

We consider that the applicant's H1 assessment of pollution risk from the installation is satisfactory. We consider the proposed preventative measures represent appropriate techniques for the facility.

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

At present, there is a lack of land quality data which prevents any comprehensive definition of the baseline conditions for the site. These limitations are due to the limited data availability and the missing chemical testing data referenced in the Ground Sense Ltd report. As such, at this stage, the Applicant states they are unable to report robust baseline conditions for the application site.

The applicant proposes to provide a robust set of baseline conditions, for the site a suitable site investigation, based on and targeting the risks identified, will be produced before the commencement of operations at the facility. The report will assess the degree and nature of any contamination identified on the application site, including its location, type, extent and quantity.

As the Applicant has not submitted an adequate baseline report, we have set a pre-operational condition (PO2) requiring the Operator to provide this information prior to the commencement of operations.

The baseline report is an important reference document in the assessment of contamination that might arise during the operational lifetime of the installation and at cessation of activities at the installation

4.2.3 Closure and decommissioning

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place for the closure and decommissioning of the Installation, as referred to in 5.1.2 of the BATOT section of the Application. The site closure plan will be drafted upon completion of the detailed design and finalised and agreed with the Environment Agency prior to commencement of operations. To ensure this pre-operational condition PO1 requires the Operator to submit a site closure plan for approval.

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

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

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

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

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

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

4.3.2 Management

The Applicant has stated in the Application that they will implement an Environmental Management System (EMS). A pre-operational condition (PO3) 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.

We reviewed the Applicant's proposed EMS against our guidance on what a competent operator is and our guidance on "Develop a management system: environmental permits". We are satisfied that appropriate management systems and management structures will be in place for this Installation, and that sufficient resources are available to the Operator to ensure compliance with all the Permit conditions.

4.3.3 Site security

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

4.3.4 Accident management

The Applicant has confirmed (in their response to a schedule 5 notice) that the design of the plant will undergo a Hazard and Operability Study, which will identify hazards as a result of potential malfunctions in the process. The HazOP will identify the potential causes of these hazards and identify the corrective actions required to prevent them.

The Applicant has submitted an Accident Management Plan. Having considered the Plan and other information submitted in the Application (e.g. the H1 risk assessment), 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. Once the final design of the plant is complete the Accident Management Plan should be reviewed, this is a permit condition by virtue of it forming part of the Environmental Management System which must be in place prior to commissioning as required by a pre-operational condition (PO3).

The Applicant submitted a Fire Prevention Plan.

The Applicant has submitted a Fire Prevention Plan. Having considered the Plan and information submitted in response to a schedule 5 notice of request for more information, dated 28/2/17, 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.

Currently the Application contains a drawing titled "Source, Pathways and Receptors Drawing 003" which identifies potential receptors up to 500m from

the proposed site. The installation has not been designed in detail as yet and the surrounding development has only 'outline' planning permission.
A Fire Protection Plan must have plans showing all sensitive receptors within a 1km radius of the site that could be affected by a fire, and pre-operating condition PO11 has been added to the permit to submit an up to date plan, before the plant is commissioned. The pre-operating condition also requires that Operator confirms that the installation has installed a fire detection system and a fire suppression system which is proportionate to the scale and nature of the activity on site. The design, installation and maintenance must be covered by an appropriate UKAS accredited third party certificated scheme.

4.3.5 Off-site conditions

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

4.3.6 Operating techniques

We have specified that the Applicant must operate the Installation in accordance with the documents contained in the Application listed in Table S1.2 in the Permit.

The details set out 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 Applicant will accept in the waste streams entering the plant and which the plant is capable of burning in an environmentally acceptable way. We have specified the permitted waste types, descriptions and where appropriate quantities which can be accepted at the installation in Table S2.2.

Except for

19 05 03	off-specification compost

We queried this use of this non-wood waste, in a schedule 5 notice dated 25/5/16, to which the operator responded with a request to remove this waste code.

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

(i) the wastes are all categorised as non-hazardous in the European Waste Catalogue and are capable of being safely burnt at the installation.

(ii) these wastes are likely to be within the design calorific value (CV) range for the plant, as they are all wood fractions only;

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

We have limited the capacity of the Installation to 80,000 tonnes per annum. This is based on the Applicant's assessment of the installation operating around 8,000 hours per year, taking into account downtime for maintenance and servicing, at a nominal capacity of 3.3 tonnes per hour on each of the 3 lines.

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.

4. The extent to which the Installation meets the requirement of Article 14(5) of the Energy Efficiency Directive which requires new thermal electricity generation installations with a total thermal input exceeding 20 MW to carry out a cost-benefit assessment to "*assess the cost and benefits of providing for the operation of the installation as a high-efficiency cogeneration installation*".
   Cogeneration means the simultaneous generation in one process of thermal energy and electrical or mechanical energy and is also known as combined heat and power (CHP)
   High-efficiency co-generation is cogeneration which achieves at least 10% savings in primary energy usage compared to the separate generation of heat and power – see Annex II of the Energy Efficiency Directive for detail on how to calculate this.

(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:

- Proposals for combined heat and power as discussed in section (iii) below;
- Basic low-cost measures will be implemented at the installation, such as seals and fast acting roller shutter doors and fitting simple control systems such as timers and sensors to heating/hot water systems;
- Hot water pipes will be fully insulated and access doors to the main plant and buildings will be closed when the plant is non-operational to prevent space heating losses;
- Energy losses from the building will be minimised through a number of approaches, including: insulation of appropriate process equipment, design of building fabric; use of energy efficient lighting, heating, ventilation and cooling;
- Space heating requirements in the facility will be provided by waste heat produced by power generation equipment;
- Maintaining steady plant capacity to prevent downtime, e.g. through waste pre-treatment - the biomass facility will operate continuously on a 24-hour, seven days per week basis;
- Prevention of uncontrolled air ingress by providing and maintaining seals.

Regular energy usage reviews are also proposed, resulting in the production of an energy efficiency plan, identifying potential savings, costs and date for implementation;

The Application states that the specific energy consumption, a measure of total energy consumed per unit of waste processed, will be 118.4 kWh/tonne. The installation capacity is 80,000 t/yr.

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

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

The BREF says that it is BAT to reduce the average installation electrical demand to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. The LCV in this case is expected to be 16.6 MJ/kg. Taking account of the difference in LCV, the specific energy consumption in the Application is still lower than that set out above, i.e. it is more efficient.

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

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

Our CHP Ready Guidance - February 2013 considers that BAT for energy efficiency for Energy from Waste (EfW) plant is the use of CHP in circumstances where there are technically and economically viable opportunities for the supply of heat from the outset.

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

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

The BREF says that where a plant generates electricity only, it is BAT to recover 0.6 – 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).

If the Installation generates electricity only, the Sankey diagram in the additional information letter dated 3/3/16 shows 10.7 MW of electricity produced (deducting the parasitic load) for an annual burn of 80,000 tonnes, which represents 13.3 MW per 100,000 tonnes/yr of waste burned (1.06 MWh/tonne of waste, based on 8000hours operation per year). The Installation is therefore above the indicative BAT range. However, this is partly due to the plant burning wood waste rather than lower calorific value MSW.

The Installation will only generate electricity, but may also have the capacity provide heat in the form of hot water, if CHP is in place, for other processes and customers. The electrical output of the plant will be unaffected by this, but another 14 MW of waste heat will be available for export. The likely extraction points for this heat is given in the table below:

Likely Extraction Points

Heat Extraction Points	Minimum Stable Plant Load (70%)	Proposed Operational Plant Load (100%)	Maximum Plant Load (100%)
Heat Recovery Syngas Cooling	1,492 kW	2,087 kW	2,087 kW
Heat Recovery Exhaust Gases Engine	4,425 kW	6,322 kW	6,322 kW
Heat Recovery Jacket Water Circuit Engine	3,948 kW	5,640 kW	5,640 kW
Maximum Heat Load Extraction	9,865 kW	14,049 kW	14,049 kW

The potential users have been considered, closer local users are more economically viable as the cost of pipeline can be up to £1000 per metre, thus short pipelines carrying large amounts of heat are most cost effective, and also cause the least disruption during the installation process as compared to a large number of smaller pipelines. Heat loss also becomes an issue over long distances.

As most of the potential heat users are existing buildings, the cost and viability of retrofitting is also a major consideration. Large centrally heated buildings are considered to have better potential as retrofitting to an already existing large system is much easier and economical than to several small systems. The preferred option is integration of a CHP scheme into a new development as it is being built. For the purposes of this assessment, a number of potential heat loads have been identified. Those that have been considered include:

- Biwaters Site;
- Mayfly Containers;
- Clay Cross Hospital;
- Tesco Supermarket;

- DS Smith Packaging;
- Bosch Thermotechnology; and
- Sharley Park Primary School.

For the potential existing heat users mentioned above, it is not clear if these sites would be capable of utilizing a district heating network without costly modifications. Supply of heat to any nearby heat user would be reliant on agreement being reached with third parties. Falcon Waste's preference would be to supply heat to the proposed Biwaters development since a district heating network could be adopted into the site's design. Falcon Waste have prepared a design for a heat network to supply the proposed Biwaters development and have held discussion with the developer. Should the supply of heat to the Biwaters site not be possible, Falcon Waste would seek to supply existing heat users in the site's vicinity. The Applicant states that discussions with the developers of the Biwaters site and other nearby businesses that could potentially benefit from the use of heat are ongoing.

The closed district heating network would circulate water between the Installation and the external customers' facilities. The process loop starts at a heat exchanger (primary heat exchanger) where the cool water in the network absorbs the heat from the identified extraction points. The heated water then leaves the Installation and transfers the heat to a secondary closed water network (the customer's network). The heat transfer to a customer's network will be achieved via heat exchangers (secondary heat exchanger). The water in the district heating network would return to the Installation at a reduced temperature. The cool water would be fed back to the primary heat exchanger and the process loop closes.

The district heating network water will be carried from the Installation to the customers' network through pre-insulated carbon steel pipes. The main flow and return pipes will run side by side in a single trench that will lead from the heat export point through the main path of the heat network. Individual user's sites will be reached by taking smaller branches off from the main trunk flow and return water lines. The diameter of the main flow and return lines will generally be smaller at the furthest away points on the network with the largest diameter pipe being near to the Installation's export point where the water flow rate is at a maximum.

It is anticipated that the plant will be able to supply the required heat at the proposed operational plant load with a potential capacity for additional users. However, if needed to supply a heat load extraction requirement in excess of the facility's capability to deliver heat, it is proposed that a heat storage system would be installed on the site. The heat storage system would enable the Installation to store heat during periods where heat load extraction exceeds the heat load extraction requirement for supply during periods when the heat load extraction requirement exceeds the heat load extraction of the plant. This would only be effective for a variable heat source since the plant would not be able to supply a constant heat load in excess of it heat supply capability.

In addition to the installation of a heat storage system, the Clay Cross Installation could import natural gas to fuel the existing CHP engines or install additional engines or a small boiler to increase the plant's maximum heat load extraction.

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 plant will be CHP ready and the applicant is pursuing opportunities for CHP in particular with the Biwaters site. However, this is reliant on agreement being reached with third parties. As discussed below this CHP scheme is viable and so we have set improvement condition IC8 to provide an implementation plan for it.

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

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

(iv) R1 Calculation

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

The Applicant has presented a calculation of the R1 factor (as defined under the WFD 2008). The R1 formula is a measure of the extent to which energy is recovered from incineration plant. The formula is:

$$R1 = (Ep – (Ef + Ei)) / (0.97 \times (Ew + Ef))$$

Where:

- Ep means annual energy produced as heat or electricity. It is calculated in the form of electricity being multiplied by 2.6 and heat for commercial use being multiplied by 1.1 (GJ/yr).
- Ef means annual energy input to the system from fuels contributing to the production of steam (GJ/yr).
- Ew means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/yr).
- Ei means annual energy imported excluding Ew and Ef (GJ/yr)

- 0.97 is a factor accounting for energy losses due to bottom ash and radiation.

Where municipal waste incinerators can achieve an R1 factor of 0.65 or above, the plant will be considered to be a ‘recovery activity’ for the purposes of the Waste Framework Directive. Again whether or not an installation achieves an R1 score of >0.65 is not a matter directly relevant to this determination. However by being classified as a ‘recovery activity’ rather than as a ‘disposal activity’, the Operator could draw financial and other benefits.

The applicant provided an R1 calculation which produced a result of 1.15 if both electrical and heat energy were used for commercial purposes and 0.77 for the scenario if electrical energy only is considered. On this basis, they concluded that facility is likely to achieve R1 status whether or not it utilises the heat energy. **However**, the R1 calculations are only applicable to incinerators dedicated to municipal waste (MWI) or automotive shredder residues (ASR). As this plant is for wood waste then the R1 calculation is not applicable.

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) Compliance with Article 14(5) of the Energy Efficiency Directive

The Applicant has discounted CHP outside of 5km on the basis that it becomes less viable due to factors such as cost of infrastructure for transportation and heat loss, and has focussed their attention on the more local potential users. The Applicant has submitted a cost-benefit assessment of opportunities for high efficiency co-generation within 5 km of the installation in which they calculated net present value. If the NPV is positive (i.e. any number more than zero) it means that the investors will make a rate of return that makes the scheme commercially viable. A negative NPV means that the project will not be commercially viable. The Applicant’s assessment showed a net present value of 5.11 which demonstrates that operating as a high-efficiency cogeneration installation will be financially viable. We have therefore included conditions in the operator’s permit as described in section [viii] below.

(viii) Permit conditions concerning energy efficiency

Condition 1.2.2 has been included in the Permit, which requires the Operator to review the options available for heat recovery on an ongoing basis.

Condition IC6 in table S1.3, has been included in the permit requiring the operator to operate as a high-efficiency co-generation installation in the manner described within the cost-benefit assessment carried out to satisfy the requirements of Article 14(5) of the Energy Efficiency Directive.

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

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

4.3.8 Efficient use of raw materials

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

The efficiency of the use of auxiliary fuel will be tracked separately as part of the energy reporting requirement under condition 4.2.2. 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:

- Water and tars condensed from the syngas stream;
- Waste liquor from syngas scrubbing; and
- Residue particulate from the gasifiers are collected in the syngas filter.

The first objective is to avoid producing waste at all. Condition 3.1.5 and associated Table S3.4 specify limits for total organic carbon (TOC) of <3% in bottom ash from the Tar/Liquor/Char Combustor Unit. Compliance with this limit will demonstrate that good combustion control and waste burnout is being achieved in the combustor and waste generation is being avoided where practicable.

Residue, such as Char, Liquor and Ash will be captured in different sections of the process including in the gasifiers, cyclones and particulate filters and the

Combustor. In the first instance the Operator will separate Char generated in the gasifiers from other ashes generated by the syngas cleaning plant. The operator may eventually combine “Char from the Gasifiers” and particulate from the syngas filter,as this is essentially the same material because they are expected to be quite similar due to the gasifier temperatures being far below that of normal incinerators. The ash from the Combustor due to the fuel for the biomass facility comprises of non-hazardous waste wood, so therefore it is assumed that the ash produced will be non-hazardous also in nature. An ash characterisation study will be undertaken as part of the commissioning programme in order to define the ash’s waste classification and to then identify potential recovery or disposal options. In the short term, it is likely that the ash will be transported off site for disposal to landfill, however the operator confirms that the preferred route will be the processing of the material to produce secondary aggregate. Monitoring of incinerator ash will be carried out in accordance with the requirements of Article 53(3) of IED. Classification of the ash for its subsequent use or disposal is controlled by other legislation and so is not duplicated within the permit.

In order to ensure that the ash residues are adequately characterised, pre-operational condition PO5 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.10 requires the Operator to carry out an ongoing programme of monitoring.

The Application states that ferrous material will be removed from the feedstock by a drum magnet whilst non-ferrous material will be removed by an eddy current separator, and sent for recycling.

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

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

5. Minimising the Installation’s environmental impact

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

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

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

5.1 Assessment Methodology

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

5.1.2 Use of Air Dispersion Modelling

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

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

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

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

PCs are considered **Insignificant** if:

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

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

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

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

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

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

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

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

Whether or not exceedences are considered likely, the application is subject to the requirement to operate in accordance with BAT.

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

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

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in the "Air quality (Combustion Pollutants), Assessment Atmospheric Dispersion Modelling" report 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 CHP stack, combustion chamber and the standby generator and its impact on local air quality. The impact on conservation sites is considered in section 5.4.

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the AERMOD 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 Watnall Airport between 2008 and 2012. The airport is 20km to the SW of the installation and the applicant stated it was the most complete and representative dataset for purposes of this assessment. The impact of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling.

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

- 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
    - Particulates
    - 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)
- they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate
- they modelled a worst case scenario whereby both the six gas engines were operating and the combustion unit was operating in emergency mode all year together. This modelled scenario will not actually be possible as the gas engines will not run at the same time as the combustion chamber in the emergency mode of operation. Emergency mode is only start-up, shut down, maintenance and emergency situations.
- the model also considered emissions of pollutants not covered by Annex VI of IED, specifically PCB's. The applicant has derived PCB emission rates from an emission factor for the combustion of waste-wood extracted from the National Atmospheric Emissions Inventory (NAEI) and apportioned for the stacks flowrates. However, we were not able to reproduce these emissions rates and in our check modelling we used the ELV from MSWI specified in the waste incineration BREF
- For the small standby generator the operator has used emission rates calculated from manufacturer stated emission values. The standby generator will only run during a power cut and CHP failure but will be tested monthly for around 3 hours. Therefore this source has been modelled as operating for 1hour per week.

The Applicant has used background air quality monitoring data from a range of sources. This data is summarised in the Application and has been used by the Applicant to establish the background (or existing) air quality against which to measure the potential impact of the incinerator. We have reviewed the background data and can confirm that the selected values are representative of the concentrations at sensitive receptors.

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

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

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

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

5.2.1 Assessment of Air Dispersion Modelling Outputs

The Applicant's modelling predictions are summarised in the tables below.

The Applicant's modelling predicted peak ground level exposure to pollutants in ambient air. We have conservatively assumed that the maximum concentrations occur at the location of receptors.

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	16.3	4.47	**11.18**	20.8	51.9
	200	2	32.6	103.8	**51.90**	136.4	68.2
PM_{10}	40	1	16.3	0.22	0.55	16.5	41.3
	50	3	19.2	0.77	1.54	19.97	39.9
$PM_{2.5}$	25	1	10.8	0.22	0.88	11.02	44.1
SO_2	266	4	9.1	146.7	**55.15**	155.8	58.6
	350	5	6.8	93.6	**26.74**	100.4	28.7
	125	6	4	11.7	9.36	15.7	12.6
HCl	750	7	0.44	39.5	5.27	39.9	5.33
HF	16	8	3.5	0.021	0.13	3.521	22.01
	160	7	7	2.6	1.63	9.60	6.0
CO	10000	9	302	33.9	0.34	336	3.4
TOC	5	1	0.41	0.22	**4.40**	0.630	12.60
PCBs	0.2	1	0.0001	5.85E-07	0.00	0.00010	0.05

TOC as Benzene

1 Annual Mean
2 99.79th %ile of 1-hour means
3 90.41st %ile of 24-hour means
4 99.9th ile of 15-min means
5 99.73rd %ile of 1-hour means
6 99.18th %ile of 24-hour means
7 1-hour average

8 Monthly average
9 Maximum daily running 8-hour mean

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	0.00022	0.000533	**10.7**	0.00075	15.06
Hg	0.25	1	0.0025	0.00107	0.43	0.00357	1.43
	7.5	2	0.005	0.0328	0.44	0.03780	0.50
Sb	5	1	0	0.000245	0.00	0.000245	0.00
	150	2	0	0.00756	0.01	0.00756	0.01
Pb	0.25	1	0.0113	0.00107	0.43	0.01237	4.95
Cu	10	1	0.0091	0.000619	0.01	0.009719	0.10
	200	2	0.0182	0.0191	0.01	0.03730	0.02
Mn	0.15	1	0.0123	0.00128	0.85	0.01358	9.05
	1500	2	0.0246	0.0394	0.00	0.06400	0.00
V	5	1	0.0012	0.000128	0.00	0.001328	0.03
	1	3	0.0024	0.00394	0.39	0.00634	0.63
As	0.003	1	0.00079	0.000533	**17.77**	0.00132	44.10
Cr (II)(III)	5	1	0.0031	0.000196	0.00	0.00330	0.07
	150	2	0.0061	0.0604	0.04	0.06650	0.04
Cr (VI)	0.0002	1	0.00009	0.00000277	**1.39**	0.00010	47.89
Ni	0.02	1	0.0025	0.0047	**23.45**	0.00719	35.95

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

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

(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:

- Particulate Matter
- Hydrogen Fluoride
- Hydrogen Chloride
- Carbon Monoxide
- PCBs
- Mercury
- Antinomy
- Lead
- Copper
- Manganese
- Vanadium
- Chromium(II)(III)

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

(ii) Emissions unlikely to give rise to significant pollution

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

- Oxides of Nitrogen
- Oxides of Sulphur
- Total Organic Compounds (as Benzene)
- Arsenic
- Chromium (VI)
- Nickel

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

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

The impact on air quality from NO_2 emissions has been assessed against the EU EQS of 40 $\mu g/m^3$ as a long term annual average and a short term hourly average of 200 $\mu g/m^3$. The applicant has used NO_x to NO_2 conversion factors of 100% for long-term and 50% for short term. These are the conversion factors recommended for screening purposes and result in higher, more conservative, predictions. For detailed modelling we recommend conversion factors of 75% for long-term and 35% for short-term.

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

The peak short term PC is 51.9%, which is above the level that would screen out as insignificant (>10% of the EUEQS). However it is not expected to result in the EUEQS being exceeded due to relatively low background levels.

These high predictions might be due a number of reasons:

- Emission Limit Values (ELVs) for Waste Incineration defined in the Industrial Emissions Directive (IED) were used to derive the emission rates for gas engines. However, due to the gasification process and installed abatement before the engines, these ELVs might be over-conservative;
- The applicant modelled a worst case scenario whereby both the gas engines and the combustion unit were operating all year together, which is actually not possible, as if the combustion unit is operating the engines would not be;
- The applicant has only considered the maximum predicted concentration off-site (maximum on the grid); concentrations at receptors may be lower.

NOx control and the option for further abatement are discussed in detail in section 6.2.2.

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

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

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

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

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

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

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

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

There is currently no emission limit prescribed nor any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition (IC2) has been included that will require a full analysis of particle size distribution in the flue gas, and hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions, as explained in section 5.3.3.

(iii) Acid gases, SO_2, HCl and HF

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

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

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

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

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

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

The Applicant has used the EQS for Benzene for their assessment, they could have used the EQS 1,3 butadiene for their assessment of the impact of VOC. Which has the lowest EQS of organic species likely to be present in VOC (other than PAH, PCBs, dioxins and furans). We carried out our own sensitivity analysis using 1,3 butadiene, which showed that emissions, as with benzene, would not be insignificant but would not result in the EQS being exceeded.

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

Benzo[a]pyrene (BaP) was not included in the Applicant's assessment. We have derived the BaP emission rate from the maximum ELV for MSWI specified in BREF and considered this in our check modelling. Our check modelling screened out BaP as insignificant. This is also representative of the potential impact of PAH emissions, and our check modelling screened out PAHs as insignificant.

The Applicant did not model ammonia as they are not proposing SNCR or SCR abatement for NOx. Our check modelling considered ammonia emissions at the maximum emission concentration given in the BRef. This had no effect the outcome of the conclusions of the impacts of air emissions.

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

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

(V) Summary

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

5.2.3 Assessment of Emission of Metals

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

Annex VI of IED sets three limits for metal emissions:

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

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

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

- Mercury
- Antinomy
- Lead
- Copper
- Manganese
- Vanadium
- Chromium(II)(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:

- Arsenic
- Chromium (VI)
- Nickel

There were no metal emissions requiring further assessment. The Applicant has concluded that exceedences of the EAL for all metals are not likely to occur. The installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document. The Environment Agency's experience of regulating incineration plant is that emissions of metals are in any event below the Annex VI limits set in IED, and that, the above assessment is an over prediction of the likely impact, especially as this is a waste wood burning plant rather than a MWI. We therefore agree with the Applicant's conclusions.

5.2.4 Consideration of Local Factors

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

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

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

i) Applying Statutory Controls

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

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

ii) Environmental Impact Assessment

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

iii) Expert Scientific Opinion

We take account of the views of national and international expert bodies. The gathering of evidence is a continuing process. Although gathering evidence is not our role we keep the available evidence under review. The following is a summary of some of the publications which we have considered (in no particular order). Some of the publications refer to municipal waste incinerators rather than wood co-incinerators, it is expected that emissions from waste wood will actually be lower for a wood co-incinerator.

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

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

HPA (now PHE) in 2009 states that "The Health Protection Agency has reviewed research undertaken to examine the suggested links between emissions from municipal waste incinerators and effects on health. While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable". In January 2012 PHE confirmed they would be undertaking a study to look for evidence of any link between municipal waste incinerators and health outcomes including low birth weight, still births and infant deaths. Their current position that modern, well run municipal waste incinerators are not a significant risk to public health remains valid. The study will extend the evidence base and provide the public with further information

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

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

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

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

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

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

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

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

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

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

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

iv) Health Risk Models

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

Models are available to predict the dioxin, furan and dioxin like PCB's intake for comparison with the Tolerable Daily Intake (TDI) recommended by the

Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment, known as COT. These include HHRAP and the HMIP model.

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

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

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

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

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

- In the same way, a difference in the pattern of personal exposures between the areas to be studied and the reference areas will affect the accuracy of the predictions of effects.

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

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

v) Consultations

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

5.3.2 <u>Assessment of Intake of Dioxins, Furans and Dioxin like PCBs</u>

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

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

The results of the Applicant's assessment of dioxin intake are detailed in the table below (see table 6-1 of the Human Health Risk Assessment dated July 2016). (worst – case results for each category are shown). The results showed that the predicted daily intake of dioxins, furans and dioxin like PCBs at all receptors, resulting from emissions from the proposed facility, were significantly below the recommended TDI levels.

Receptor	adult	child
Hypothetical resident	1.79E-04	1.11E-04
Hypothetical Farmer	4.23E-02	2.07E-02

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

The applicant has performed a HHRA to assess dioxins and furans from the ERF stack emissions. The applicant has used Lakes IRAP-h View, based on the US EPA Human Health Risk Assessment Protocol[6] (HHRAP) considering the following pathways:

- Inhalation
- Ingestion of soil, food grown, etc.
- Consumption of fruit and vegetables

The ingestion exposure pathways considered in the applicant's assessment is in table 5-1 of the applicant's HHRA report. The applicant has not included the consumption of local fish or ingestion of water. Although the ingestion of soil and fruit and vegetables are likely to be the most relevant pathways, our HHRA checks have included potential intake from all pathways.

The Applicant's congener profile is detailed in table 3-3 of the applicant's HHRA report. The mass emission of each congener has been calculated on the basis of the USEPA congener profile, factored on the basis of WHO Toxic Equivalency Factors (TEF) at the IED emission concentration. We were able to reproduce this congener profile and agree with Applicant's values.

The Applicant has not assessed dioxin-like PCBs in the HHRA. We have established the worst-case PCBs impacts based on monitoring data from MSWI and have considered these in our check modelling. Our check modelling indicates dioxin-like PCBs screen-out as insignificant.

The Human Health Risk Assessment (HHRA) demonstrates that "the predicted risks as a consequence of emissions of dioxins and furans are well within limits for the protection of human health". As a result of our check modelling and sensitivity analysis we find that, although we do not agree with applicant's exact numerical predictions and methodology, we are satisfied that levels for human health protection can be considered insignificant.

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

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

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

5.3.4 <u>Assessment of Health Effects from the Installation</u>

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

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

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

The Applicant’s assessment of the impact from:
- Particulate Matter
- Hydrogen Fluoride
- Hydrogen Chloride
- Carbon Monoxide
- PCBs
- Mercury
- Antinomy

- Lead
- Copper
- Manganese
- Vanadium
- Chromium(II)(III)

have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions of:

- Oxides of Nitrogen
- Oxides of Sulphur
- Total Organic Compounds (as Benzene)
- Arsenic
- Chromium (VI)
- Nickel

have not been screened out as insignificant, the assessment still shows that the predicted environmental concentrations are well within air quality standards or environmental action levels.

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

The Human Health Risk Assessment (HHRA) demonstrates that "the predicted risks as a consequence of emissions of dioxins and furans are well within limits for the protection of human health". As a result of our check modelling and sensitivity analysis we find that, although we do not agree with Applicant's exact numerical predictions and methodology, we are satisfied that levels for human health protection can be considered insignificant.

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

Public Health England and the Local Authority Director of Public Health were consulted on the Application and concluded that they had no significant concerns regarding the risk to the health of humans from the installation. Details of the responses provided by Public Health England to the consultation on this Application can be found in Annex 2.

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

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

5.4.1 Sites Considered

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

- South Pennine Moors (SAC & SPA)

There are no Sites of Special Scientific Interest within 2Km of the proposed Installation.

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

- Avenue Washlands
- North Wingfield
- St Lawrences Churchyard
- Padley Wood
- Cavell Drive Meadow
- Britton Wood
- Cowlishaw Wood
- Carr Plantation
- Far Tupton Wood
- Mulberry Wood & Berresford Moor (p-LWS)
- Bridge Street Grassland (p-LWS)
- Oak Coppice and Pond (LWS)

5.4.2 Habitats Assessment

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

In line with our guidance where predicted concentrations (PCs) are less than 1% of the relevant long term (i.e. annual) critical levels or loads, or are less than 10% of the short term (daily, or weekly) critical levels or loads , then the impacts can be considered insignificant. In these cases no further assessment is required.

The table below presents the Applicant's process contribution data, however the critical loads used are different as we have used the minimum Critical loads and levels for the most sensitive receptors within the South Pennine Moors (phase 1) SAC/SPA, taken from the Air Pollution Information System website

“site relevant critical loads” tool on 30/11/16. Background data was not used as all PC’s screen out as insignificant.

Pollutant	EQS / EAL (µg/m³)	Back-ground (µg/m³)	Process Contribution (PC) (µg/m³)	PC as % of EQS / EAL	Predicted Environmental Concentration (PEC) (µg/m³)	PEC as % EQS / EAL
Direct Impacts[2]						
NO_x Annual	30	-	0.06	0.2%	-	-
NO_x Daily Mean	75	--	1.98	2.6%	-	-
SO2	10 (1)	-	0.01	0.1%	-	-
Ammonia	1 (1)	-	N/A	-	-	-
HF Weekly Mean	0.5	-	0.01	1.3%	-	-
HF Daily Mean	5	-	0.01	0.2%	-	-
Deposition Impacts[2]						
N Deposition (kg N/ha/yr)	5-10	-	0.006	0.12%	-	-
-Acidification - Nitrogen Dep (Keq/ha/yr) MinCLminN	0.178	0.83	<0.001	0.56%	-	-
Acidification Sulphur Dep (Keq/ha/yr) MinCLMaxS	0.21	2.75	0.002	0.95%	-	-

(1) The lichen and bryophyte sensitivity standards for ammonia and sulphur dioxide have been assigned for this assessment as the presence of these features has been recorded on the APIS wensite.

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

Using the APIS critical level tool for acid deposition, it shows that the process contribution is insignificant when compared to acid critical load function. It is worth noting that the background acid deposition already exceeds the critical load, so it is good that the process contribution is predicted to be insignificant.

Critical Load Function

CLmaxS:	0.21
CLminN:	0.178
CLmaxN:	0.428

Deposition data

Source	keq/ha/yr		
	Sulphur Deposition	Nitrogen Deposition	Total Acid Deposition (S+N)
Process Contribution (PC)	0.002	.001	0
Background	2.75	0.83	3.58
Predicted Environmental Concentration (PEC)	2.75	0.83	3.58

Results - exceedance and deposition as a proportion of the CL function

Source	Exceedance (keq/ha/yr)	% of CL function*
Process Contribution (PC)	no exceedance of CL function	0
Background	3.15	836.4
Predicted Environmental Concentration (PEC)	3.15	836.4

* % of CL function is calculated after the value of PEC relative to CLminN is taken into account. See detailed explanation for further information and justification.

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 Applicant is using BAT to control emissions.

The applicant's critical level predictions are presented in tables 6-6 and 6-7 of the July 2016 Air Quality Impact assessment. The applicant's contribution to nitrogen and acid critical loads are presented in table 6-8 and 6-9, respectively.

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

5.5 Impact of abnormal operations

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

For incineration plant, IED sets backstop limits for particulates, CO and TOC which must continue to be met at all times. The CO and TOC limits are the same as for normal operation, and are intended to ensure that good combustion conditions are maintained. The backstop limit for particulates is 150 mg/m^3 (as a half hourly average) which is five times the limit in normal operation. The Applicant has proposed a plausible abnormal emission of just 50mg/m3 (at 11% oxygen), and we have set the equivalent limit in the permit of 75mg/m3 (at 6% oxygen, due to it being decided that the plant will be a co-incinerator). However, we did conduct check modelling and sensitivity analysis using the 150mg/m3 (at 11% oxygen) limit to satisfy ourselves that abnormal emissions will not cause significant pollution.

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

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

In making an assessment of abnormal operations the following worst case scenario has been assumed by the Applicant:

Pollutant	Permitted Emission (mg/Nm^3)		Plausible Abnormal Emission (mg/Nm^3)
	Daily Average	½ hourly max	
NO_X	200	400	600
PM_{10}	10	30	50
SO_2	50	200	250
CO	50	100	1000
HCl	10	60	250
HF	1	4	10
Group 1 Metal	0.05		0.5
Group 2 Metal	0.05		0.5
Group 3 Metal	0.5		5.0

Note:
Group 1 Metals include Cadmium & thallium and their compounds, which have no short term EQS's
Group 2 Metals will be Mercury and its compounds
Group 3 metals include Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total), and the applicant has used the lowest short EQS which is for Vanadium

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

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

Short-term Impacts Resulting from Plausible Abnormal Emissions (µg/m^3)

Pollutant	EAL	Process Contribution		Predicted Environmental Concentration	
		µg/m^3	% of EAL	µg/m^3	% of EAL
NO_2	200	155.7	77.9%	188.3	94.2%
PM_{10}	50	3.8	7.7%	23.0	46.1%
SO_2	350 (1-hr)	117.0	33.4%	123.8	35.4%
	266 (15-min)	183.3	68.9%	192.4	72.3%
CO	10000	678.7	6.8%	980.7	9.8%
HCl	750	164.7	22.0%	165.2	22.0%
HF	160	6.6	4.1%	13.6	8.5%
Group 2 Metal	7.5	3.3E-01	4.4%	3.3E-01	4.4%
Group 3 Metal	1	3.9E-02	3.9%	4.2E-02	4.2%

Group 2 metal limit is the short term EQS for Mercury
Group 3 metal limit is the short term for Vanadium

From the table above the emissions of the following substances can still be considered insignificant, in that the PC is still <10% of the short-term EQS/EAL: PM_{10}, CO, HF, group 2 metals and group 3 Metals

Also from the table above emissions of the following emissions (which were not screened out as insignificant) have been assessed as being unlikely to give rise to significant pollution in that the predicted environmental concentration is less than 100% of short term EQS/EAL: NO_2, SO_2 and HCl.

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

We have not assessed the impact of abnormal operations against long term EQSs for the reasons set out above. Except that if dioxin emissions were at 10 ng/m^3 for the maximum period of abnormal operation, this would result in an increase of approximately 70% in the TDI reported in section 5.3.2. In these circumstances the TDI would be 0.072 pg(I-TEQ/ kg-BW/day) for the worst case hypothetical farmer, which is 3.6% of the COT TDI. At this level, emissions of dioxins will still not pose a risk to human health.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

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

We then consider in particular control measures for the emissions which were not screened out as insignificant in the previous section on minimising the installation's environmental impact. They are:

- Oxides of Nitrogen
- Oxides of Sulphur
- Total Organic Compounds (as Benzene)
- Arsenic
- Chromium (VI)
- Nickel

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

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

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

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

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

6.1.1 Consideration of Furnace Type

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

The Waste Incineration BREF elaborates the furnace selection criteria as:

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

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

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

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

- Costs

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

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

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

			Low LOI of bottom ash			

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) □mainly used for clinical wastes	<7 t/h	can deal with liquids and powders	bed agitation may be lower	Dependen t 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	Dependen t 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 informatio n	No information
Gasification - fixed bed	- mixed plastic wastes - other similar consistent streams - gasification less widely used/proven than incineration	1 to 20 t/h	-low leaching residue -good burnout if oxygen blown - syngas available - Reduced oxidation of recyclable metals	- limited waste feed - not full combustion - high skill level - tar in raw gas - less widely proven	-Low leaching bottom ash -good burnout with oxygen	High operation/ maintenance costs

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

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

- Moving Grate Furnace
- Pyrolysis
- Gasification - Updraft gasifier, Downdraft gasifier & Fluidised bed gasifier.

The application considers incineration such as moving grate incinerators but discounted them as they are principally for large scale incineration and not as efficient for smaller scale plant such the one proposed. Pyrolysis is also discounted due to the presence of other hydrocarbons (oils and tars) in the syngas which can be a problem and require significant clean up to avoid damage to a gas engine.

The application considers gasification in more detail:

Updraft (or "counterflow") gasifier,
Biomass or waste fuel enters the top of the reaction chamber while steam and air (or oxygen) enter from below a grate. The fuel flows downwards and up-flowing hot gases pyrolyses it. The syngas exits from the top of the chamber while the ashes fall through the grate and are collected.
The updraft design is relatively simple and can handle biomass fuel with high ash and moisture content. However, the producer gas contains 10% to 20% volatile oils (tar), making the gas unsuitable for use in engines or gas turbines without significant cleanup.

Downdraft gasifier,
These utilise air flowing in the same direction at the feedstock, and successful operation of this type of gasifier requires a relatively dry feedstock (less than 20%wt moisture). Fuel and air (or oxygen) enter the top of the reaction chamber. Down-flowing fuel particles ignite, burning intensely to produce the heat required to react with material further down the bed and produce syngas, leaving a charcoal residue.
The charcoal in the bed (which is about 5 to 15% of the original fuel mass) reacts with the combustion gases to produce a much lower tar syngas which flows down and exits from the chamber below a grate. The producer gas leaving the gasifier is at a high temperature (around 700° C). Combustion ash falls through the grate and is collected.

Fuidized-bed gasifier,
These typically contains a bed of inert granular particles (usually silica or ceramic). Biomass fuel, reduced to particle size, enters at the bottom of the gasification chamber. A high velocity flow of air from below forces the fuel upward through the bed of heated particles. The heated bed is at a temperature sufficient to partially burn and gasify the fuel. The processes of pyrolysis and char conversion occur throughout the bed.

Although fluidized-bed gasifiers can handle a wider range of biomass fuels, the fuel particles must be less than 10 centimetres in length and must have no more than 65% moisture content. The fluidized-bed design produces a gas with low tar content but a higher level of particulate compared with fixed-bed designs. Due to fluid dynamic constraints, fluidised bed systems are generally only able to be used on schemes of around 160ktpa or greater.

Proposed Gasification Process

The proposed plant has been designed to use three bubbling fluidised bed reactors, which gasify feedstock by introducing small quantities of air into the base of the reactor, and bubbling this through the feedstock bed in order to gasify the material.

The reactors have been designed for the gasification of relatively homogeneous waste, which means that incoming waste will require pre-treatment before feeding to the reactor, to remove metals and other contaminants. The heat transfer between the hot combusting particles and the remainder of the bed material which results from the constant movement of the bubbling bed means that the conditions in the bed are kept as homogeneous as possible and the resulting syngas produced is of good quality and low tar content. This simplifies the gas clean-up requirements for the syngas before it is suitable for engine use, although as proposed, gas cleanup is still required in order for the engines to perform reliably.

The use of reciprocating engines to utilise the syngas produced in order to generate electricity and heat for export to the national gird and nearby consumers respectively means that the plant is able to achieve a greater efficiency than a conventional incineration plant, and therefore offset a greater quantity of fossil fuel than an incinerator with steam cycle.

In summary, a fluidised bed technology is proposed for this plant as the applicant believes that it represents the best choice when balancing the factors of mechanical reliability, energy efficiency, environmental impact and costs.

As discussed above the Applicant has proposed to use a fluidised bed gasifier, which is identified in the table above as being considered BAT in the BREF or TGN for this type of waste feed.

The Applicant proposes to use natural gas/LPG as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is considered to be BAT as it is considered sulphur free.

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

6.2 BAT and emissions control

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

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

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

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

6.2.1 Particulate Matter

Particulate matter				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Bag / Fabric filters (BF)	Reliable abatement of particulate matter to below $5 mg/m^3$	Max temp 250°C	Multiple compartments Bag burst detectors	Most plants
Wet scrubbing	May reduce acid gases simultaneously.	Not normally BAT.	Require reheat to prevent visible plume and	Where scrubbing required for

		Liquid effluent produced	dew point problems.	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

Syngas is cleaned in a series of steps as follows:

- Cyclonic separation of coarse particulate;
- Quench cooling and heat exchange cooling;
- Ceramic filtration of remaining fine particulate; and
- Scrubbing.

As a result of this syngas clean up, before the gas engines, the flue gas emissions do not require any form of abatement in order to achieve the emission limits set in the Permit.

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

6.2.2 Oxides of Nitrogen

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

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

Reagent Type: Urea	Likely to be BAT			All plant

The Applicant proposes to implement the following primary measures:

- Syngas clean-up system will remove Ammonia (NH_3) in the syngas that would lead to the generation of fuel NO_x;
- The six CHP engines will employ the Jenbacher LEANOX® combustion control system. This system operates the engines in a lean burn mode, meaning that combustion takes place in conditions of excess air. Syngas has been demonstrated to be an excellent fuel for lean burn engine operation, leading to higher engine efficiency and reductions in NO_x formation due to lower combustion temperatures leading to a reduction in thermal NO_x formation;
- Delaying the ignition timing in lean burn conditions has also been shown to lead to a reduction in NO_x emissions. Delayed ignition timing means the volume of air and fuel in the combustion chamber is not at its minimum leading to a lower combustion temperature and thermal NO_x formation. This can be balanced such that engine efficiency and output are not compromised as a result;
- Low NO_x burners – this technique reduces NO_x at source and is defined as BAT where auxiliary burners are required. The operator has confirmed the use of low NOx burners in the combustion chamber.
- Starved air systems – this technique also simultaneously reduces CO and is defined as BAT for pyrolysis and gasification systems.

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

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

The Applicant proposes to rely on syngas clean up and not use SCR or SNCR.

Emissions of NO_x cannot be screened out as insignificant. Therefore the Applicant has carried out an options appraisal and a cost / benefit study of the alternative techniques.

Their options appraisal is as follows:

Options Comparison

Option	Energy (MWh/yr)	Raw Material (tonnes / year)	Waste Generation	Local Air Impacts		Global Warming Impact	Photochemical Ozone Creation Potential
				LT[9]	ST[10]		
Syngas Clean-Up Only	5,400	0	Oils and tars Solid residues Water scrubbing effluent	12.0	65.5	-37,154	308.3
Syngas Clean-Up SNCR Urea	9,400	240	Oils and tars Solid residues Water scrubbing effluent	6.48	62.7	-36,023	166.6
Syngas Clean-Up SNCR Ammonia	9,400	390	Oils and tars Solid residues Water scrubbing effluent	6.48	62.7	-36,578	166.6
Syngas Clean-Up SCR	14,600	120	Oils and tars Solid residues Water scrubbing effluent Spent catalyst	5.18	62	-36,078	133.3

From the above, the base case of syngas clean up only is worse for NOx emissions and ozone creation potential, but is better for energy consumption, raw material use, waste generation and global warming impact.

For SNCR, operating the engine in lean burn would require reheating of the exhaust gas to enable effective abatement which increases energy consumption. Likewise for SCR, to ensure optimal operation of the catalyst and prevent polychlorinated dibenzodioxins/furans (PCDD/F) formation, reheating of the exhaust air is required.

The cost per tonne of NO_x abated over the projected life of the plant has also been calculated and compared with the NOx reduction as shown in the table below. The base case is taken as syngas clean up only, as this is required in all cases in order to protect the gas engines.

Ref.	Description	NOx Removal tonne per annum	Cost of NO_x removal £/tonne
0	Base Case Syngas clean up	N/A	N/A
1	SNCR Ammonia	20	13,793
2	SNCR Urea	20	13,478
3	SCR	61	9,803

The Applicant states that the predicted cost per tonne of NOx abatement far exceeds the recommended damage cost as outlined in Annex 2 of the EA's H1 Annex K guidance of £4142. Based on the figures above the Applicant considers that the additional cost of SCR and SNCR is not justified by the reduction in environmental impact.

We have reviewed the figures and used the more up to date figure of £10,858 for the waste industry air quality damage costs for NOx, given in table 1 of the DEFRA "Air quality economic analysis - Damage costs by location and source" report. Using this figure the financial cost per tonne per annum for removing the NOx is higher than this for SNCR and so we agree with the Applicant's conclusion that SNCR is not BAT for this facility. The SCR costs are lower than the environmental cost by £1055 per tonne NOx removal, which shows that the environmental benefits could outweigh the costs, however this is really a marginal difference between the costs and benefits. As shown in the options comparison table above, there will be increased environmental costs for SCR due to increases energy consumption, raw material use, waste generation and global warming impact. Furthermore there will be ammonia emissions due to ammonia slip from the SCR process.

The air dispersion modelling discussed in section 5.2.1 of this document shows that short-term NO_2 PC is relatively high but, because the background concentration is relatively low, exceedancies of the short term EQS are unlikely. This is very much a worst case scenario assuming that the combustion chamber will operate 100% of the time burning syngas in emergency mode, at the same time as the gas engines burn syngas. This cannot happen and in reality the combustion chamber will only burn syngas in emergency mode for a few hours during start up, shut down or during maintenance on the gas engines. We have looked at the impact of emissions from just the gas engines at the nearest sensitive receptor, and these showed that actually the impacts would only be just over the threshold of insignificance for both short term and long term emissions.

In conclusion given that:

- the plant can meet the IED limits without abatement;
- the CHP engine's PC contributions at the nearest receptor are only just above the level of insignificance;
- the short and long term NOx EQS's will not be breached;
- there are environmental costs of using SCR (increased energy usage, raw material usage, waste generation, global warming potential and ammonia emissions);
- the financial benefit is marginal;

we agree with the Applicant's conclusion that syngas clean-up and the proposed primary measures constitute BAT for this Installation.

6.2.3 Acid Gases, SO_x, HCl and HF

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

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

- Use of low sulphur fuels for start up– gas should be used if available, where fuel oil is used, this will be low sulphur (i.e. <0.1%), this will reduce SO_x at source. The Applicant confirmed its choice of gas / LPG as the support fuels which are low sulphur fuels.
- Waste materials containing chloride, fluorides and sulphur are the primary sources of acid gases. Significant undiluted volumes of these materials are not expected to be received at the installation. Pre-acceptance procedures will only permit non-hazardous materials for treatment. Site waste acceptance procedures will ensure that loads of wood containing an unacceptable volume of contaminants are isolated and quarantined prior to removal off-site.
- Concentrations of acid gas forming compounds are reduced in the syngas during the syngas clean up, prior to combustion within the engines.

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 incinerator will be burning non-hazardous waste wood, the Applicant does not propose using wet scrubbing, and the Environment Agency agrees that wet scrubbing is not appropriate in this case.

The Applicant has therefore considered dry and semi-dry methods of secondary measures for acid gas abatement, along with the base case of just primary measures.

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

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

The applicant has considered 4 options in detail:

0. Base case, i.e. no secondary abatement

1. Semi-Dry Scrubbing

2. Dry Scrubbing with hydrated lime

3. Dry Scrubbing with sodium bicarbonate

The Applicant states that that primary measures and syngas clean-up will enable the installation to achieve the acid gas, i.e SO_2, HCl and HF, emission limits required by the IED. Furthermore, the Applicant has provided a detailed BAT assessment for the above options. The key table (table 9 reproduced below) shows the tonnes of acid gases abated in comparison with the base case and the cost to abate each tonne of this gas:

Table 9
Comparison of Costs per Tonne Acid Abated

Ref	Description	Acid Abated tonnes/year	Equivalent Annual Cost (£)	Equivalent annual cost per tonne of Acid Abated (£)
1	Semi - Dry	22	818,673	36,922
2	Dry Lime	25	741,410	29,918
3	Dry Bicarb	17	873,512	51,849

Our guidance on Air Quality: Economic Analysis, gives the central Damage Costs for SO_2 as £1,956 per tonnes, with the highest cost being £2,224. If we use this to represent the acid gases, then clearly the financial cost of abating the extra 17 to 22 tonnes of acid gases outweighs the environmental benefits; consequently we agree with the Applicants conclusion that primary measures along with syngas clean up can be considered BAT for this facility.

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 sections on furnace selection, and NOx control	All plants

The Applicant also proposes to use abatement to reduce carbon monoxide emissions. They propose the use of a selective catalytic conversion process. This process uses a converter, made of a matrix of noble metals (palladium, platinum) which are catalysts, enabling any CO present to be oxidised to CO_2 before exhaust.

6.2.5 Dioxins and furans (and Other POPs)

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

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

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

In this case the Applicant proposes no activated carbon injection, and this is based on the design of fluidised bed and subsequent syngas clean-up which they consider will mean there will be no dioxins and furans.

The Applicant has justified this for the following reasons:

- The composition of the waste will avoid the use of chlorinated compounds such as PVC;
- A temperature of above 850ºc for a period of 2 seconds is maintained in the thermal cracking unit to help destroy the dioxins and furans;
- In the thermal cracking reactor oxygen is added so it reacts with unburnt carbonaceous matter, increasing the stream temperature above 900°C. This cracking of hydrocarbons, virtually removes all oxygenated organics, leading into an increased presence of polyaromatics (insoluble in water) which can be removed by separation in the water treatment;
- Rapid cooling from 900ºc to 340ºc and then to 80ºc to avoid the denovo synthesis range for dioxin and furan formation;
- Dioxins and furans require oxygen to form. The characteristic of the gasification reaction in the fluidized bed is that oxygen (air) is at a lower ratio than the stoichiometric one (around one third of that required for complete combustion of the raw material). This means that, past the reaction step, the process continues in an oxygen depleted atmosphere, which inhibits the formation of dioxins and furans;
- After leaving the cracking reactor, the raw gas goes through a cyclone to remove the coarser particles. These particles have a high content of unburnt compounds, which promote the reactions of formation of dioxins, and so their removal is important;
- In order to remove fine particles remaining in the syngas, it goes through a metal filter. This operates at a high temperature, 340°C, to prevent the condensation of hydrocarbons present in the gas stream. It is a critical to remove these hydrocarbons, but it means operating at a temperature which is optimal for the formation of dioxins and furans. Therefore, the equipment is designed to avoid air ingress to, minimise the presence of oxygen, and also there is a high gas flow rate, so that the gas residence time in the filter is not enough to promote the formation of dioxins and furans.
- After the metal filter the gas is rapidly cooled in a scrubber, to 80°C, which outside the range of reaction temperature of formation of dioxins and furans.

and considering the above techniques we are satisfied their proposal 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	Can be combined with	Combined feed rate usually		All plant.

injection for mercury recovery	acid gas absorber or fed separately.	controlled by acid gas content.		Separate feed normally BAT unless feed is constant and acid gas control also controls dioxin release.

Ferrous material will be removed from the feedstock by a drum magnet whilst non-ferrous material will be removed by an eddy current separator. Pre-screening and metals removal will be performed as a mitigation measure against contrary material in order to reduce downtime due to out of specification material.

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

Unlike other metals however, mercury if present will be in the vapour phase. BAT for mercury removal is usually the dosing of activated carbon into the exhaust gas stream. The Applicant is not proposing to use activated carbon to capture mercury, as they consider that the syngas clean-up process which remove the mercury from the syngas.

Due to the low solubility of elemental mercury in water and its nature as a vapour, the syngas clean up system has been designed to convert elemental mercury vapour into forms which are readily captured within the system, leaving low concentrations which could be emitted to atmosphere. Upon cooling to a temperature below 400ºC, the elemental mercury vapour in the syngas will be converted into solid phase compounds, adsorbed onto the surface of other solid particles or partially oxidised due to the presence of halogenated compounds present in the syngas prior to clean up. The syngas clean up includes fine particulate filtration and water scrubbing steps which are designed to capture particulate mercury and water-soluble oxidised mercury within the syngas. For this reason, the Applicant does not consider it necessary to install a Powdered Activated Carbon system for the treatment of flue gases. We have reviewed the Applicant's justification and we are satisfied that their proposals are BAT.

6.3 BAT and global warming potential

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

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

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. If the Applicant had chosen to use SCR for NOx abatement then N_2O emissions would increase the overall global warming potential of the installation. However, the Applicant has not chosen to use secondary abatement for NOx and so the Operator’s preferred option is best in terms of GWP.

6.4 BAT and POPs

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

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

The unintentionally-produced POPs addressed by the Convention are:

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

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

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

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

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

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

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

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

The release of **dioxins and furans** to air is required by the IED to be assessed against the I-TEQ (International Toxic Equivalence) limit of 0.1 ng/m^3. Further development of the understanding of the harm caused by dioxins has resulted in the World Health Organisation (WHO) producing updated factors to calculate the WHO-TEQ value. Certain **PCBs** have structures which make them behave like dioxins (dioxin-like PCBs), and these also have toxic equivalence factors defined by WHO to make them capable of being considered together with dioxins. The UK's independent health advisory committee, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has adopted WHO-TEQ values for both dioxins and dioxin-like PCBs in their review of Tolerable Daily Intake (TDI) criteria. The Permit requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be monitored for reporting purposes, to enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. The Permit also requires monitoring of a range of PAHs and dioxin-like PCBs at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs as listed in the Permit. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2.1 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

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

> "*due to comparatively low levels in emissions from most (combustion) processes special measures for HCB control are usually not proposed. HCB emissions can be controlled generally like other chlorinated*

organic compounds in emissions, for instance dioxins/furans and PCBs: regulation of time of combustion, combustion temperature, temperature in cleaning devices, sorbents application for waste gases cleaning etc." [reference http://www.eea.europa.eu/publications/EMEPCORINAIR4/sources_of_HCB.pdf]

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

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

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

6.5 Other Emissions to the Environment

6.5.1 Emissions to water

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

All uncontaminated surface water runoff, including rainwater, will infiltrate into the underlying made ground primarily through overland flow. It is unlikely that effective SUDS can be successfully implemented due to the existence of made ground. Therefore a series of lined attenuation ponds will be constructed. Any remaining surface water will flow to these attenuation ponds for the eventual discharge into the existing watercourse

The enclosed waste reception building, where waste is stored and pre-treated, will benefit from impermeable concrete surfacing and a sealed drainage system preventing any potentially contaminated run off from escaping the site. All water required in the gasifier process will be re-circulated in the enclosed system. When process water needs to be replaced, it will be stored in tanks before removal off site to a suitably licensed facility.

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

6.5.2 Emissions to sewer

Currently there will be no process water discharges to sewer and, as described above, when process water needs to be replaced, it will be stored in tanks before removal off site to a suitably licensed facility.

6.5.3 Fugitive emissions

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

The following methods will be implemented to ensure against loss of containment on site:

- containment system: tanks containing potentially polluting liquids will be constructed so that any leaks/spillages will be contained. Tanks will be surrounded by a leakage containment bund capable of containing at least 110% of the volume of the largest tank within the bund;
- storage vessels: storage tanks will be constructed to the appropriate British Standards;
- inspection: tanks will be inspected visually on a daily basis by the site staff to ensure the continued integrity of the tanks and will identify the requirement for any remedial action;
- spill kits: materials suitable for absorbing and containing minor spillages will be maintained on site;
- monitoring techniques: the site staff will undertake daily monitoring for evidence of spillage and leakage. Alongside regular visual inspections, the tanks will be fitted with level indicators to prevent overfilling; and
- building design: the biomass facility buildings, in which potentially polluting materials will be located, will drain directly to a sealed drainage system.

In the event of any potentially polluting leak or spillage occurring on site, the following action will be taken:

- Minor spillages will be cleaned up immediately, using sand or proprietary absorbent. The resultant materials will be placed in a container for off-site disposal to a suitable facility as appropriate.
- In the event of a major spillage, which is causing or is likely to cause polluting emissions to the environment immediate action will be taken to contain the spillage and prevent liquid from entering surface water drains and unsurfaced ground. The spillage will be cleared immediately and placed in containers for off-site disposal, and the Environment Agency will be informed. Records of spillages and incidents will be kept on site together with a summary of the remedial action taken.

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

6.5.4 Odour

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.

Wood waste feedstock will generally have low odour characteristics.

All vehicles entering the facility will be covered / sheeted. All waste wood will be delivered inside the main reception building which has roller shutter doors. No waste will be stored outside.

Management procedures will ensure that prepared materials will be stored for short periods of time so as to prevent the onset of biological decomposition and the development of anaerobic conditions that could be associated with odour.

No putrescible or readily degradable wastes will be accepted at the biomass facility.

The site will be monitored for odours, if required, by site personnel throughout the working day. In the event that odours are detected, investigations will be undertaken to determine the cause and appropriate remedial action taken.

In the event that odorous waste is delivered to site it will be segregated & removed at the earliest opportunity.

Good housekeeping techniques will be implemented to ensure the fuel feedstock storage area is kept clean to avoid any decomposition of waste.

As much odorous air as possible will be used as in the gasification process.

Ash produced by the facility will be quenched producing a wet ash by-product. It is not envisaged that ash handling will cause significant odour issues as handling will take place inside the biomass building, and ash is not considered to be a highly odorous material. In addition vehicles removing ash will be covered before leaving the site.

6.5.5 Noise and vibration

All waste treatment will take place within the main waste reception building. Maintenance plans will be included as part of the EMS that will ensure maintenance is undertaken in accordance with manufacturer’s specifications.

A Noise Management Plan has been included in Appendix BATOT4 of the application.
In summary, appropriate measures to reduce/control noise will include:

- the design of the facility will minimise reversing and so reduce noise from reversing ‘bleepers’;
- all plant will be situated within the main enclosed reception building;

- feed water & condensate pumps will be located within the enclosed waste reception building which will benefit from concrete surfacing;
- the steam exhaust will be fitted with a silencer; all plant will be maintained according to the Manufacturer's instructions and fitted with silencing equipment where appropriate;
- drop heights will be kept to a minimum;
- all site surfaces will be kept in a good state of repair to reduce vehicle noise and vibration;
- localised screening and/or acoustic enclosures will be used if required;
- where possible, plant will be sited or routed away from sensitive receptors;
- vehicles and plant will be switched off when not in use;
- the six gas engines will be located within a separate enclosed room within the main reception building;
- low level noise plant will be selected wherever possible; and
- a speed limit for all vehicles will be imposed on site.

The overall risk from the proposed activities from noise was assessed as not significant given the proposed mitigation measures and location of the site.

The noise management plan follows the structure of our guidance note but rather than (say) give details of sensitive receptors in the plan, the operator refers back to the noise assessment report. Also the design of the plant may change by the time it is constructed. Consequently we have set pre-op condition PO4 to review and update the noise management plan. We have also set an improvement condition IC1 to ensure that the operator verifies (through corroborative measurements over a range of operational and atmospheric conditions) the overall effectiveness of the proposed noise attenuation measures.

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

The application contained a noise assessment report "Clay Cross Energy Recovery Facility – Environmental Permit Application Noise Assessment. SLR Ref: 4027.05333.00002. Version No: 2, July 2016" which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures. Measurements were taken of the prevailing ambient noise levels to produce a baseline noise survey and an assessment was carried out in accordance with BS 4142:2014 to compare the predicted plant rating noise levels with the established background levels.

The report concludes that there will be a numerical noise impact for night-time operation which, according to BS 4142:2014, could be an indication of an ‘adverse impact’. This is at one location on Brassington Street. Note the predicted impact is not a ‘significant adverse’ impact that may indicate the need for further mitigation.

The report states that the background sound levels measured at the Brassington Street location could possibly be lower than those measured at the nearest property and consequently it considered that the ‘adverse’ impact identified at this location could possibly be less than predicted.

We have audited the assessment and made observations conducting check modelling with sensitivity analysis to our observations and have predicted a similar worst-case numerical impact in the limited area of Brassington Street.

We have identified that the impact of the facility is sensitive to the stack sound power level. The Applicant claims that they can achieve an attenuation of 83dB(A) for noise emissions from the stack. Once the final plant design is complete, the Applicant needs to confirm that the attenuation used would provide this level of reduction. Consequently we have set pre-operating condition PO4 to confirm the final build design of the plant, and improvement condition IC1 to demonstrate that noise attenuation is at least as effective as that predicted in the Noise Assessment report

The Applicant has concluded, on the basis of a numerical noise impact prediction, that there are no indications of ‘significant adverse’ impacts associated with the proposed facility. Using a conservative approach we predict a similar numerical noise impact and from our sensitivity modelling and reading of the context we expect that the impact of noise will be acceptable.

6.6 Setting ELVs and other Permit conditions

6.6.1 Translating BAT into Permit conditions

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

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

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

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

(i) Local factors

We have assessed the impacts of emissions locally and concluded that no EQS's will be breached as a result of emissions from the Installation.

(ii) National and European EQSs

No National or European EQSs will be breached as a result of emissions from the Installation.

(iii) Global Warming

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

We have therefore considered setting equivalent parameters or technical measures for CO_2. However, provided energy is recovered efficiently (see section 4.3.7 above), there are no additional equivalent technical measures (beyond those relating to the quantity and characteristics of the waste) that can be imposed that do not run counter to the primary purpose of the plant, which is the recovery of energy from waste. Controls in the form of restrictions on the volume and type of waste that can be accepted at the Installation and permit conditions relating to energy efficiency effectively apply equivalent technical measures to limit CO_2 emissions.

(iv) Commissioning

Given that it may be some time before the plant is actually fully designed and built we have set several pre-operating conditions in Table S1.4, for the operator to confirm the final design of the plant before commissioning begins.

Improvement conditions IC1, IC3, and IC4 have been set to submit reports post commissioning to confirm that the performance of the plant is that described within the Application.

6.7 Monitoring

6.7.1 Monitoring during normal operations

We have decided that monitoring should be carried out for the parameters listed in Schedule 3 using the methods and to the frequencies specified in those tables. These monitoring requirements have been imposed in order to demonstrate compliance with emission limit values and to enable correction of measured concentration of substances to the appropriate reference conditions; to establish data on the release of dioxin-like PCBs and PAHs from the incineration process and to deliver the requirements of Chapter IV of IED for monitoring of residues and temperature in the combustion chamber.

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

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

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

The Operator has stated that they will provide back-up CEMS working in parallel to the operating CEMS. These will be switched into full operation immediately in the event that there is any failure in the regular monitoring equipment. The back-up CEMS measure the same parameters as the operating CEMS.
In the unlikely event that the back-up CEMS also fail Condition 2.3.10 of the permit requires that the abnormal operating conditions apply. The Operator states that in this scenario, the plant will be safely shut down. This will take approximately 45 minutes of unmonitored but not uncontrolled emissions.

6.7.3 Continuous emissions monitoring for dioxins and heavy metals

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

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

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

In the case of dioxins, equipment is available for taking a sample for an extended period (several weeks), but the sample must then be analysed in the conventional way. A CEN committee has agreed Technical Specifications (EN TS 1948-5) for continuous sampling of dioxins. This specification will lead to a CEN standard following a validation exercise which is currently underway. According to IED Article 48(5), “As soon as appropriate measurement techniques are available within the Union, the Commission shall, by means of delegated acts in accordance with Article 76 and subject to the conditions laid down in Articles 77 and 78, set the date from which continuous measurements of emissions into the air of heavy metals and dioxins and furans are to be carried out. This is yet to happen. However, our extant ‘dioxin enforcement policy’ recommends continuous sampling of dioxins where multiple emission exceedances occur and no clear root cause can be identified. Therefore should continuous sampling be required at a later date during the operation of the installation, then sampling and analysis shall comply with the requirements of EN TS 1948

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

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

6.8 Reporting

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

7 Other legal requirements

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

7.1 The EPR 2016 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 2016 – **IED Directive**

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

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

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

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

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

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The report to the Derbyshire County Council Planning Committee from the Strategic Director – Economy, Transport and Communities *"The construction and operation of an energy recovery facility (ERF) and ancillary facilities, comprising offices and welfare facilities, visitor centre, access roads and weighbridge facilities, electrical compound, together with peripheral landscaping, drainage and security fence, at bridge street, clay cross code no: cw4/1114/98"*.

- The response of the Environment Agency to the local planning authority in its role as consultee to the planning process.

The planning application was reported to the planning committee in April 2016. The resolution was to permit subject to a section 106 legal agreement. The detail of the legal agreement is outlined in the committee report, and includes reference to CHP. The planning permission cannot be issued until the legal agreement is completed and signed by all relevant parties

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

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

7.1.2 Schedule 9 to the EPR 2016 – **Waste Framework Directive**

As the Installation involves the treatment of waste, it is carrying out a *waste operation* for the purposes of the EPR 2016, and the requirements of Schedule 9 therefore apply. This means that we must exercise our functions so as to ensure implementation of certain articles of the WFD.

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

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

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

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

Article 23(1) requires the permit to specify:

(a) the types and quantities of waste that may be treated;
(b) for each type of operation permitted, the technical and any other requirements relevant to the site concerned;
(c) the safety and precautionary measures to be taken;
(d) the method to be used for each type of operation;

(e) such monitoring and control operations as may be necessary;
(f) such closure and after-care provisions as may be necessary.

These are all covered by permit conditions.

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

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

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

7.1.3 Schedule 22 to the EPR 2016 – **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 2016), 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 2016 requires the Environment Agency to prepare and publish a statement of its policies for complying with its public participation duties. We have published our public participation statement.

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

Our decision in this case has been reached following a programme of extended public consultation in that we advertised the application within a local paper. As we had no public responses to this initial consultation, we did not consult on the draft decision. The way in which this consultation was done is set out in Section

2.2. A summary of the responses received to our consultations and our consideration of them is set out in Annex 2.

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, as there are no Sites of Special Scientific Interest within 2Km of the proposed Installation.

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.

7.2.6 **Deregulation Act 2015**

Section 108 – Growth duty

We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit.
Paragraph 1.3 of the guidance says:
"The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation."

We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.

We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards

7.3 National secondary legislation

7.3.1 **The Conservation of Natural Habitats and Species Regulations 2010**

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

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

The habitat assessment is summarised in greater detail in section 5.4.2 of this document. A copy of the full Appendix 11 Assessment can be found on the public register.

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2.2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 4. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive.

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

IED Article	Requirement	Delivered by
45(1)(a)	The permit shall include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2000/532/EC, if possible, and containing information on the quantity of each type of waste, where appropriate.	Condition 2.3.4(a) and Table S2.2 in Schedule 2 of the Permit.
45(1)(b)	The permit shall include the total waste incinerating or co-incinerating capacity of the plant.	Condition 2.3.4(a) and Table S2.2 in Schedule 2 of the Permit.
45(1)(c)	The permit shall include the limit values for emissions into air and water.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1(a) in Schedule 3 of the Permit.
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	Not Applicable
45(1)(e)	The permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Conditions 3.5.1 to 3.5.5 and Tables S3.1, S3.1(a), S3.3 and S3.4 in Schedule 3 of the Permit.
45(1)(f)	The permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.10 and 2.3.11.
45(2)(a)	The permit shall include a list of the quantities of the different categories of hazardous waste which may be treated.	Not Applicable
45(2)(b)	The permit shall include the minimum and maximum mass flows of those hazardous waste,	Not Applicable

IED Article	Requirement	Delivered by
	their lowest and maximum calorific values and the maximum contents of polychlorinated biphenyls, pentachlorophenol, chlorine, 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.	Condition 2.3.1and Table S1.2 of Schedule 1 of the Permit.
46(2)	Emission into air shall not exceed the emission limit values set out in parts 4 or determined in accordance with part 4 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a.
46(3)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(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. Limits on dust, CO and TOC not to be exceeded during this period.	Conditions 2.3.10 and 2.3.11
47	In the event of breakdown, reduce or close down operations as soon as practicable. Limits on dust, CO and TOC not to be exceeded during this period.	condition 2.3.10
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Conditions 3.5.1 to 3.5.5. Reference conditions are

IED Article	Requirement	Delivered by
		defined in Schedule 6 of the Permit.
48(2)	Installation and functioning of the automated measurement systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Condition 3.5.3, and tables S3.1, S3.1(a), and S3.3
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Conditions 3.5.3 and 3.5.4
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Conditions 4.1.1 and 4.1.2, and Tables S4.1 and S4.4
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	conditions 3.1.1 and 3.1.2 and 3.5.5
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 S3.4
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Condition 2.3.7, Pre-operational condition PO6 and Improvement condition IC4 and Table S3.3
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.7
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.7
50(4)(c)	Automatic shut to prevent waste feed if the CEMs show that ELVs are exceeded due to disturbances or failure of waste cleaning devices.	Condition 2.3.7
50(5)	Any heat generated from the process shall be recovered as far as practicable.	(a) The plant will generate electricity (b)implement combined heat and

IED Article	Requirement	Delivered by
		power scheme (Condition IC8) and review options every 2 years (Conditions 1.2.1 and 1.2.2)
50(6)	Relates to the feeding of infectious clinical waste into the furnace.	No infectious clinical waste will be burnt
50(7)	Management of the Installation to be in the hands of a natural person who is competent to manage it.	Conditions 1.1.1 to 1.1.3 and 2.3.1 of the Permit.
51(1)	Different conditions than those laid down in Article 50(1), (2) and (3) and, as regards the temperature Article 50(4) may be authorised, provided the other requirements of this chapter are met.	No such conditions Have been allowed
51(2)	Changes in operating conditions do not cause more residues or residues with a higher content of organic polluting substances compared to those residues which could be expected under the conditions laid down in Articles 50(1), (2) and (3).	No such conditions Have been allowed
51(3)	Changes in operating conditions shall include emission limit values for CO and TOC set out in Part 3 of Annex VI.	No such conditions Have been allowed
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	Conditions 2.3.1, 2.3.3, 3.2, 3.3, 3.4 and 3.6.
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Condition 2.3.4(a) and Table S2.2 in Schedule 3 of the Permit.
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).	Not Applicable

IED Article	Requirement	Delivered by
52(4)	Prior to accepting hazardous waste, the operator shall carry out the procedures set out in Article 52(4).	Not Applicable
52(5)	Granting of exemptions from Article 52(2), (3) and (4).	Not Applicable
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Conditions 1.4.1, 1.4.2 and 3.5.1 with Table S3.4
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	conditions 1.4.1 2.3.1, 2.3.2 and 3.2.1.
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1 and Table S3.4 and pre-operational condition PO5.
55(1)	Application, decision and permit to be publicly available.	All documents are accessible from the Environment Agency Public Register.
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Condition 4.2.2 and 4.2.3.

ANNEX 2: Pre-Operational Conditions

Based on the information on the Application, we consider that we do need to impose pre-operational conditions. These conditions are set out in the permit in table S1.4 in schedule 1, and referred to, where applicable, in the text of the decision document. We are using these conditions to require the Operator to confirm that the details and measures proposed in the Application have been adopted or implemented prior to the operation of the Installation.

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 in table S1.3, in schedule 1 of the permit - 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.

ANNEX 4: Consultation Reponses

A) Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website, and in the Derbyshire Times on *31/3/16*. The Application was made available to view at the Environment Public Register at: The Environment Agency, Trentside Offices, Trentside North, West Bridgford, Nottingham, NG2 5FA.

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

- Director of Public Health, Derbyshire County Council
- Environmental Health, North East Derbyshire District Council
- Food Standards Agency
- HSE
- Derbyshire Fire and Rescue Service
- National Grid
- Public Health England

The only response we received was from Public Health England:

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Public Health England (Letter dated 12 April 2016)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
The main emissions of potential concern are emissions to air of products of combustion from the incinerator. However, the dispersion modelling submitted with the application notes that, if the incinerator complies with emission limits submitted within the application, environmental concentrations of pollutants will be below air quality standards. Based on the information contained in the application supplied to us, Public Health England has no significant concerns regarding the risk to the health of the local population from the installation.	No action required. Air quality discussed in section 5 of this document

This consultation response is based on the assumption that the permit holder shall take all appropriate measures to prevent or control pollution, in accordance with the relevant sector guidance and industry best practice.	No action required. Appropriate measures discussed in section 6 of this document

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

a) Representations from Local MP, Assembly Member (AM), Councillors and Parish / Town / Community Councils

None received

b) Representations from Community and Other Organisations

None Received

c) Representations from Individual Members of the Public

None Received