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

Decision document recording our decision-making process

The Permit Number is:	EPR/CP3936CA
The Applicant / Operator is:	UYE (UK) Limited
The Installation is located at:	Rother Valley Way Holbrook Sheffield, S20 3RW.

What this document is about

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

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

Preliminary information and use of terms

We gave the application the reference number EPR/CP3936CA/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/CP3936CA. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 03rd October 2013

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

UYE (UK) Limited proposed facility is located at Rother valley Way, Holbrook, Sheffield, S20 3RW. We refer to this as "the **Installation**" in this document.

How this document is structured

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Glossary of acronyms used in this document

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

APC	Air Pollution Control
AQD	Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BREF	BAT Reference Note
CEM	Continuous emissions monitor
CFD	Computerised fluid dynamics
CHP	Combined heat and power
COMEAP	Committee on the Medical Effects of Air Pollutants
CROW	Countryside and rights of way Act 2000
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
EAL	Environmental assessment level
EIAD	Environmental Impact Assessment Directive (85/337/EEC)
ELV	Emission limit value
EMAS	EU Eco Management and Audit Scheme
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended
EQS	Environmental quality standard
EU-EQS	European Union Environmental Quality Standard
EWC	European waste catalogue
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 (Public Health England)

HW	Hazardous waste
HWI	Hazardous waste incinerator
IBA	Incinerator Bottom Ash
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
I-TEF	Toxic Equivalent Factors set out in Annex VI Part 2 of IED
I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
LCPD	Large Combustion Plant Directive (2001/80/EC) – now superseded by IED
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
LOI	Loss on Ignition
LTHW	Low Temperature Heating Water
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
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
RGS	Regulatory Guidance Series
SAC	Special Area of Conservation
SCR	Selective catalytic reduction
SGN	Sector guidance note

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

1 Our decision

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

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

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

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

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 03rd October 2013. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

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

2.2 Consultation on the Application

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

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

We placed a paper copy of the Application and all other documents relevant to our determination (see below) on our Public Register at the Environment Agency, Lateral House, 8 City Walk, Leeds and also sent a copy to Sheffield City Council for its own Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made.

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

- *National Grid*
- *Health and Safety Executive*
- *Food Standards Agency*
- *Public Health England*
- *Local Planning Authority*
- *Local Fire Service*

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

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

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it, and issued an information notices on 23rd October 2013 and 11th February 2014. A copy of each information notice was placed on our public register and sent to Sheffield City Council local authority for inclusion on its register, as was the response when received.

3 The legal framework

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

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

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

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

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

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

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

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

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

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

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

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

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

4.1.2 The Site

The application site is located in the Holbrook Industrial Estate, approximately 1.4 km north-west of Killamarsh and 1.4 km north-east of Halfway. Sheffield City Centre is located approximately 14 km north-west of the application site.

The site is centred on Grid Ref SK 445 817 and is approximately 0.9 ha in area. The northern perimeter of the application site is bounded by industrial units, while the eastern perimeter of the site is bounded by Rother Valley Way, an unclassified public highway. The western perimeter of the site is bounded by an area of open space and an adjacent line of trees. The southern perimeter of the site is bounded by Short Brook and a line of trees.

In terms of current land uses, as the application site is situated in Holbrook Industrial Estate, land uses in the immediate surrounding local area are primarily industrial based. However, there are also residential land uses nearby, with a Travellers' site located approximately 100 m to the west of the site.

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

Further information on the site is addressed below at 4.3.

4.1.3 What the Installation does

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

The IED applies to incineration and co-incineration plants. Co-incineration plants constitute a particular form of incineration plant, based on a set of criteria that establish the primary purpose of the plant made on the basis of the facts existing at the time at which the assessment is carried out. The primary purpose of the plant can therefore be re-assessed at a later date should the facts change. For the purposes of the IED, waste co-incineration is where the main purpose of the plant is **generation of energy** or **production of material products**, and waste is fed as a regular or additional fuel, or in which waste is thermally treated for disposal purposes. Notwithstanding the fact that waste will be thermally treated by the process; the proposed process is considered to be co-incineration because in accordance with Environment Agency Guidance RGN 2 'Understanding the meaning of regulated facility', Energy recovery is at least 0.8 MWhe/tonne waste and the main purpose of this plant can therefore be considered to be the generation of energy.

The fuel for the installation will be pre-prepared non-hazardous waste wood chippings which will be prepared at an off-site facility. The wood will be delivered in bulk haulage vehicles in accordance with the requirements of the manufacturers of the combustion chamber, but in any event to maintain a fuel load equivalent to eight days' operation, circa 1,000 tonnes.

Fuel delivery vehicles will use a one-way system to pass over a weighbridge to weigh the load and inspect the relevant waste transfer notice, along with attendant details on the source and exact nature of the wood materials. The four fuel stores will be rotated in terms of use to ensure that anaerobic conditions are given minimal chance to develop. From the relevant fuel store a Front End Loader (FEL) will deliver the material to one of two walking floors, each one associated with the two combustion lines.

The charge system will be electronically linked to a series of sensors in the combustion chamber which will react to conditions in the furnace, such as change of temperature or inadequate airflow. The system will therefore also be liked into the auxiliary burner system. There will be a control mechanism on the ram feeder which discharges into the control hopper of the firebox. This will work on an interlocking system to control air flow in the combustion chamber and ensure the maximum efficiency of the secondary combustion measures.

The furnace grate for the installation will comprise an inclined grate furnace, with a water cooling system. The grate has been designed to maintain the steady state process flow and is capable of accommodating $35m^3$ of fuel per hour. The grate will include three steps to agitate the waste as it moves through the system. The generation of unburned particulates is minimised by an increased residue time of approximately 2.5 seconds within the combustion chamber. Beyond a constant feed rate, there are three secondary control measures to maintain steady combustion conditions: one in the form of the secondary fan system with direct nozzles to focus the oxygen input where required, and in the form of re-circulated flue gas ("FGR") to manage oxygen input and combustion temperature

Each combustion chamber will benefit from two auxiliary natural gas fired burners provided to ensure that the combustion conditions required under IED are maintained. The burners will normally be powered from generated or mains electricity but in the case of electrical failure they will benefit from a back-up battery bank or, in the event of this resource becoming exhausted, a diesel generator retained on site.

During operational conditions, the system will benefit from a comprehensive monitoring regime that will validate the design, taking measurements on:

(i) traverse temperature sensing;
(ii) one minute mean temperatures; and
(iv) oxygen levels.

The gases from the combustion chamber will be subject to a detailed mitigation package to control emissions of all substances listed in the tables and annexes of Chapter IV of the IED, the type of fuel chosen is the primary management measure.

During the combustion cycle, NOx emissions will be minimised via two dedicated systems. The principal primary control system will be the use of the FGR technology to provide the necessary turbulence and managed oxygen air supply to the combustion process, which will in turn minimise NOx formation. There is also an element of the FGR feeding back into a preheater system, creating net energy savings. The secondary control will be urea injection. This system is a selective non-catalytic reduction (SNCR) which will have the benefit of removing NO_X emissions, thus contributing to the minimisation of emissions. The system will involve the direct injection of the urea before the gases from the combustion chamber enter the thermal oil heat exchanger. The injection nozzles will be specifically designed to optimise the reagent.

The creation of acid gas in the form of hydrogen chloride and hydrogen fluoride is minimal as a result of the proposed abatement and the nature of the waste source. A bicarbonate of soda dosing system will be used on the bag filters which will be triggered when HCl or HF concentrations approach 40 and 4 mg/m^3 respectively.

The system to mitigate particulate matter emissions will have three control systems,
namely:

(i) cyclone separator (CS);
(ii) electrostatic precipitator (ESP); and
(iii) bag filter units.

The generation of electricity will be dependent on the use of an Organic Rankine Cycle (ORC). The ORC is a thermodynamic cycle which converts heat energy into mechanical energy. The mechanical energy is in turn transferred to a generator to create the electrical energy. The installation will be self-reliant for its energy demand, with all parasitic demand supplied by the plant in operational conditions, consistent with Renewable Obligations Legislation. Any remaining electricity is to be distributed to the National Grid. The ORC works on the same principle as a steam turbine, but instead of using steam it uses vaporised silicate oil, (which has a much higher molecular weight particle, travelling at a much lower velocity). This results in lower pressure, heat and less erosion of metal components in the system.

The ash management system will comprise two elements: bottom ash and fly ash. Neither incinerator bottom ash (IBA) nor fly ash/APC residue will be subject to treatment on site and both waste streams will be taken off-site to for disposal/recovery. Wood ash will be collected in the base of the combustion unit and will be extracted via a sealed conveyor.

Bottom ash or wood ash arises in two ways - ash falling through the grates and ash falling off the end of the furnace grate. A hydraulic push rod system will be used to ensure that there is no build-up of these materials. The conveyor and push rod will in turn feed into a sealed storage unit for storage of the ash prior to recycling/disposal off site. In total it is estimated that 65 kg/hr of bottom or wood ash will be generated per line.

The fly ash will be collected and stored at the installation in a fully sealed system, the fly ash will be generated at a rate of approximately 4.32kg per hour per line, which means that circa 75.68 tonnes of this material could be generated per annum. The sealed system comprises a waste hopper for each bag filter. The hoppers will feed into a sealed conveyor, which in turn will feed into FGT residue silos which will also receive the residues from the CS and ESP systems, with a seven day residence time.

Resultant flue gasses will be discharged via an Inducted Draft Fan to be discharged via the two 25m high chimney stacks.

A summary of the overall process is as follows:

- Lorries will deliver the pre-prepared wood chips into the internal bays (refer Plan H40/V3/01) and will leave by the designated one-way system.

- A front-end loader (FEL) will then load the wood on to the two walking floors, which will have six push rods to feed two conveyors.

- Each conveyor will feed a ram feeder at each line that further feeds thermal units/boilers.

- The heat from the boiler heats thermal oil, which in turn heats a silicate.

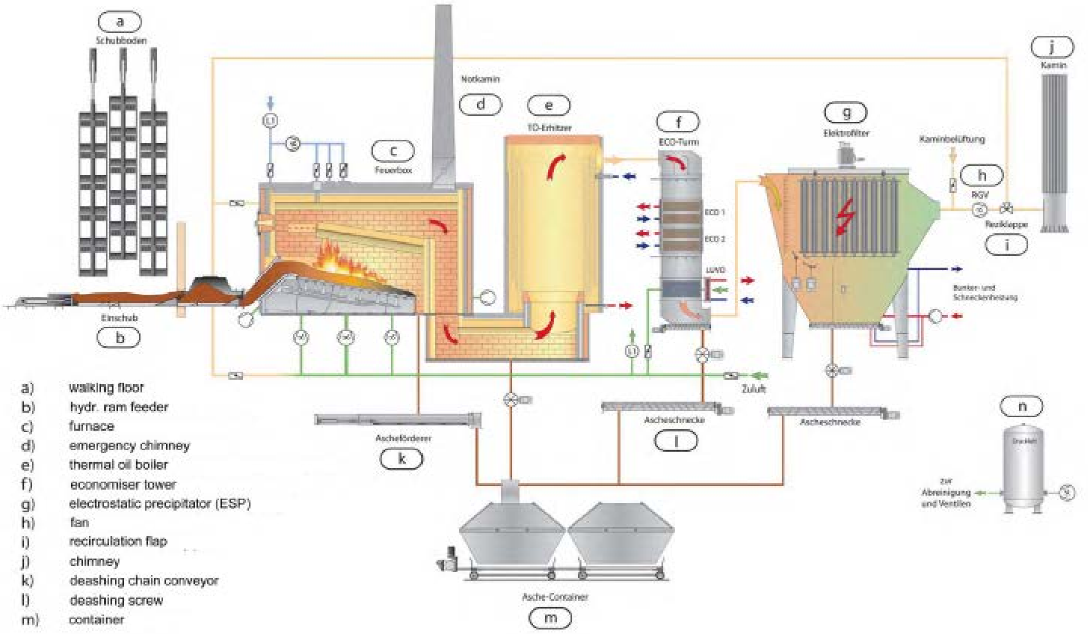
- The heated silicate, being a very dense liquid, is vaporised and the vapours will drive the Organic Rankine Cycle (ORC) Turbine.

- The turbine in turn provides the mechanical energy to drive the generation turbines.

- The silicate is cooled to a liquid again and re-circulated into the ORC system.

- The resultant flue gasses from the thermal unit pass through a Cyclone Separator (CS) unit, an Electrostatic Precipitator, and bag filters in order to clean the emissions and remove any particulate matter prior to the exhaust gases exiting via the flue stack.

Plant Layout



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

Waste throughput, Tonnes/line	45,000 tonnes per annum maximum	Nominal 5.2 tonnes per hour (2 lines)
Waste processed	Wood	
Number of lines	2	
Furnace technology	Grate	
Auxiliary Fuel	Natural Gas	
Acid gas abatement	Dry	
NOx abatement	SNCR	urea
Reagent consumption	Urea (Dry state pellets – Quantity to be determined by the use of SNCR) Sodium Bicarbonate: 1000 te/annum Activated carbon: 30.0 te/annum	
Flue gas recirculation	Yes	
Dioxin abatement	Activated carbon	
Stack	Height, 25m	Diameter, 1.1m
Flue gas	Flow, 7.3Nm^3/s	Velocity, 11m/s
Electricity generated	37,720MWh Annually	4.6 MW (max output)
Electricity exported	37,400MWh Annually	
Heat energy exported	4MWth Potential	CHP ready
LTHW conditions	None CHP ready	None CHP ready

4.1.4 Key Issues in the Determination

The key issues arising during this determination were the potential for emissions to air 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

A Site Condition Report detailing the environmental setting of the site (including geology, hydrogeology and hydrology), pollution history and historical land use of the proposed site has been compiled by the applicant.

The proposed installation is located in the Holbrook Industrial Estate, approximately 1.4 km north-west of Killamarsh and 1.4 km north-east of Halfway. Sheffield City Centre is located approximately 14 km to the north-west. The site is centred on Grid Ref SK 445 817 and is approximately 0.9 ha in area, the northern perimeter of the site is bounded by industrial units, while the eastern perimeter of the site is bounded by Rother Valley Way, an unclassified public highway. The western perimeter of the site is bounded by an area of open space and an adjacent line of trees. The southern perimeter of the site is bounded by Short Brook and a line of trees.

In terms of current land uses, as the site is situated in Holbrook Industrial Estate, land uses in the immediate surrounding local area are primarily industrial based (B1, B2 and B8). However, there are also pseudo residential land uses nearby, with a Travellers' day site located approximately 100 m to the west which has been a key factor in the design of the proposals.

With reference to the series of Ordnance Survey maps the site mainly has a history of agricultural land use through the late 19th Century and early-mid 20th Century. This was also the case in the context of surrounding uses, with the exception being the development of Holbrook Colliery some 3 km south of the site. Reference to the 1898 mapping data confirms the development of a bridge and track across the site to connect to Low Lane (now Rother Valley Way).

Land to the south-east was historically used as a brick yard in association with the development of the colliery, through until the 1920's when a sewerage works was established on what is now the Massey Trucks site.

The site itself was subject to opencast coal mining in the mid-1960s, along with land to the west. This was subsequently restored to approximately original levels using inert waste materials in the period 1978-1991. The Envirocheck report reproduced at Appendix B includes summary details on this facility at Entry 43. The aforementioned contaminated land investigations (refer section 2.2 above) have confirmed that the deposited materials can be considered as being inert.

The site is located in the wider catchment of the River Rother which is located approximately 300 m south-east.

Reference to geological maps confirms that the site is specifically located on the outcrop of the Middle Coal Measures associated with the Swallow Wood, Dunsil and Top Hard Coal Seams. The Measures in and around these coal seams tend to be dominated by mudstone facies with some carbonaceous shaley materials.

The Rother is fed by a number of smaller tributaries, one of which, the Shire Brook (or Short Brook) is adjacent to the southern perimeter of the site. The brook comprises a narrow well-aligned watercourse, with steeply incised banks. The brook flows from west to east into the nearby Beighton Marsh wetland area, part of the wider Shire Brook Valley LNR.

The site is located in Flood Zone 1 and is therefore not within the functional floodplain. The floodplain, which is in close proximity to the application site to the east of Rother Valley Way, has been largely influenced by anthropogenic activity which includes the nearby Rother Valley Lake, which is a designated flood storage area.

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

There are no Sites of Special Scientific Interest within 2Km of the proposed Installation. The following non-statutory sites lie within 2km of the site.

- Dale Road Marsh
- Site Name: Chesterfield Canal - Norwood
- Site Name: River Rother Meander #2
- Site Name: Westthorpe Railway Cutting
- Site Name: Forge Lane Railway Trail

4.2.2 <u>Proposed site design: potentially polluting substances and prevention measures</u>

All wood materials will be handled and stored in an enclosed environment with no scope for water-based emissions from the unit.

As part of the combustion process, fly ash and bottom ash will be created as waste products, both will be retained in sealed closed systems and disposed of off-site at an appropriately licensed facility.

The site has been designed to be separate and not be in hydraulic continuity with the surrounding hydrological system. Rainwater run-off will be collected and harvested for use in the wash down in the dust suppression in the entrance/weighbridge area or as grey water in the onsite facilities where necessary, discharged to the adjacent sewer network.

There will be no discharges off site except emissions to air, be it point source or diffuse to any natural receptors, and therefore no impact on the surrounding hydrological and hydro-geological regime. This applies in both the construction and operational phases of the installation.

The proposed installation will use a number of materials/substances to augment the primary and secondary (i.e. abatement) operations. As part of standard operational procedures and in accordance with the Environmental Management System, a full inventory will be maintained at all times of all the materials stored on site, along with their quantity and condition. In principle, such measures will mainly cover the use of the silicate oils, the lubricating oils, fire fighting equipment and all other ancillary materials

The SCR submitted confirms limited plausible pathways to surface water features, however these do represent potential receptors in the event of pollution incidents from the site. This risk can be reduced by primary and secondary containment methods and suitably designed drainage systems. Pollution of land and water is unlikely

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

The Applicant has submitted a site condition report which does not include a report on the baseline conditions as required by Article 22. We have reviewed that report and consider that it does not adequately describe the condition of the soil and groundwater prior to the start of operations. We have therefore set a pre-operational condition (PO1) requiring the Operator to provide this information prior to the commissioning 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 Volume 4, Section 5.9 of the Application. Pre-operational condition PO2 requires the Operator to have an Environmental Management System in place before the Installation is operational, and this will include a site closure plan.

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

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

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

The 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) that will be certified under ISO14001, pre-operational measure (PO2) requires the operator to provide a summary of the EMS to the Environment Agency prior to commencement of operations. The Environment Agency recognises that certification of the EMS cannot take place until the Installation is operational. An improvement condition (IC1) is included requiring the Operator to report progress towards gaining accreditation of its EMS.

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

4.3.3 Site security

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

4.3.4 Accident management

The Applicant has submitted an Accident Management Plan. Having considered the Plan other information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. An Accident Management Plan will form part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO2).

4.3.5 Off-site conditions

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

4.3.6 Operating techniques

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

Description	Parts Included	Justification
Application	Volume 3 of the application Installation details, Sections 1,2 3,4,5,6,7,8,9,10,11 and 12. Volume 5 of the application Emissions - sections 2, 3 and 4.	Duly Made 01/10/13
Response to Schedule 5 Notice dated 23/10/13	Partial Schedule 5 (Question1) responsive - via E-Mail – Clarification Energy Recovery Values and throughputs/operating hours.	13/12/13

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

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

Raw Material or Fuel	Specifications	Justification
Fuel Oil (Back Up generator)	< 0.1% sulphur content	As required by Sulphur Content of Liquid Fuels Regulations.

Article 45(1) of the IED requires that the Permit must include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2005/532/EC, EC, if possible, and containing information on the quantity of each type of waste, where appropriate. The Application contains a list of those wastes in Volume 3, Installation details, Section 12.2.2, 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, waste wood is subject to a minimum lower heating LHV Value of >14.0Mj/kg.

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;
(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 45,000 tonnes per annum. This is based on the installation operating 8,760 hours (subject to maintenance) per year at a nominal capacity of 5.64 tonnes per hour.

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

4.3.7 Energy efficiency

(i) Consideration of energy efficiency

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

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

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

3. The combustion efficiency and energy utilisation of different design options for the Installation are relevant considerations in the determination of BAT for the Installation, including the Global Warming Potential of the different options. This aspect is covered in the BAT assessment in section 6 of this Decision Document.

(ii) Use of energy within the Installation

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

The Application details a number of measures that will be implemented at the Installation in order to increase its energy efficiency including

- Specific choice of motors and/or drivers to minimise the energy requirements of conveyors and walking floors. The use of hydraulic power will aid in this process;

- Heat energy will be recovered wherever possible in the system and used to export as a product to offset a large proportion of the fuel demands from third parties (CHP- Ready);

- The use of waste heat in the pre-heater and in secondary combustion (i.e. FGR) this is a key design element for thermal efficiency in the combustion process;

- Wherever possible energy efficient plant and equipment will be selected primarily to reduce the parasitic load and thereby increase both the thermal and electrical efficiency of the plant;

- The layout of the process has been optimised to safeguard direct flow lines and minimise the need for transfer points and liquid pumping distances;

- A continued monitoring system will be in place, monitoring all elements of the installation; this ensures the best use of energy at all times.

- All plant, equipment and machinery will be subject to regular inspection and maintenance to ensure that the plant (including all ancillary infrastructure such as ducting and piping) is being operated as efficiently as possible.

- Energy consumption will be regularly monitored and other improvement opportunities will be identified outside of the energy production process, for example staff training to make all personnel aware of energy efficiency measures that can be implemented as part of day to day working, which may include switching any equipment off when not required.

The Application states that the specific energy consumption, a measure of total energy consumed per unit of waste processed, will be 7.78kWh/tonne. The installation capacity is 45,000 t/a.

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

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

The BREF says that it is BAT to reduce the average installation electrical demand to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. The LCV in this case is expected to be 14.0MJ/kg. Taking account of the difference in LCV, the specific energy consumption in the Application is in line with that set out above.

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

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

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

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

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

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

The Installation will generate electricity only and has been specified to maximise electrical output with little or no use of waste heat. The Sankey diagram in Volume 3 of the Application shows 4.6MW of electricity produced for an annual burn of 45,000 tonnes which represents 10.2 MW per 100,000 tonnes/yr of waste burned. The Installation is therefore high up in the indicative BAT range.

The SGN and Chapter IV of the IED both require that, as well as maximising the primary use of heat to generate electricity; waste heat should be recovered as far as practicable. I.e. by identifying and utilising opportunities for Combined Heat and Power (CHP) and district heating. Where steam or hot water are raised for use in an industrial process or for district heating the potential efficiency of electrical power generation is reduced but overall energy efficiency can be significantly improved depending upon finding a demand for heat produced by the facility.

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. The Applicant carried out a feasibility study, which showed there was a demand and potential to provide district heating to the Westfield residential area where the heat can be economically exported and used by consumers in the local community. The proposed plant has been designed with the ability to export “low grade” heat to third parties, The potential heat capacity available for such use would be up to 32,000 MWth/year. Establishing a district heating network to supply the Westfield residential area would involve significant technical, financial and planning challenges such that this is not seen as a practicable at present, It is unclear at this stage when the necessary infrastructure will be put in place for the supply of low grade heat and therefore the plant remains ‘CHP-R’ only, the Operator intends to review this position on a regular basis.

Our draft CHP guidance also states that opportunities to maximise the potential for heat recovery should be considered at the early planning stage, when sites are being identified for incineration facilities. 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 Sheffield *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 6(6) are met.

(vii) Permit conditions concerning energy efficiency

Pre-operational condition PO3 requires the Operator to carry out a comprehensive review of the available heat recovery options prior to commissioning, in order to ensure that waste heat from the plant is recovered as far as possible.

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

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

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

4.3.8 Efficient use of raw materials

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

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

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

This requirement addresses wastes produced at the Installation and does not apply to the waste being treated there. The principal waste streams the Installation will produce are bottom ash (Approx 1038tpa) and air pollution control residues (Approx 600tpa)

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree of burnout of the ash in the furnace, which results in a material that is both reduced in volume and in chemical reactivity. Condition 3.1.5 and associated Table S3.3 specify limits for loss on ignition (LOI) of <5% in bottom ash. Compliance with this limit will demonstrate that good combustion control and waste burnout is being achieved in the furnaces and waste generation is being avoided where practicable.

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

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

In order to ensure that the IBA and APC residues are adequately characterised, pre-operational condition PO4 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.3 requires the Operator to carry out an ongoing programme of monitoring.

The Application also proposes that, where possible, bottom ash will be transported to a suitable recycling facility, from where it could be re-used in the construction industry as an aggregate.

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

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

5. Minimising the Installation’s environmental impact

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

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

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

5.1 Assessment Methodology

5.1.1 Application of Environment Agency H1 Guidance

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

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

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

5.1.2 Use of Air Dispersion Modelling

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

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

Where an EU EQS exists, the relevant standard is the EU EQS. Where an EU EQS does not exist, our guidance sets out a National EQS (also referred to as Environmental Assessment Level - EAL) which has been derived to provide a similar level of protection to Human Health and the Environment as the EU

EQS levels. In a very small number of cases, e.g. for emissions of Lead, the National EQS is more stringent that the EU EQS. In such cases, we use the National EQS standard for our assessment.

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

PCs are considered **Insignificant** if:

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

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

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

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

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

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

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

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

This is not the end of the risk assessment, because we also take into account local factors (for example, particularly sensitive receptors nearby such as a

SSSIs, SACs or SPAs). These additional factors may also lead us to include more stringent conditions than BAT.

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

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in Section 5 of the Application. The assessment comprises:

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

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

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS 4.2 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data observed at a weather station at Rotherham between 2001 and 2005. The impact of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling.

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

- First, they assumed that the ELVs in the Permit would be the maximum permitted by Article 46(2) and Annex VI of the IED. These substances are:
    - o Oxides of nitrogen (NO_x), expressed as NO_2
    - o Total dust
    - o Carbon monoxide (CO)
    - o Sulphur dioxide (SO_2)
    - o Hydrogen chloride (HCl)
    - o Hydrogen fluoride (HF)
    - o Metals (Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium)
    - o Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)

- Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC)

- Second, they assumed that the Installation operates continuously at the relevant long-term emission values under IED and the following a Schedule 5 request for further information on 11th February 2014 short-term emission limit values, i.e. the maximum permitted emission rates under IED

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

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.

"On review of the applicant's assessment, we have reservations about many aspects of the methodologies but asked for additional information only on those matters we considered have the potential to affect their conclusions or were missing (schedule 5 Notices dated 23rd October and 11th February 2013).

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

5.2.1 Assessment of Air Dispersion Modelling Outputs

The Applicant's modelling predictions are summarised in the tables below. The figures shown indicate the predicted peak ground level exposure to pollutants in ambient air.

(i) Long Term

Pollutant	Period	EQS	Back-ground Conc.	Process Contribution (PC)	PC as % of EQS	Predicted Environmental Concentration (PEC)	PEC as % EQS
PM_{10}	Annual mean (1hr)	40	-	0.132	0.33	-	-
$PM_{2.5}$	Annual mean (1hr)	20	-	0.132	0.66	-	-
HF	Annual mean (1hr)	16	-	0.0132	0.08	-	-
NO_2	Annual mean (1hr)	40	22.29	2.63	6.59	24.924	62.30
Cd and Ti (ng/m3)	Annual mean (1hr)	5	0.19	0.658 (Note 5)	13.16	0.848	16.96
NH_3	Annual mean (1hr)	180	-	0.81973	0.43	-	-
Hg (ng/m3)	Annual mean (1hr)	250	-	0.658 (Note 5)	0.26	-	-
As (ng/m3)	Annual mean (1hr)	3	0.69	0.7306667	24.35	1.421	47.36
Cr	Annual mean (1hr)	5	-	0.0007307	0.01	-	-
V (Note 3)	Annual mean (1hr)	5	-	0.0007307	0.01	-	-
Pb (Note 3)	Annual mean (1hr)	0.25	-	0.0007307	0.29	-	-
Ni[3] (ng/m3)	Annual mean (1hr)	20	2.53	0.7306667	3.65	3.261	1.63
1,3-butadiene (Note 4)	Annual mean (1hr)	2.25	0.103	0.132	2.64	0.235	10.44
PAH's (Note 2) (ng/m3)	Annual mean (1hr)	0.25	0.61	0.013200	5.28 (note 6)	0.623	249.2

Note 1 All the above concentration figures are in $\mu g/m^3$ unless otherwise stated.
Note 2 As bezo(a)pyrene
Note 3 Modelled as 'other metals' taken as 1/9th of result and representative of Sb, Co ,Cu and Mn, calculations for Ni,Cr and V shown and calculated separately with relevant EQS as shown.
Note 4 Modelled as VOC's; assume 100% contribution
Note 5 Modelled at Maximum IED ELV
Note 6 This is a high PC as the applicant assumed that all PAH emissions are as BaP which is highly conservative and unrealistic – refer to text below

(ii) Short Term

Pollutant		EQS	Back-ground Conc	Process Contribution (PC)	PC as % of EQS	Predicted Environmental Concentration (PEC)	PEC as % EQS
HCl (Note 2)	Hourly maximum	750	-	66.56	8.88	-	-
HF (Note 2)	Hourly maximum	160	-	4.44	2.77	-	-
SO_2	15-mins (99.9th %ile)	266	8.2	56.02	21.06	64.22	24.14
SO_2	1-hour (99.73th %ile)	350	8.2	49.43	14.12	57.63	16.46
NO_2 (1)	1-hour (99.79th %ile)	200	55.6	49.68	24.84	105.28	52.64
PM_{10}	24-hour (99.18th %ile)	50	-	0.538	1.08	-	-
SO_2	24-hour (99.4th %ile)	125	-	6.081	4.86	-	-
CO (mg/m^3)	8-hour (100th %ile)	10	-	0.012)	0.12	-	-
NH_3	Hourly maximum	2500	-	2.703	0.11	-	-
Hg (ng/m^3)	Hourly maximum	7500	-	13.516	0.18	-	-
V	Hourly maximum	1	-	0.0150176	1.50	-	-

Note 1 All the above concentration figures are in µg/m^3 unless otherwise stated.
Note 2 Presented as maximum 'grid' PC rather than at relevant receptor.

(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:

PM_{10}, $PM_{2.5}$, HF, NH_3, CO, Hg, Pb, Sb Cr, V,Co, Cu and Mn

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

(ii) Emissions unlikely to give rise to significant pollution

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

- NO_2, SO_2, Cd & Ti, As, Ni and 1,3-butadienne.

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

(iii) Emissions requiring further assessment

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

- *PAH's*

PAH's

Pollutant	EQS	Back-ground Conc.	Process Contribution (PC)	PC as % of EQS	Predicted Environmental Concentration (PEC)	PEC as % EQS
PAH's(ug/m^3)	0.00025	0.00061	0.0000132	5.28	0.0006232	249.28

The applicant 'maximum' PC prediction for PAH's at relevant receptors (R10) is based on a highly conservative assumption that 100% emissions of all PAH's comprised of BaP emissions and that the emission rate used in modelling was derived from the typical BaP emission concentration from waste incineration plant. They have not sourced this value and the emission rate used is more than 10 times the maximum recorded value at our regulated incinerators. Our operator self monitoring data for IED compliant plant show that the highest emissions are ~0.087μg/m^3 this is more than 10times lower than the value used by the applicant.

Check modelling undertaken by the Environment Agency using worst case monitoring data from regulated sites indicates that BaP emissions are likely to be low risk. The predicted PC of 1.3e$^{-5}\mu$g/m^3 is more than 10 times what it is expected to be, and hence more likely to be insignificant at <1% of the EQS at the most affected modelled receptor (R10). The background value from the centre of Sheffield indicates a potential exceedence but we consider the impact likely to be low risk due to the above

In any case, with respect to these pollutants, 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 μg/m^3 as a long term annual average and a short term hourly average of 200 μg/m^3. The model assumes a 100% NO_x to NO_2 conversion for the long term and 50% for the short term assessment this represent a more conservative approach than recommended in Environment Agency guidance on the use of air dispersion modelling where 70% and 35% conversion rates are specified.

The above tables show that the peak long term PC is greater than 1% of the EUEQS at 2.63μg/m^3 at the most affected modelled residential receptor (R10) 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 49.68μg/m^3 representing a PC of 24.84% of a EUEQS of 200μg/m^3 this is above the level we would consider insignificant (>10% of the EUEQS). However it is not expected to result in the EUEQS being exceeded.

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

The impact on air quality from particulate emissions has been assessed against the EQS for PM_{10} (particles of 10 microns and smaller) and $PM_{2.5}$ (particles of 2.5 microns and smaller). For PM_{10}, the EUEQS are a long term annual average of 40 μg/m^3 and a short term daily average of 50 μg/m^3. For $PM_{2.5}$ the EUEQS of 25 μg/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.

Pollutant	EQS	Back-ground Conc.	Process Contribution (PC)	PC as % of EQS	Predicted Environmental Concentration (PEC)	PEC as % EQS
Long Term						
PM_{10}	40	-	0.132	0.33	-	-
$PM_{2.5}$	20	11.19	0.132	0.66	-	-
Short term						
PM_{10}	50	-	0.538	1.50	-	-

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

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

- It assumes that the plant emits particulates continuously at the IED Annex VI limit for total dust, whereas actual emissions from similar plant are normally in the range 1 to 5 mg/m^3.
- 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 10% of the short term EQS and so can be considered insignificant. It also shows that predicted process contribution for

Long Term emissions of PM10 and $PM_{2.5}$ are slightly above 1% EQS and so cannot be considered insignificant. However, the assessment is based very much on a worst case scenario, and in reality the process contribution is expected to be <1% of the EQS. Even so, from the table above, the emission is not expected to result in the EQS being exceeded.

There is currently no emission limit prescribed nor any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition has been included 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.

(iii) Acid gases, SO_2, HCl and HF

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

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

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

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

The above tables show that for VOC emissions, the maximum peak long term PC is greater than 1% of the EAL/EQS at 10.44% 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 peak short term PC for CO is is less than 10% of the EAL/EQS and so can be screened out as insignificant.

The Applicant has used the EQS for 1,3-butadiene for their assessment of the impact of VOC. This is based on 1,3-butadiene having the lowest EQS of organic species likely to be present in VOC (other than PAH, PCBs, dioxins and furans). The Applicant has also used the EQS for benzo[a]pyrene (BaP) for their assessment of the impact of PAH. We agree that the use of the BaP EQS and 1,3-butadiene EQS is sufficiently precautionary.

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

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

The ammonia emission is based on a release concentration of 10 mg/m^3. We are satisfied that this level of emission is consistent with the operation of a well controlled SNCR NO_x abatement system.

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 the best available techniques, this is considered further in Section 6. We are satisfied that PAH and VOC emissions will not result in significant pollution.

Emission limits for ammonia (NH_3) are not listed within the IED, the applicant has assumed a WCS emission concentration of $10mg/m^3$ for NH_3 due to their SNCR NOx abatement.

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

5.2.3 <u>Assessment of Emission of Metals</u>

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

Annex VI of IED sets three limits for metal emissions:

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

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

Where Annex VI of the IED sets an aggregate limit, the Applicant's assessment assumes that for cadmium and thallium each metal is emitted individually at the aggregate limit value and for the other metals that each metal is emitted as the proportion of metals in its group (i.e. one ninth of the limit for each of the group 3 metals). Historical data for Municipal Waste Incinerators indicates that 1/9th of the limit is an over estimate of actual emissions, in addition this is a non-hazarous waste wood co-incinerator only so we are satisfied that the Applicant's proposal is reasonable in this context.

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

- Hg, Pb, Sb Cr, V and Co, Cu and Mn

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

- Cd & Ti, As and Ni

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

Chromium (VI)

The applicant wrongly applied emission levels for CrVI contained in our guidance on assessment of Metals from Municipal Waste incinerators for the purposes of dispersion modelling which concluded a maximum PC of 0.146ng/m^3 and a PEC of 608% based on a background of 1.06ng/m^3.

Pollutant		EQS	Back-ground Conc	Process Contribution (PC)	PC as % of EQS	Predicted Environmental Concentration (PEC)	PEC as % EQS
CrVI (note 1) (ng/m^3)	Annual mean (1hr)	0.2	1.07	0.146	73	1.216	608

Note 1 Modelled as 'other metals'; taken as 20% of total chromium; background taken as 20% of total chromium

The applicant was requested via way of Schedule 5 request dated 11th February 2014 to provide evidence to support the use of our guidance on assessment of metals from Municipal Waste Incinerators, because as a wood co-incinerator the data may not be representative and overly conservative.

The applicant responded to the Schedule 5 question on 14th March 2014 via e-mail stating that the emission rates for CrVI are based on worst case scenario as there is a paucity of data, specifically in relation to the burning of wood waste. Liaison had been made with the manufacturer of the plant and their range of clients, and that they have been unable to derive realistic evidence based values for CrVI emissions for operations within the UK or on the continent, and were therefore unable to provide a satisfactory model at this time. The operator requested that the matter be deferred to an improvement condition requiring the submission of emissions (component metals including CrVI) monitoring data to the Environment Agency obtained during operation of the installation, which would be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application.

The Expert Panel on Air Quality Standards (EPAQS) – “Guidelines for Metal and Metalloids in Ambient Air for the Protection of Human Health”, proposes new ambient air quality guidelines for Arsenic, Nickel and Chromium (VI). These guidelines have been incorporated as EALs in the revised H1 Guidance issued by the Agency in 2010. Arsenic, Nickel and Chromium are three of the nine Group 3 metals whose emissions are subject to a mandatory maximum emission limit by the IED. IED sets an aggregate limit of 0.5 mg/m^3 for all nine Group 3 metals. The EPAQS guidelines refer only to that portion of the metal emissions contained within PM_{10} in ambient air. The new guidelines are $3ng/m^3$ for Arsenic, $20ng/m^3$ for Nickel and $0.2ng/m^3$ for Chromium (VI). These are significantly lower than previous EALs. The IED limit for Group 3 metals of 0.5 mg/m^3 covers gaseous and vapour forms of the metals and their compounds as well as that present in particulate matter. IED has separate emission limit values for emissions to air of total particulate material. The EPAQS guideline also refers to Chromium (VI) only, whereas the Group 3 IED limit includes all Chromium. Measurement of Chromium (VI) at the levels anticipated at the stack emission points is expected to be difficult, with the likely levels being below the level of detection by the most advanced methods. We have considered the concentration of total chromium and chromium (VI) in the APC residues collected upstream of the emission point for existing Municipal Waste incinerators and have assumed these to be similar to the particulate matter released from the emission point. This data shows:

- The mean proportion of Cr(VI) to total Cr is less than 1%. There are two outliers at 2%.
- The mean total Cr emission from these plants is 0.007 mg/m^3 (max 0.03 mg/m^3).
- The mean Cr(VI) emission concentration (based on the bag dust ratio) is $2.1 * 10^{-5}$ mg/m^3 (max $1.0 * 10^{-4}$).

This data is remarkably self-consistent. Based on these data, we consider it remains a conservative assumption to consider that if the maximum Cr(VI) emission concentration will be 0.0001 ng/m^3 for a Municipal waste incinerator then a waste wood incinerator would not be any higher.

Although the assessment shows that an exceedence of the EAL for Chromium (VI), emissions are likely to be low risk based on feedstock. The installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document.

Despite our conclusions above, but in recognition of the potential inadvertent burning of wood having been contaminated with those metals not screened out of the impact assessment above as insignificant, we have imposed improvement condition IC5 requiring the Applicant to reassess the impact of emissions to air of metals based on actual monitoring data from the first year of operation to confirm this judgement, in which case no further action is required. We have included Chromium (VI) in this improvement condition in order to validate the above assumption, even though the above assessment suggests the impact to be low risk.

5.2.4 Consideration of Local Factors

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

Sheffield City Council has declared An area covering entire eastern part of the City containing the major built up areas for annual and 1-hour nitrogen dioxide objectives, and the 24-hour PM_{10} objective primarily due to road vehicle exhaust emissions. The site is located outside of areas of expected high NO_2 and PM_{10} concentrations.

The Applicant's modelling predictions for the pollutants in the AQMA are summarised in the tables below. The figures shown indicate the predicted PC at receptors close to major roads subject to the AQMA and indicative ambient air NO_2 levels within the AQMA.

Receptor	Pollutant	EQS	Back-ground Conc.	Process Contribution (PC)	PC as % of EQS
R10	$PM_{10(\mu g/m^3)}$	40	16.4	0.132	0.33
R13	$NO_{2(\mu g/m^3)}$	40	22.29	0.41	1.025
R14	$NO_{2(\mu g/m^3)}$	40	22.29	0.65	1.625
R16	$NO_{2(\mu g/m^3)}$	40	22.29	1.62	4.05

Overall, whilst all emissions cannot be screened out as insignificant <1%, the Applicant's modelling shows that the installation is unlikely to result in a breach of the EUEQS at relevant receptors within the AQMA.

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

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

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

i) Applying Statutory Controls

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

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

ii) Environmental Impact Assessment

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

iii) Expert Scientific Opinion

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

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

HPA A Position Statement issued by the **HPA** 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 concludes "Modern, well managed incinerators make only a small contribution to local concentrations of air pollutants. It is possible that such small additions could have an impact on health but such effects, if they exist, are likely to be very small and not detectable.". While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable".

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

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

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

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

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

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

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

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

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

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

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

iv) Health Risk Models

Comparing the results of air dispersion modelling as part of the H1 Environmental Impact assessment against European and national air quality standards effectively makes a health risk assessment for those pollutants for which a standard has been derived. These air quality standards have been developed primarily in order to protect human health via known intake mechanisms, such as inhalation and ingestion. Some pollutants, such as dioxins and furans, 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.

Dioxin Intake Models: Two models are available to predict the dioxin 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 are HHRAP and the HMIP model.

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

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

In addition to an assessment of risk from dioxins and furans, the HHRAP model enables a risk assessment from human intake of a range of heavy metals. The HMIP report does not consider metals. 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 models using either the HHRA or HMIP models as described above for dioxins and furans. Where an alternative approach is adopted for dioxins, we check the predictions ourselves using the HMIP methodology.

v) Consultations

As part of our normal procedures for the determination of a permit application, we would consult PCT (England), FSA and in some cases HPA. In this case the PCT also consulted with the HPA. 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 and Furans</u>

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

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

The results of the Applicant's assessment of dioxin intake are detailed in the table below (worst – case results for each category are shown). The results showed that the predicted daily intake of dioxins at all receptors, resulting from emissions from the proposed facility, were below the recommended TDI levels. The operator in calculating this figure has used overly conservative assumptions regarding deposition velocity and without lifetime exposure, more realistic predictions are likely to be substantially lower than this. Given the assumptions in the impact modelling and the application of BAT for minimising dioxin emissions, it is unlikely that the TDI would be exceeded due to the proposed plant's emissions.

Receptor	adult	child
Maximum Exposed individual	0.22 (11% of TDI)	0.77 (39% of TDI)

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

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

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

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

5.3.3 Particulates smaller than 2.5 microns

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

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

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

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

5.3.4 Assessment of Health Effects from the Installation

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

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

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

The Applicant's assessment of the impact from PM10, PM2.5, HF, NH_3, CO. Hg, Pb, Sb Cr, V and Co, Cu and Mn have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions of 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 except PAH's and CrVI which are extensively addressed in section 5.2.1

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

The applicant's precise values for human intake of dioxins, furans and dioxin-like PCB's can only be used for highly conservative screening.

Overall, taking into account the conservative nature of the impact assessment (i.e. that it is based upon an individual exposed for a life-time to the effects of the highest predicted airborne concentrations and consuming mostly locally grown food), it was concluded that the operation of the proposed facility will not pose a significant carcinogenic or non-carcinogenic risk to human health.
Public Health England and Food Standards Agency were consulted on the Application and concluded that they had no significant concerns regarding the

risk to the health of humans from the installation. The Food Standards Agency was also consulted during the permit determination process and it concluded that it is unlikely that there will be any unacceptable effects on the human food chain as a result of the operations at the Installation. Details of the responses provided by the HSE, Public Health England, Planning Authority and National Grid 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

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

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 (Receptors R22-R25):

- Dale Road Marsh
- Site Name: Chesterfield Canal - Norwood
- Site Name: River Rother Meander #2
- Site Name: Westthorpe Railway Cutting
- Site Name: Forge Lane Railway Trail

5.4.2 Assessment of Non-Statutory Sites

The Applicant submitted collected data on the aerial emissions that would be generated by the proposed development and modelling was undertaken which showed that for all pollutants (NOx, SO2, NH_3, N deposition and acid deposition), PC did not exceed 100% of any relevant Critical Level or Critical load.

Maximum PC at Receptor - non-statutory sites (R23)

Receptor	EQS	PC	%EQS
NO_2	30	12.7	42.3
NO2(24)	75	33.07	44.09
HFdaily	<5	0.33	66.0
HFweekly	<0.5	0.17	3.4
SO_2	20	3.17	31.70
NH_3	3	2.56	21.12

For all modelled receptors the Process Contribution is <100% of the relevant Critical Level function and is therefore insignificant.

Calculated total N deposition

For all modelled receptors the Process Contribution is <100% of the relevant Critical Load function and is therefore insignificant.

Receptor	PC (Total N, as N (kg/ha/y))	% of lower band of Critical Load
R22	2.14	21.41
R23	4.84	48.38
R24	2.56	25.60
R25	1.17	11.67
R26	1.73	17.35

Calculated total acid deposition

For all modelled receptors the Process Contribution is <100% of the relevant Critical Load function and is therefore insignificant.

	PC Exceedance	% of CL function
R22	none	8.7
R23	none	20.1
R24	none	10.5
R25	none	4.8
R26	none	6

There are no point source emissions to water, land

A full assessment of the application and its potential to affect the site(s) habitat has been carried out as part of the permitting process. We consider that the application will not affect the features of the site/species/habitat

We have not formally consulted on the application. The decision was taken in accordance with our guidance.

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.

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

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

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

- Particulate emissions of 150 mg/m^3 (15 x normal)
- CO emissions of 200mg/m^3 (4x normal)

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

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

Pollutant	Averaging period	ES (µg/m^3)	PC (µg/m^3)	%ES
CO	8 hour mean	10,000	26.22	0.26

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

The waste (waste wood) is bought to site clean, pre-chipped and prepared and has low levels of heavy metals, chlorides, S and HF and, therefore emissions of metals and acid gases will be inherently low. In addition, the acid gases contained within the flue gas will be readily absorbed by the sodium bicarbonate additive within the bag filter plant.

The plant has both primary measures to prevent the formation of NOx and secondary abatement in the form of SNCR and Urea injection, the operator has confirmed that the plant has been designed as low NOx and baseline conditions (operation without SNCR) are not expected to exceed IED limits, therefore secondary abatement measures will only be used as and where necessary.

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 still be below 2 pg(I-TEQ/ kg-BW/day), of the COT TD and 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: NO_2, PM10, PM2.5, Benzene, CO, Cd, Hg, Pb, As and Ni (Long Term) and SO_2 and NO_2 (Short Term)

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

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

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

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

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

6.1.1 Consideration of Furnace Type

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

The Waste Incineration BREF elaborates the furnace selection criteria as:

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

The BREF also provides a comparison of combustion and thermal treatment technologies and factors affecting their applicability and operational suitability used in EU and for all types of wastes. There is also some information on the comparative costs. The table below has been extracted from the BREF tables. This table is also in line with the Guidance Note "The Incineration of

Waste (EPR 5.01)). However, it should not be taken as an exhaustive list nor that all technologies listed have found equal application across Europe.

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

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

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

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

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

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

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

Static hearth
- Moving Grate Furnace
- Rotary Kiln
- Fluidised Bed
- Pyrolysis / Gasification

Option 1: Fixed Hearth

Pile burning/fixed hearth furnace technologies have in the past been used for clinical and chemical waste, but are now more suited to wastes with low pollution potential.

Fixed hearth furnaces can accept bulk and batch loads of waste and can be adapted for both manual and automatic loading. A basic fixed hearth furnace comprises a main combustion chamber, a secondary after burning emission control chamber and a discharge chimney.

Whilst this type of furnace is relatively simple in design, can accept bulk and batch waste and is relatively cheap to manufacture, the furnace is more expensive to maintain than other technologies, with more moving parts than a rotary kiln for example.

Option 2: Moving Grate

Sloping grate furnace technologies can be both fixed and movable (ie mechanical or conveyor driven). Once the waste has been fed on to the sloping grate, the movement of the grate/influence of gravity shifts the waste towards the opposite end of the grate where it is incinerated.

Primary combustion air is supplied beneath the grate/fire bed, meaning that the air makes efficient contact with the fuel. Secondary and tertiary combustion air (if required) is blown in above the grate/fire bed in order to burn the combustible gases which have been released.

A moving grate means that the waste travelling through the combustion chamber can be managed/optimised for more efficient combustion. Fixed sloping grates however mean that combustion is more unstable due to discontinuous fuel transport within the furnace; the use of a secondary stem is therefore of importance.

Exhaust gases from the furnace will require treatment to achieve compliance with the emission limit requirements of the Waste Incineration Directive (WID). Moving grate systems will produce two residues, bottom ash and air pollution control (APC) residues. Bottom ash, which is the larger (in quantity) of the two residues, can be reused as an aggregate.

Option 3: Rotary Kiln

Rotary kilns fall within two main types: those that can be rotated fully and those which can only be subject to partial rotation. The rotation element of this type of furnace means that the waste is agitated before combustion and therefore achieves good burnout.

As there are no exposed metal surfaces, rotary kilns can operate at high temperatures. Regular maintenance of the furnace is necessary however, particularly in respect of the seals between the rotating kiln and the end plates to prevent leakages of gas or un-burnt waste. Secondary combustion of fine particles may also be required and it is for this reason that such technology is not suitable in this instance.

Option 4: Fluidised Bed

A fluid bed furnace typically comprises a windbox, fluid bed and freeboard zone. A gas oil burner is also used at start-up to enable optimal heating of the bed and to supply additional heat to the combustion process if necessary.

Fluidised bed technology is only suitable for low density and relatively homogenous waste such as wood. This type of furnace uses a hot bed of sand or other granular material which is held in uniform suspension by an upward moving air stream. Combustible solids (i.e. the wood fuel) are dispersed throughout the bed and are subject to rapid combustion.

The advantages of a fluidised bed furnace are that the combustion efficiency is high and temperatures are uniform; it is a relatively simple furnace with no moving parts; lower temperatures lead to low NOx emissions; and the sand/other granular material provides continuous attrition of the burning material, removing the layer of char as it forms and exposing fresh material for combustion.

However, suspended ash (particulate matter) is created in significant quantities that could compromise the abatement systems and lead to a higher level of environmental impact due to the greater need of off-site disposal.

Option 5: Pyrolysis/Gasification

Gasification is the conversion of a solid or liquid feed into a gas by partial oxidation through the application of heat. Pyrolysis is the thermal degradation of a material in the absence of an oxidising agent. The gas produced as part of the gasification process, referred to as syngas, can be highly corrosive due to an endemic toxic content. Extra care must therefore be made to ensure that the gas produced in the reactor and passed to the combustion stage is contained.

In respect of pyrolysis, although most plants have an externally heated sealed chamber, air ingress can be a problem, leading to oxidation. Also as with gasification, the gas produced is highly corrosive and the same plant considerations need to be applied. The advantages of gasification and pyrolysis installations are that the plants comprise small modular units which can be added to/taken away as waste streams or volumes change. The plants are also quicker to construct

Another advantage is that by using less oxygen, fewer air emissions are produced than other technologies. However if the gases coming off the process are burnt (which at Holbrook they will be), this will generate emissions, including a very high TOC level, this requiring further abatement technology

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

The inclined grate system has been chosen for this application as it allows better dispersion of particulates in the combustion chamber, eliminating the scope for fire suppression. This means that combustion rates can be better controlled, with accelerated rates of reheating/cooling where required. The cooling of the grate and the feed cone will be provided on a re-circuited water system that will also connect with the cooling systems on the thermal oils, creating net energy savings within the combustion system.

This is a proven technology suitable for use in this particular application within this wider system already used extensively under a wide range of applications.

The Applicant proposes to use gas as support fuel for start-up, shut down and for the auxiliary burners. Each combustion chamber will benefit from two auxiliary natural gas fired burners provided to ensure that the combustion conditions required under IED are maintained (in particular a minimum temperature of 850°C). The burners would therefore cover the conditions covered in paragraph 4.1.4 above. The burners will normally be powered from generated or mains electricity but in the case of electrical failure they will benefit from a back-up battery bank or, in the event of this resource becoming exhausted, a diesel generator retained on site.

The total capacity of each auxiliary burner will be around 30% of the main boiler design load. The input will be carefully balanced with the primary air and FGR systems. All the ducting, casing and ancillary systems associated with the auxiliary burners will be maintained as gas tight as possible, consistent with BAT

Boiler Design

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

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

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

6.2 BAT and emissions control

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

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

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

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

6.2.1 Particulate Matter

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

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

Maximum emissions of particulate matter have been assessed as insignificant at relevant receptors, and so the Environment Agency agrees that the Applicant's proposed technique is BAT for the installation.

6.2.2 Oxides of Nitrogen

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

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

Reagent Type: Urea	Likely to be BAT			All plant

The Applicant proposes to implement the following primary measures:

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

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

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

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

Long term emissions of NO_x have been assessed as not insignificant but not significant, the maximum PC at modelled human receptors is <70% PEC, and so the Environment Agency agrees that the Applicant's proposed technique is BAT for the installation.

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

6.2.3 Acid Gases, SO_x, HCl and HF

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

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Wet	High reaction rates Low solid residues production Reagent delivery may be optimised by concentration and flow rate	Large effluent disposal and water consumption if not fully treated for re-cycle Effluent treatment plant required May result in wet plume Energy required for effluent treatment and plume reheat		Plants with high acid gas and metal components in exhaust gas – HWIs
Dry	Low water use Reagent consumption may be reduced by recycling in plant	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 and auxiliary burners – gas should be used if available, where fuel oil is used, this will be low sulphur (i.e. <0.1%), this will reduce SO_x at source. The Applicant has justified its choice of natural gas as the support fuel on the basis that this ensures compliancy with EU Directive 75/716/EEC (as emended) and IED and we agree with that assessment.
- Management of heterogeneous wastes – this will disperse problem wastes such as PVC by ensuring a homogeneous waste feed.

There are three recognised techniques for secondary measures to reduce acid gases. These are wet, dry and semi-dry. Wet scrubbing produces an effluent for treatment and disposal in compliance with Article 46(3) of IED. It will also require reheat of the exhaust to avoid a visible plume. Wet scrubbing is unlikely to be BAT except where there is high acid gas and metal components in the exhaust gas as may be the case for some hazardous waste incinerators. In this case, the Applicant 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 methods as secondary measures for acid gas abatement. However due to the nature of the waste being burnt (Waste wood only) there is minimal scope for the generation of acid gasses in the flue gas system

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

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

In this case, the Applicant proposes to include a bicarbonate dosing element with direct injection into the FGS before the ESP, this is a back-up measure only to cover off spikes in the half-hourly average outputs in accordance with IED. The Environment Agency is satisfied that this is BAT

6.2.4 Carbon monoxide and volatile organic compounds (VOCs)

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

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

6.2.5 Dioxins and furans (and Other POPs)

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

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

- optimisation of combustion control including the maintenance of permit conditions on combustion temperature and residence time, which has been considered in 6.1.1 above;
- avoidance of de novo synthesis, which has been covered in the consideration of boiler design;
- the effective removal of particulate matter, which has been considered in 6.2.1 above;

- injection of activated carbon. This can be combined with the acid gas reagent or dosed separately. Where the feed is combined, the combined feed rate will be controlled by the acid gas concentration in the exhaust. Therefore, separate feed of activated carbon would normally be considered BAT unless the feed was relatively constant. Effective control of acid gas emissions also assists in the control of dioxin releases.

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

6.2.6 Metals

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

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

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

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

6.3 BAT and global warming potential

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

The principal greenhouse gas emitted is CO_2, but the plant also emits small amounts of N_2O arising from the operation of secondary NO_x abatement. N_2O has a global warming potential 310 times that of CO_2. The Applicant will therefore be required to optimise the performance of the secondary NO_x abatement system to ensure its GWP impact is minimised.

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

The electricity that is generated by the Installation will displace emissions of CO_2 elsewhere in the UK, as virgin fossil fuels will not be burnt to create the same electricity. The Applicant has therefore included within its GWP calculations a CO_2 offset for the net amount of electricity exported from the Installation.

Taking this into account, the net emissions of CO_2 from the installation are estimated to save approximately 18,000 tonnes of CO_2 equivalent per annum. The Installation is not subject to the Greenhouse Gas Emissions Trading Scheme Regulations 2003; therefore it is a requirement of IED to investigate how emissions of greenhouse gases emitted from the installation might be prevented or minimised.

The Applicant has considered GWP as part of its BAT options appraisal. There are a number of areas in which a difference can be made to the GWP of the Installation in summary: the following factors influence the GWP of the facility:-

On the debit side

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

On the credit side

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

- CO_2 saved from the use of waste heat by displacement of burning of virgin fuels
- CO_2 saved from extensive use of photovoltaic cells reducing parasitic demand on generated electrical energy.

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

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

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

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

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

6.4 BAT and POPs

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

However, it needs to be borne in mind that this application is for a particular type of installation, namely a waste 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 Equivalen) 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 specifies that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be monitored and reported 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 requires monitoring of a range of PAHs and dioxin-like PCBs at the same frequency as dioxins. 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 and Section 5.5 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

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

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

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

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

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

6.5 Other Emissions to the Environment

6.5.1 Emissions to water

The site will be fully sealed/bunded and will only have a single discharge point to sewer.

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

The site will be fully sealed/bunded and will only have a single discharge point to sewer, appropriate silt traps and interceptors will be fitted where required. Only clean surface waters will be discharged in accordance with the appropriate discharge consent.

The grate cooling system is water based and does not use any additives; it is closed loop with a total volumetric content of $2.5m^3$. There is no release from the cooling system under normal operating conditions.

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

6.5.3 Fugitive emissions

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

Fugitive releases have been identified by the Applicant and assessed as part of the Environmental Risk Assessment (Section 10, Volume 3 of Permit Application). The assessment indicates that the proposed measures for control of fugitive releases will ensure that no significant risks from fugitive releases are expected from the proposed EfW facility.

Good housekeeping practices will be in operation to ensure that any spillages or potentially dusty emissions are prevented or cleared up at the earliest opportunity. Spill kits will be available for cleanup of all chemicals and oils stored and used within the EfW facility and will be located in proximity to the relevant storage areas and delivery points. Site procedures will detail those actions that should be followed in the event of a spillage.

In relation to water emissions to surface, groundwater and/or sewers, the site will be fully sealed and will only have a single discharge point to public sewer with no diffused discharges to any receptor. Whilst there is a risk of emission, the pathway to sensitive receptors is non-existent and there is negligible risk to any receptor. Potential fugitive releases to sewer are likely to occur only as a result of an incident or accident.

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.

Waste accepted at the installation will be delivered in covered vehicles or within containers and bulk storage of waste will only occur in the installation's waste bunker. A roller shutter door will be used to close the entrance to the tipping hall outside of the waste delivery periods and combustion air will be drawn from above the waste storage bunker in order to prevent odours and airborne particulates from leaving the facility building.

Waste accepted at the installation would not ordinarily be expected to be a significant source of odour. However, the EMS required by condition 1.1.1 and the pre-operational condition P03 shall provide details for the management of odours from on-site activities, wastes, process residues and water storage facilities. However, were an odour issue to arise, condition 3.3.2 could require a separate odour management plan to be agreed and implemented in addition to those measures.

6.5.5 Noise and vibration

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

The proposed installation is relatively remote from residential amenity located in the middle of the Holbrook Industrial Estate surrounded by industrial units, the nearest relevant receptor is the 'travellers' day site at Long Acre View, some 120m north west of the installation view.

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

The noise assessment concluded that the potential for noise levels from all the site's activities to unlikely to give rise to complaints

The applicant has confirmed that much of the process will be enclosed within the acoustically clad housing unit and hence the scope for adverse emissions is minimal. The applicant has additionally identified the most scope for impact is during construction and commissioning phase and between the daytime hours of 10.00 and 15.00 in the operational phase when wood fuel will be delivered to site.

In summary the operator has concluded:

Both daytime and night time calculated noise levels from the Renewable Energy Facility are at a level which BS 4142 considers to give a positive indication that complaints are unlikely. Noise levels do not exceed existing ambient noise levels at the residential area of Longacre View with levels of minus 7 to 10dB(A) during daytime operations and approximately minus 9dB(A) during night time hours.

Condition 1.1 and pre-operational condition PO2 require that the EMS is in place prior to operation of the proposed plant, and we would normally expect the EMS to cover noise management. Condition 3.4 requires noise to be managed in such a way as to not cause pollution outside the site and, where this has not been achieved, the implementation of a separate noise management plan. We believe that the controls proposed are BAT and, along with the conditions in place in the permit, that the proposed activity is unlikely to give rise to noise complaints.

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.

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

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

(i) Local factors

We have considered the following information:- location and proximity to nearby residents and wildlife habitats, the air quality and habitats assessments, human health risk assessment, proposed design and air pollution control systems and we are satisfied that for the co-incineration plant there is no justification to reduce ELVs below those established by IED.

(ii) National and European EQSs

We are satisfied that the limits imposed under the Industrial Emissions Directive are appropriate for the installation with no further changes.

(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

We have included a pre-operational condition (PO5) which requires the Applicant to submit a written commissioning plan, including timescales for completion. This condition also requires the Applicant to summarise the expected emissions to the environment during the different phases of commissioning and the actions to be taken to protect the environment.

6.7 Monitoring

6.7.1 Monitoring during normal operations

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

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

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

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

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.

Back up CEMS are not being used, if the period of abnormal operation cannot be resolved within the allocated 4hrs as per Article 46(6) the plant will go into full automised shutdown.

6.7.3 Continuous emissions monitoring for dioxins and heavy metals

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

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

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

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

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

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

6.8 Reporting

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

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

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

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

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The decision of the Sheffield City Council to grant planning permission on 04th march 2013.
- The report and decision notice of the local planning authority accompanying the grant of planning permission.
- The response of the Environment Agency to the local planning authority in its role as Consultee to the planning process.

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

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

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

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

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

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

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

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

Article 23(1) requires the permit to specify:

- (a) the types and quantities of waste that may be treated;
- (b) for each type of operation permitted, the technical and any other requirements relevant to the site concerned;
- (c) the safety and precautionary measures to be taken;
- (d) the method to be used for each type of operation;
- (e) such monitoring and control operations as may be necessary;
- (f) such closure and after-care provisions as may be necessary.

These are all covered by permit conditions.

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

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

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

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

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

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

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

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

This Application has been consulted upon in line with this statement, 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.

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).

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.

There are no designated SSSI's within the relevant screening distances.

7.2.5 Natural Environment and Rural Communities Act 2006

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

7.3 National secondary legislation

7.3.1 The Conservation of Natural Habitats and Species Regulations 2010

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

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.

7.5 Other relevant legal requirements

7.5.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 4. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. In addition to meeting our consultation responsibilities, we have also taken account of our guidance in Environment Agency Guidance Note RGS6 and the Environment Agency's Building Trust with Communities toolkit.

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

IED Article	Requirement	Delivered by
45(1)(a)	The permit shall include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2000/532/EC, if possible, and containing information on the quantity of each type of waste, where appropriate.	Condition 2.3.3 and Table S2.2 in Schedule 2 of the Permit
45(1)(b)	The permit shall include the total waste incinerating or co-incinerating capacity of the plant.	Condition 2.3.3 and Table S2.2 in Schedule 2
45(1)(c)	The permit shall include the limit values for emissions into air and water.	.
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	
45(1)(e)	The permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Conditions 3.5.1 and Tables S3.1, S3.2, S3.3 also compliance with Articles 10 and 11
45(1)(f)	The permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.6 to 2.3.9
46(1)	Waste gases shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Emissions and their ground-level impacts are discussed in the body of this document,
46(2)	Emission into air shall not exceed the emission limit values set out in parts 4 or determined in accordance with part 4 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a

IED Article	Requirement	Delivered by
46(3)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(4)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(5)	Prevention of unauthorised and accidental release of any polluting substances into soil, surface water or groundwater. Adequate storage capacity for contaminated rainwater run-off from the site or for contaminated water from spillage or fire-fighting.	The application explains the measures to be in place for achieving the directive requirements
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance, and with a maximum cumulative limit of 60 hours per year. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	Condition 2.3.10. and Table S3.1(a)
47	In the event of breakdown, reduce or close down operations as soon as practicable. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	condition 2.3.10
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Schedule 7 details this standardisation requirement
48(2)	Installation and functioning of the automated measurement systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	condition 3.5.3, and tables S3.1, S3.1(a),
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	tables s4.1 and s4.4
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify	

IED Article	Requirement	Delivered by
	compliance with the operating conditions and emission limit values which are included in the permit.	
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	(a) Conditions 3.5.1 and Table S3.3
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	(b) - Pre-operational condition PO7.The application specifies measurement point
50(3)	At least one auxiliary burner which must not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil liquefied gas or natural gas.	(c) Condition 2.3.7
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.6
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.6
50(4)(c)	Automatic shut to prevent waste feed if the CEMs show that ELVs are exceeded due to disturbances or failure of waste cleaning devices.	Condition 2.3.6
50(5)	Any heat generated from the process shall be recovered as far as practicable.	(a) The plant will generate electricity (b)Operator to review the available heat recovery options prior to commissioning (Condition PO3) and then every 2 years
50(7)	Management of the Installation to be in the hands of a natural person who is competent to manage it.	Conditions 1.1.1 to 1.1.3 and 2.3.1 of the Permit fulfil this requirement
51(1)	Different conditions than those laid down in Article 50(1), (2) and (3) and, as regards the temperature Article 50(4) may be authorised, provided the other requirements of this chapter are me.	No such conditions Have been allowed

IED Article	Requirement	Delivered by
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	- EPR require prevent or minimise pollution. -Volume 3 of the Application defines how this will be carried out. - conditions 2.3.1, 2.3.3, 2.3.2, 2.3.3 and 2.3.4
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Volume 2 of the application describes procedures for the reception and monitoring of incoming waste
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	condition 3.5.1
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	conditions 2.3.1 and 3.2.1
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1 and pre-operational condition PO4.
55(1)	Application, decision and permit to be publicly available.	
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Condition 4.2.2

ANNEX 2: Pre-Operational Conditions

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

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

ANNEX 3: Improvement Conditions

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

Reference	Improvement measure	Completion date
IC1	The Operator shall submit a written report to the Environment Agency on the implementation of its Environmental Management System and the progress made in the certification of the system by an external body or if appropriate submit a schedule by which the EMS will be certified.	Within 12 months of the date on which waste is first burnt.
IC2	The Operator shall submit a written proposal to the Environment Agency to carry out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air from emission point A1 and A2, identifying the fractions within the PM_{10}, and $PM_{2.5}$ ranges. The proposal shall include a timetable for approval by the Environment Agency to carry out such tests and produce a report on the results. On receipt of written agreement by the Environment Agency to the proposal and the timetable, the Operator shall carry out the tests and submit to the Environment Agency a report on the results.	Within 6 months of the completion of commissioning.
IC3	The Operator shall submit a written report to the Environment Agency on the commissioning of the installation. The report shall summarise the environmental performance of the plant as installed against the design parameters set out in the Application. The report shall also include a review of the performance of the facility against the conditions of this permit and details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions.	Within 4 months of the completion of commissioning.
IC4	The Operator shall carry out checks to verify the residence time, minimum temperature and oxygen content of the exhaust gases in the furnace whilst operating under the anticipated most unfavourable operating conditions. The results shall be submitted in writing to the Environment Agency.	Within 4 months of the completion of commissioning.

Reference	Improvement measure	Completion date
IC5	The Operator shall submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NO_x) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report shall include an assessment of the level of NO_x and N_2O emissions that can be achieved under optimum operating conditions. The report shall also provide details of the optimisation (including dosing rates) for the control of acid gases and dioxins	Within 4 months of the completion of commissioning.
IC6	The Operator shall carry out an assessment of the impact of emissions to air of [all] the [following] component metals subject to emission limit values, i.e. Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V *(only include those metals which do not screen out in section 5.2.3).* A report on the assessment shall be made to the Environment Agency. Emissions monitoring data obtained during the first year of operation shall be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application. An assessment shall be made of the impact of each metal against the relevant EQS/EAL. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work.	15 months from commencement of operations
IC7	The Operator shall submit a written summary report to the Agency to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified in Table S3.1 and Table S3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.	Initial calibration report to be submitted to the Agency within 3 months of completion of commissioning. Full summary evidence compliance report to be submitted within 18 months of commissioning.
IC8	The Operator shall submit the written protocol referenced in condition 3.2.4 for the monitoring of soil and groundwater for approval by the Environment Agency. The protocol shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The procedure shall be implemented in accordance with the written approval from the Agency.	15 months from commencement of operations

ANNEX 4: Consultation Reponses

A) Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website from 7th October to 12th November. Copies of the Application were placed in the Environment Public Register at Quadrant 2, Environment Agency Office and the Public Register at Sheffield City Council.

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

- Public Health England.
- Local Authority – Environmental Health Protection Department.
- Local Authority – Planning Department
- Food standards Agency.
- Health and Safety Executive.
- National Grid.
- Local Fire Service

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from - Public Health England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Public Health England – No significant concerns regarding the risk to the health of the local population from the installation based on the information contained within the application. This assumption is based that the permit holder shall take all reasonable appropriate measures to prevent or cause pollution, in accordance with the relevant sector guidance and industry best practice.	No action Needed The data supplied in the Application regarding potential emissions from the installation have been verified by the Agency.

Response Received from Sheffield City Council – Local planning	
Brief summary of issues raised:	Summary of action taken / how this has been covered
The plant is appropriately located in an industrial area and the Environmental Statement demonstrates that it should not have a significant impact in terms of noise, air quality and traffic. The air quality assessment shows that the impact on air quality will be within acceptable limits and the Environment Agency will ensure that emissions are controlled to not have an have a significant harmful impact on health and the environment	No action needed.

Response Received from – Health and Safety Executive	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments on Proposals	No action needed

Response Received from – National grid Protection team	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments on Proposals	No action needed