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

The Permit Number is:	EPR/HP3238ZC
The Applicant / Operator is:	MWH Treatment Limited
The Installation is located at:	Fordrough Yardley Birmingham B25 8DW

What this document is about

This is a decision document, which accompanies a permit.

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

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

Preliminary information and use of terms

We gave the application the reference number EPR/HP3238ZC/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/HP3238ZC. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 02/05/2014.

The Applicant is MWH Treatment Limited. We refer to MWH Treatment 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 MWH Treatment Limited" the **Operator**".

MWH Treatment Limited's proposed facility is located at Fordrough, Yardley Birmingham, B25 8DW. 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
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
HRA	Human Rights Act 1998
HW	Hazardous waste
HWI	Hazardous waste incinerator
IBA	Incinerator Bottom Ash

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IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED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

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

1 Our decision

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

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

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

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

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 2nd May 2014. 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. However, we do not consider the installation to be a Site of High Public Interest (as defined in RGS 6). 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 have not carried out additional advertising (local newspapers) or displayed additional copies of the Application locally as the site has been deemed not to be a Site of High Public Interest (SHPI). This decision was taken following advice from local Environment Agency officers, and has been confirmed by having not received any consultation comments in response to the website advertisement.

A copy of the Application and all other documents relevant to our determination (see below) were placed on the Environment Agency's public register system. 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":

- Birmingham City Council (Environmental Health and Planning Authority)
- Local Sewage Undertaker – Severn Trent Water
- Food Standards Agency (FSA)
- Health and Safety Executive (HSE)
- Public Health England (PHE)

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly.

Note that 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. There are no European Designated habitat sites within 10km of the Installation, or Sites of Special Scientific Interest (within 2km), however, there are a number of local wildlife sites within 2km.

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 notice on 8th October 2014. A copy of the information notice was placed on our public register.

In addition to our information notices, we received additional information during the determination from the operator for the following:-

Additional Information	Received date
Amended application form B2	19th June 2014
Amended application form B3	
Backup CEMs detail	
Supplementary information for Health Risk Assessment	
Supplementary noise information – 1	20th June 2014
Supplementary noise information – 2	
MCERTs CEMs specification	15th July 2014
Supplementary noise information – 3	19th August 2014
Schedule 5 response - Metal emission concentrations and assessment for Abnormal Operations.	24th October 2014
Storage inventory.	03/11/2014
Energy consumption clarification.	05/11/2014
Request for additional waste types.	27/11/2014
Managing Fire Risk @BBPL	20/02/2015
Construction Management Plan	27/02/2015

We made a copy of this information available to the public in the same way as the response to our information notice.

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 of 3 tonnes or more per hour.

The Installation is classified as a co-incinerator, having considered the Environment Agency's –'Guidance on when a plant is a Co-Incineration Plant – v3 March 2011'. The main factors determining this include the consistent feedstock, which will be based upon waste wood, and the level of energy recovery that the plant can achieve - by gasification of the wood to produce syngas for combustion / power generation.

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

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

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

An Installation may also comprise "directly associated activities", which at this Installation includes the generation of electricity using a steam turbine. These activities comprise one Installation, because the co-incineration plant and the steam turbine are successive steps in an integrated activity.

Together, this listed and directly associated activity comprises the Installation.

4.1.2 The Site

The Installation is located within an existing industrial site at Hay Mills, Tyseley (National Grid Reference 410753, 284778). The Surrounding area land use comprises both mixed residential and industrial usage. The closest

residential properties lie to the North of the site area, at a distance of just over 200 metres.

Webster and Horsfall have occupied the site since the early 19th Century – manufacturing wire and strip. The company still exist, although some areas of the site are now redundant and plans are to redevelop these areas into an Energy Park (and this application forms part of this).

Ground within the subject area is made of three platforms; upper, middle and lower. The upper level (a sloping area) is of compact asphalt (previously used as a lorry park), and the middle / lower levels of concrete were previously occupied by factory buildings.

There are no European Designated habitat sites within 10km of the Installation, or Sites of Special Scientific Interest within 2km; however, there are a number of local wildlife sites within 2km.

The Applicant submitted a site 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 Timber Resource Recovery Plant. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the Installation is a waste co-incineration plant because:

Notwithstanding the fact that waste will be thermally treated by the process; the process is never the less 'co-incineration' because it is considered that main purpose of this plant is the generation of energy.

The facility will operate a high efficiency steam boiler turbine for the recovery of energy. It is proposed that waste heat will be exported (via heat main) to local users within the Energy Park, and electricity to the grid (10.3MWe). The Facility will recover energy at a rate greater than 0.8 MWh/tonne waste. The principal source of fuel to produce the syngas is from a consistent feedstock of waste wood, which will undergo some pre-treatment prior to being gasified (including shredding and drying).

Although the process used to thermally treat the waste is gasification; for the process not to be considered a waste co-incineration plant (i.e. combustion plant), the resultant gases from the gasification process would have to be purified to such an extent that they would no longer be considered a waste (prior to combustion) and that emissions were no higher than those from the burning of natural gas.

The Applicant has not applied for ‘end of waste’ test as referred to in the Waste Framework Directive; therefore the whole process is considered to be a waste co-incineration plant and therefore subject to the requirements of Chapter IV of the IED.

The Installation will process a maximum of 72,000 tonnes (15% moisture) or 60,000 tonnes (dry) of waste wood per annum, with a calorific value of 20MJ/kg ± 10%. It is antifipated that most of the wood feedstock will arrive on site pre-prepared, however facilities will be in place to carry out manual sorting and mechanical shredding (on site) prior to entering the feed system.

Shredded feedstock will be stored within the reception hall. A ‘storage push floor’ system (complete with perforated steel plate for air drying) will load the feedstock onto a conveyor. Screening takes place by removal of ferrous metals and fines, utilising a magnetic separator and screen prior to being transported to the gasifier units.

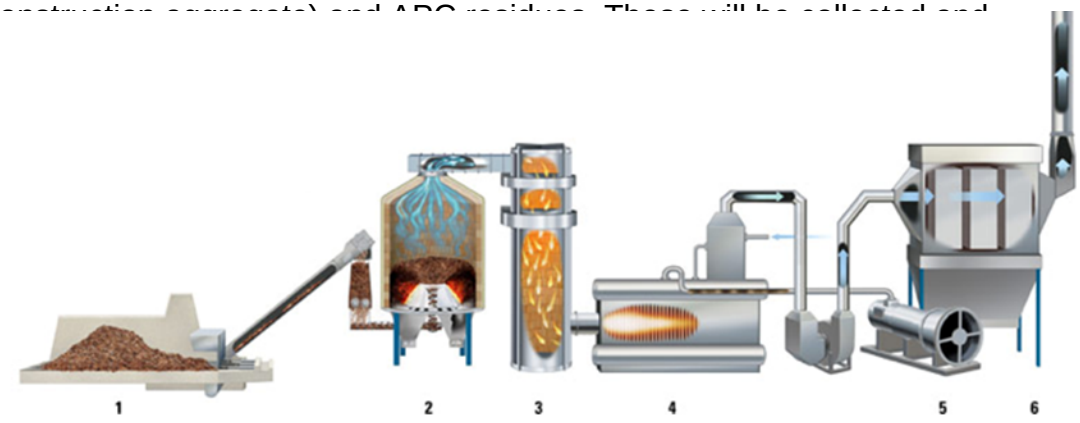
The shredded feedstock will be fed into one of four gasifier units by an auger at a rate of 7,500kg per hour per individual gasifier.

Ignition of the wood (by natural gas) occurs once required temperatures (850°C) are met within the secondary combustion chamber by pre-heating with natural gas. Where required, heat can also be supplied within the transfer

ducts (between gasifier and combustion chamber) in order to maintain temperatures.

The gasifiers provide a low oxygen atmosphere to which a hydrogen and carbon monoxide rich 'syngas' can be produced (at a rate of 13,400m^3 per hour per unit). Syngas streams are combined, cleaned and cooled prior to arriving at the combustion tube / chamber. At this point, combustion takes place at a temperature in excess of 850°C for a minimum residence time of 2 seconds.

Following combustion, hot gases are transported to a single boiler and steam turbine allowing for the production of electricity at a rate of 9.0 MWe (net) for the National Grid (and local industrial users) and excess heat (to potential future heat users). The process will generate grate ash (potential re-use as construction aggregate) and APC residues. These will be collected and



Gasifier Schematic
1 Fuel store
2 Gasifier (one of four number)
3 Secondary combustion chamber (one of one number)
4 Boiler
5 Steam Turbine Generator set
6 Bag filter

There is one release point to air (A1) via a 45m stack. Emissions released from this point will undergo the following gas abatement prior to discharge:-

- SNCR (Selective Non-Catalytic Reduction) for reduction of NOx (Oxides of Nitrogen) using urea,
- Acid Gas Abatement (injection of dry lime),
- Activated Carbon (injected upsteam of the fabric filter) for Metals and Dioxins, and
- Advanced bag (fabric) filter for Particulate Matter (and APC residues).

Effluents from the cooling process will be discharged to sewer via release point (S1) under trade effluent consent. Fugitive emissions will be minimised (e.g. undertaking shredding within an enclosed building).

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

Waste throughput, Tonnes/line	60,000 tonnes/annum (dry)	

	or 72,000 tonnes/annum (@ 15% moisture)	9 tonnes/hour (@ 15% moisture)
Waste processed	Prepared shredded wood	
Number of lines	One (4 x gasifier units feed into a single combustion unit)	
Furnace technology	Gasification	
Auxiliary Fuel	Natural Gas	
Acid gas abatement	Dry	Hydrated lime
NOx abatement	SNCR	Urea
Reagent consumption	Auxiliary Fuel 24000m^3/annum (Natural Gas) Urea : 21.4 te/annum Lime : 500 te/annum Activated carbon: 10 te/annum *Operationally it may be decided to use some limestone within the feed for control of slagging and some preliminary acid gas control. It is converted to lime within the fuel bed and will offset use of this lime.*	
Flue gas recirculation	Yes	
Dioxin abatement	Activated carbon	
Stack	410753, 284778	
	Height, 45 m	Diameter, 1.38 m
Flue gas	Flow, 23.44Nm^3/s	Velocity, 15m/s
	Temperature 90°C	
Electricity generated	10.3 MWe	
Electricity exported	9.0 MWe	
Waste heat use	Waste heat used internally for process heating (and drying of feedstock). Excess heat to be exported to a large industrial user within the Webster and Horsfall site (Tyseley Energy Park) – but this is to be confirmed.	

4.1.4 Key Issues in the Determination

The key issues arising during this determination are listed below and we therefore describe how we determined these issues in most detail in this document.

• Emissions to air. *The discharge from emission point A1 required careful consideration of the potential impacts on human health and nature conservation sites. The Applicant used air dispersion modelling to establish the predicted impact of the Installation on air quality and made comparisons against Environmental Quality Standards (EQS) for the protection of human health and standards for the protection of habitats provided in the Agency's H1 Environmental Risk Assessment guidance.*
• Energy recovery and reuse *The excess heat will be available for exporte to Webster and Horsfall for use within their process as well as the future industrial users of the Tyseley Energy Park. The heat main for these future phases of development will be installed from the outset of construction/operations*

4.2 The site and its protection

4.2.1 Site setting, layout and history

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The earliest mapping provided (1888) indicates the site to comprise open land with a wire factory (*Webster and Horsfall)* on its most northern boundary, with the Grand Union Canal on the sites southern boundary. The subject area slopes downwards when travelling north from the canal.

Over time the factory has expanded southwards, and the surrounding area has become heavily industrialised with manufacturing industries.

Currently, the site exists on three levels; lower, middle and upper:-

- Lower and middle – concrete surface on the lower level (from former factory buildings) with a small slope to the middle level. On the western boundary of this area oil drums and steel castings are currently stored.
- The upper level of the site comprises a sloping area of compacted asphalt – formerly used as a lorry park.

The site is underlain by Mercia mudstone (secondary aquifer) which overlies Sherwood sandstone (primary aquifer). The site is not within a source protection zone, but is within 1000 meters of a groundwater abstraction.

Site investigations consisting of 16 boreholes with gas and groundwater monitoring were undertaken prior to application submission. Of these, 15 samples were sent for chemical analysis (groundwater) for which detections

of total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), metals, phenols and cresols were found above detection limits. Further gas monitoring is still required, and the Applicant commits to undertaking this work (as stated within the Application).

The Installation will comprise a new custom built building and hardstanding (less than 0.8Ha in size) both of which will ensure that the site is covered 100% by impermeable surfaces.

Earthworks are planned in order to lower the upper level and raise the lower levels of the site.

The Operator provided additional information on raw materials and their storage on the 3rd November 2014, detailing:-

Area	Material	Quantity	Storage	
APC	Urea Solution	30 m^3	Gasifier Hall	Bunded storage tank
	Hydrated Lime	73 m^3	Process Hall	Internal Silo
	Activated Carbon	3 x 500 kg bag storage		Big Bag system
Water Treatment Chemicals	Eliminiox	200 kg	Water Treatment Room	Bunded Tank
	Amine	200 kg		
	Phosphate	200 kg		
	Brine	300ℓ		Tank
Turbine Oil	Oil	7000ℓ	Turbine House	Integral Tank – fully bunded
Workshop	Oil cans	10 x 5ℓ	Workshop	Cans
	Greases	5 x 1ℓ		

The local Groundwater and Contaminated Land team assessed the content of of the Application Site Report, including data from Site Investigation and Baseline data (taken in 2013). The report concludes no significantly elevated levels of contaminants / concentrations, and our groundwater and contaminated land team agree that sufficient data has been provided within the Application, and that pollution of land and water is unlikely.

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

The Applicant has submitted a site condition report (Appendix 10) which includes a report on the baseline conditions as required by Article 22. We have reviewed that report and consider that it adequately describes the condition of the soil and groundwater prior to the start of operations.

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

4.2.3 Closure and decommissioning

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place for the closure and decommissioning of the Installation, as referred to in section 2.11 of the main Application document.

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

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

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

A number of different organisations are referred to throughout the Application, and as a result of this we required the operator to provide clarification for this. A response was provided prior to the Application being duly made confirming the following:

- MWH Treatment Limited (MWHT) is the Operator contracted to operate and maintain the plant in accordance with the definition of Environment Agency Regulatory Guidance Note 1 (Understanding the meaning of 'Operator')(RGN1)
- MWH Treatment (MWHT) is the EPC Contractor constructing the plant;
- Birmingham Bio Power Limited (BBPL) is the Owner;
- O-Gen UK is acting on behalf of the Owner to provide the necessary licences and permits to allow MWHT to operate the plant; and
- Carbonarius was the Project Developer and is a shareholder of BBPL.

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. A pre-operational condition is included requiring the Operator to provide a summary of the EMS prior to commissioning of the plant and to make available for inspection all EMS documentation. The Environment Agency recognises that certification of the EMS cannot take place until the Installation is operational. An improvement condition 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 is developing a Management Plan, and provided some information within the Application.

We requested further clarification from the applicant on the Accident Management Plant. The following confirmation was received in relation to this:-

The accident management plan will have to be developed as part of the ISO accreditation. Currently the site has a construction management plan which includes detail on environment and accidents at this stage.

We requested a copy of the construction management plan [received 27/02/2015 as further information].

The applicant was also required to provide further information on Fires and their Prevention, - with consideration for TGN7.01 “Reducing fire risk at sites storing combustible materials”. This was requested in response to an increasing profile of fires occurring at waste sites, and sites storing combustible materials.

The applicant provided further information titled “Managing Fire Risk @BBPL” on 20th February 2015. The document considers TGN7.01 and provides details on fire prevention.

Main points covered within the document include:-

- Timber storage and processing are separated from power generation activities – each area has their own independent fire monitoring and protection systems.
- Feedstock will be stored for no more than 72 hours (covering the weekend periods) @ ca 600 tonnes. It is anticipated that normal storage (weekdays) will cover 24 hours @ ca 450 tonnes. The site will employ ”Just In Time” delivery principals.
- A two hour firewall will be present between the fuel reception and processing areas.
- A thermal sensor will be present within the reception area / tipping hall.
- Construction and demolition timber has a reasonably low moisture content throughout the year, and thus anticipated to have lower microbial activity.

Detail within this document is provisional and subject to change as the site develops. The applicant already has a meeting scheduled with the fire service in March to cover this very subject. As a result of this, the following actions will be made within the permit – allowing the operator to further develop these plans, but also ensuring that these are in place, and approved prior to commissioning.

Pre-operational condition

Prior to commencing commissioning, the Operator shall submit a written report to the Environment Agency detailing the storage arrangements for feedstock on site. The storage arrangements shall have specific regard to TGN 7.01, or other such appropriate guidance as is adopted, for the storage of combustible materials and include specific details of the odour and dust control measures to be implemented.
The report shall seek written approval from the Environment Agency. Storage arrangements and control measures shall be implemented from such approval.

We have also included an operational technique within table S1.2 – for the operator to comply with all parts of TGN7.01 “reducing fire risk at sites storing combustible materials” – linked to the pre-operational condition detailed above.

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. A copy of the Accident Management Plan will be required as part of this pre-operational condition.

Having considered the information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised.

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	Non Technical Summary; Application Document; Appendices : **4** [H1]; **5** [AQ Report]; **9** [Noise Assessment]; **16** [HF monitoring]; **17** [Operational Details]; **18** [Residence Time Calculation]; **19** [Grate Ash Residue Analysis]; and **23** [CHP ready]. Additional info for Duly Making:- BAT Review Emissions Monitoring IED summary Operator clarification	Includes detail on:- - Incineration capacity - Startup and Shut-Down - Temperature monitoring / residence time - Emissions and their control - Details of how the plant will be operated - Energy production and recovery - Process parameters - Waste feed cessation / abnormal operations.
Additional information	Amended application forms B2 / B3, CEMs provisions, PAHs / PCBs assessment.	
	Additional noise assessment.	
	MCERT specifications	
	Acoustics information.	
Response to Schedule 5 Notice dated 08/10/14	Metal emission concentrations and assessment for Abnormal Operations.	
Additional information	Energy consumption clarification.	

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

Article 45(1) of the IED requires that the Permit must include a list of all types of waste which may be treated using at least the types of waste set out in the European Waste List established by Decision 2005/532/EC, EC, if possible, and containing information on the quantity of each type of waste, where appropriate. The Application contains a list of those wastes comprising

"waste wood" in table 2.5.2 including European Waste Catalogue (EWC) number, which the Applicant will accept in the waste streams entering the plant and which the plant is capable of burning in an environmentally acceptable way. We have specified the permitted waste types, descriptions and where appropriate quantities which can be accepted at the installation in Table S2.2.

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

(i) 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 72,000 tonnes (based at 15% moisture) per annum. This equates to 60,000 tonnes on a dry moisture content. This is based on the Installation operating 8,000 hours per year at a nominal capacity of 9 tonnes per hour. The impact assessments that have been assessed as part of this Application have been based upon these maximum throughput rates, and therefore are the basis for our limitation.

The Installation will be designed, constructed and operated using BAT for the co-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:-

- Waste heat will be used to heat the process buildings and offices within the Installation.
- Low grade heat - taken from the steam turbine condensate, will be utilised to heat and dry the waste wood feedstock to optimum moisture content levels for thermal treatment.
- The Installation will operate a high pressure high efficiency steam boiler and turbine, and surplus heat will be exported to neighbouring developments (via heat main) as part of a CHP scheme. *The CHP scheme will be included within the construction phase of the development. Excess heat will also be available to Webster and Horsfall for use within their process.*

The Applicant confirmed by email on 5th November 2014 the specific energy consumption of the plant, a measure of total energy consumed per unit of waste processed, will be 141.5 kWh/tonne. The Installation capacity is 60,000 t/a (72,000 @ 15% moisture).

Data from the BREF for Municipal Waste Incinerators shows that the range of specific energy consumptions for municipal waste incinerators (as in the table below). *This application is not for a MSW Incinerator, however we have used this table for comparison purposes.*

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 18 MJ/kg (based upon 20MJ/kg [dry] ±20%). Taking account of the difference in LCV, the specific energy consumption in the Application is in line with that set out above.

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

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

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

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

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

The BREF says that where a plant generates electricity only, it is BAT to recover 0.4 – 0.65 MWh/ tonne of waste (based on LCV of 10.4 MJ/kg). 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 primarily generate electricity, but will also provide heat in the form of steam for other processes and customers. The electrical output of the plant will be 10.4MWe (gross) with 4MWth available as heat.

The applicant has committed to register the Installation for CHPQA (Combined Heat and Power Quality Assurance), which upon certification will require annual monitoring and be subject to validation and audit (see below).

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

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. The Applicant carried out a feasibility study, which showed there was potential to provide district heating to local businesses; suitable opportunities are being explored, though there are no firm commitments at this stage. The Applicant has planned export of heat to local industry within their design of the Installation.

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.

A pre-operational condition has been included in the permit in order to review this position prior to operation.

(iv) R1 Calculation and the DEFRA Good Quality CHP Scheme

The R1 calculation and gaining accreditation under the DEFRA Good Quality CHP Scheme do not form part of the matters relevant to our determination. They are however general indicators that the Installation is achieving a high level of energy recovery.

The Applicant has not presented an R1 calculation with this Application, nor have we received a separate application for a determination on whether the Installation is a recovery or disposal facility.

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

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

(v) Choice of Steam Turbine

An appropriate turbine design will be selected to facilitate the distribution of heat to third-party customers off-site, as part of the technology parks development.

(vi) Choice of Cooling System

The Applicant confirmed that the plant would operate an Air Cooled Condenser (ACC) for cooling spent steam after the boiler.

The Air Cooled Condenser has a minimal water usage requirement, whilst preventing a steam plume. The ACC was considered to represent BAT for this Installation and we agree with this conclusion.

(vii) Permit conditions concerning energy efficiency

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

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

4.3.8 Efficient use of raw materials

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

The Operator is required to report with respect to raw material usage under condition 4.2. and Schedule 4, including consumption of Limestone, Lime, Activated Carbon and Urea used per tonne of waste burned. *The operator provided clarification (upon reviewing the draft permit) it may be decided to use some limestone within the feed for control of slagging and some preliminary acid gas control. It is converted to lime within the fuel bed and will offset use of this lime.-= this is valid. As a result, both limestone and lime are referred in the permit.* R 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 gasification ash, air pollution control residues and recovered metals.

The first objective is to avoid producing waste at all. Waste production will be avoided by controlling the temperature and non-oxidative atmosphere in the gasifier, to enable the organic content to be degraded and transformed into gaseous components or syngas. Condition 3.1.3 and associated Table S3.5 specify limits for total organic carbon (TOC) of <3% in gasification 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.

Gasification ash, similar to 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 gasifier ash will be carried out in accordance with the requirements of Article 53(3) of IED. Classification of gasification ash 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 Gasification Ash and APC residues are adequately characterised, a pre-operational condition requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.5 requires the Operator to carry out an ongoing programme of monitoring.

The Application states that ferrous and non ferrous metals will be recovered upfront during extensive waste wood pre-preparation (timber shredding).

Following the gasification process the ash residue is expected to be low content (timber biomass) and where possible will be recovered / treated for use as a fertiliser (where possible) and as an inert aggregate type material for the construction industry.

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. 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 co-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 exceedance of an EU EQS is identified, we may require the Applicant to go beyond what would normally be considered BAT for the Installation or refuse the application if the applicant is unable to provide suitable alternative proposals. Whether or not exceedences are considered likely, the application is subject to the requirement to operate in accordance with BAT.

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

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

5.2 Assessment of Impact on Air Quality

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

- An H1 (appendix 4) screening assessment of emissions to air from the operation of the incinerator.
- Dispersion modelling (appendix 5) of emissions to air from the operation of the incinerator.
- A study of the impact of emissions on nearby sensitive receptors / sites.

Amenity impacts during construction and air quality impacts arising from additional road traffic have not been considered as these are essentially matters for the local planning authority when considering the parallel application for planning permission, and outside the scope of our determination under the Environmental Permitting Regulations.

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the incinerator chimney and its impact on local air quality. The impact on conservation sites is considered in section 2.2 of appendix 4 of the Application (*and also additional information provided for duly making – "An Assessment of the Potential Impact on Local Wildlife Sites of Pollutant Emissions from the Proposed Wood Gasification Plant to be Built by Birmingham Bio-Power Ltd in Tyseley"*).

As the Installation is designed solely for waste wood, the requirement to assess any odour impacts during plant shut down are not considered relevant. This is appropriate for sites incinerating more odorous wastes – such as municipal waste.

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation sites and human health. There are no conservation sites within

the screening distance of 10km for SAC's, SPA's, Ramsar's or 2km for SSSI's.

These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS 5 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at Birmingham Airport between 2007 and 2011. This station is located 6km east of the Installation and considered to offer the most representative conditions to that of the site.

Impacts from terrain surrounding the site have not been considered, and we agree that this is appropriate given that there are no significant gradients of more than 1:10 within the modelling domain.

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) of the IED. These substances are:
    - Oxides of nitrogen (NO_x), expressed as NO_2
    - Total dust
    - Carbon monoxide (CO)
    - Sulphur dioxide (SO_2)
    - Hydrogen chloride (HCl)
    - Hydrogen fluoride (HF)
    - Metals:-

Cadmium [Cd]	Thallium [Tl]	Mercury [Hg]
Antimony [Sb]	Arsenic [As]	Lead [Pb]
Chromium [Cr]	Cobalt [Co]	Copper [Cu]
Manganese [Mn]	Nickel [Ni]	Vanadium [V]

    - Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans).
    - Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC).
- Second, they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate (except for emissions of arsenic, chromium and nickel, which are considered in section 5.2.3 of this decision document).
- Third, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically ammonia (NH_3). We required further information for consideration of Polycyclic Aromatic Hydrocarbons (PAH) and PCBs (Poly Chlorinated Biphenyls), and this assessment was provided as additional information on 19 June 2014.

Emission rates used in the modelling have been derived from data in the Waste Incineration BREF and are considered further in this section.

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

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

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

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

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

5.2.1 Assessment of Air Dispersion Modelling Outputs

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

Assessment of Emissions to Air (non metals)

Pollutant	EQS / EAL		Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m³		µg/m³	µg/m³	% of EAL	µg/m³	% of EAL
NO_2	40	1	27	2.13	5.33	29.1	72.8
	200	2	27	28.08	14.0	55.08	27.5
PM_{10}	40	1	16.4	0.15	0.38		
	50	3	16.4	0.53	1.06		
$PM_{2.5}$	25	1	8.9	0.15	0.60		
SO_2	266	4	2.2	47.7	17.9	49.9	18.8
	350	5	2.2	37.91	10.83	40.11	11.5
	125	6	2.2	5.24	4.2	7.44	6.0
HCl	750	7	0.27	16.35	2.18		
HF	16	8	0.49	0.02	0.13		
	160	7	0.49	1.09	0.68125		
CO	10000	9	450	20.3	0.20		
TOC	2.25	1	0.77	0.15	6.67	0.920	40.89
PAH note1	0.00025	1	-	8.92E-07	0.36		
NH_3	180	1	1.45	0.15	0.08		
	2500	10	1.45	5.45	0.22		
PCBs Note1	0.2	1	-	3.57E-10	0.00		
	6	10	-	-	-		
Dioxins			2.78E-08	1.86E-09		2.97E-08	

TOC as 1,3 butadiene
PAH as benzo[a]pyrene

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

note1 PAH / PCB assessed at receptor with highest impact (Fordrough 1) – rather than maximum ground level concentration.

No data provided for the 1-hour maximum PCBs assessment. Considering the impact assessed for PCBs Annual Mean, and check modelling that we have carried been out, we are satisfied that the absence of such data does not change our conclusions in respect of Air Quality impacts.

(i) Screening out emissions which are insignificant

From the table 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, HCl, CO, PAH, $NH_{3,}$ PCB

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, TOC.

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

All emissions either screen out as insignificant or where they do not screen out as insignificant are considered unlikely to give rise to significant pollution.

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

The application is located within an Air Quality Management Area for NOx. This is discussed within section 5.2.4 of this document.

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

The above tables show that the peak long term PC is greater than 1% of the EUEQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EUEQS being exceeded. The peak short term PC is marginally 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 $\mu g/m^3$ and a short term daily average of 50 $\mu g/m^3$. For $PM_{2.5}$ the EUEQS of 25 $\mu g/m^3$ as a long-term annual average to be achieved by 2010 as a Target Value and by 2015 as a Limit Value has been used.

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

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

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

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

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

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

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

require a full analysis of particle size distribution in the flue gas, and hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions, as explained in section 5.3.

(iii) Acid gases, SO_2, HCl and HF

From 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 CO, the PC is less than 1% of the EAL/EQS and so can be screened out as insignificant. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

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

The Applicant has used the EQS for Benzene for assessing VOC impacts.

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

The 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. Ammonia emissions have been screened out as insignificant in that the process contribution is < 1% of the long term EQS/EAL and <10% of the short term EAQ/EAL.

The applicant provided an assessment of the impacts from PAH and PCBs emissions as additional information to the application. They have used the EQS for benzo[a]pyrene (BaP) for their assessment of the impact of PAH. We agree that the use of the BaP EQS is sufficiently precautionary.

Data was based upon the receptor with the greatest impact (rather than maximum in grid), and concluded impacts < 1% of the long term EQS/EAL and <10% of the short term EAQ/EAL. We are satisfied that PAH / PCB emissions will not result in significant pollution.

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.

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 Assessment of Emission of Metals

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

Annex VI of IED sets three limits for metal emissions:

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

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

Assessment of Emissions to Air (metals)

Pollutant	EQS / EAL		Back-ground	Process Contribution		Predicted Environmental Concentration	
	µg/m^3		µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
Cd	0.005	1	0.00014	0.00038	7.6	0.00052	10.4
Tl				0.00038	0.00038		
Hg	0.25	1		0.00076	0.30		
	7.5	2		0.013624	0.18		
Sb	5	1		0.000836	0.02		
	150	2		0.014987	0.01		
Pb	0.25	1		0.000836	0.33		
Co				0.000836			
Cu	10	1		0.000836	0.01		
	200	2		0.014987	0.01		
Mn	0.15	1		0.000836	0.56		
	1500	2		0.014987	0.00		
V	5	1		0.000836	0.02		
	1	3		0.008842	0.88		
As	0.003	1	0.00068	0.000836	27.87	0.0015	50.53
Cr (II)(III)	5	1		0.000836	0.02		
	150	2		0.011989	0.01		
Cr (VI)	0.0002	1	0.0005	0.000167	83.50	0.0007	334
Ni	0.02	1	0.00125	0.0008	4.18	0.0021	10.43

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

(i) Screening out emissions which are insignificant

From the table 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:

- Tl, Hg, Sb, Pb, Cu, Mn, V, Cr (II)(III)

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

(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

- Cd, As, Ni

This left emissions of CrVI requiring further assessment.

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

For metals not screened out as insignificant, our guidance sets out a two step approach:

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

Then for metals that had not screened out;

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

The applicant has only provided data for the latter of these approaches (including As and Ni) using maximum and minimum values of concentrations measured:-

Pollutant	**EQS / EAL**	**Background**	**Process Contribution** data based upon 20 waste incinerators (collected between 2007 and 2009).		**% of EAL**
	µg/m^3	**µg/m^3**	**µg/m^3**		
As	0.003	0.00068	Max	0.000175	5.83
			Min	0.000005	0.15
Cr (VI) as % of total Cr	0.0002	0.0005	Max	0.000006	2.77
			Min	0.00000004	0.02
Ni	0.02	0.00125	Max	0.002070	10.35
			Min	0	0

Considering the minimum measured values from municipal waste incinerators, none of the PCs exceed 1% of any EAL values.

The 2009 report of the Expert Panel on Air Quality Standards (EPAQS) – "Guidelines for Metal and Metalloids in Ambient Air for the Protection of

Human Health", sets non statutory ambient air quality guidelines for Arsenic, Nickel and Chromium (VI). These guidelines have been incorporated as EALs in the revised H1 Guidance issued by the Agency in 2010.

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

- Measurement of Chromium (VI) at the levels anticipated at the stack emission points is expected to be difficult, with the likely levels being below the level of detection by the most advanced methods. We have considered the concentration of total chromium and chromium (VI) in the APC residues collected upstream of the emission point for existing Municipal Waste incinerators and have assumed these to be similar to the particulate matter released from the emission point. This data shows that the mean Cr(VI) emission concentration (based on the bag dust ratio) is $3.5 * 10^{-5}$ mg/m^3 (max $1.3 * 10^{-4}$).

Based on this data, we consider it remains a conservative assumption for the Applicant to consider that the Cr(VI) emission concentration will be 0.0000532 mg/m^3.

The Applicant has used the above data to model the predicted Cr(VI) impact using data from municipal waste incinerators. The PC is predicted as 0.02% using the lowest value, and 2.77% using the maximum value.

The lower value shows that at such levels, emissions of Chromium (VI) are likely to be insignificant. (Using the maximum value of all concentrations measured the PC is only marginally above 1% at 2.77%). Although this is marginally above the 1% - this is using the maximum value as the EQS is an annual average we expect impacts to be lower than this. We are confident that emissions of Cr(VI) will not result in significant pollution. The installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document.

An improvement condition requires further assessment of this using actual emissions data during operation. We have also included this requirement for Arsenic as the assessment assumed 1/9^{th} of the metal ELV rather than use of worse case assumption.

We agree with the Applicant's conclusions.

5.2.4 Consideration of Local Factors

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

Birmingham City Council declared the whole of the City of Birmingham as an Air Quality Management Area (AQMA) in January 2003 with respect to Nitrogen Dioxide. This was later extended to include Particulate Matter (PM_{10}) in 2004, which was later revoked in 2010. Although compliance with the objective for particulates is achieved, the council maintain a pre-cautionary approach and continue to monitor against such objective. In respect to Nitrogen Dioxide, 12 actions were identified (such as transportation planning) to reduce levels of Nitrogen Dioxide.

From previous table (maximum ground level concentration –within AQMA):-

Pollutant	**EQS / EAL**		**Back-ground**	**Process Contribution (PC)**		**Predicted Environmental Concentration (PEC)**	
	µg/m³		**µg/m³**	**µg/m³**	**% of EAL**	**µg/m³**	**% of EAL**
NO_2	40	1	27	2.13	5.33	29.1	72.8
	200	2	27	28.08	14.0	55.08	27.5
PM_{10}	40	1	16.4	0.15	0.38		
	50	3	16.4	0.53	1.06		
$PM_{2.5}$	25	1	8.9	0.15	0.60		

Further assessment of NO_2 at the most impacted sensitive receptor – within AQMA.

Pollutant	**EQS / EAL**		**Back-ground**	**Process Contribution (PC)**		**Predicted Environmental Concentration (PEC)**	
	µg/m³		**µg/m³**	**µg/m³**	**% of EAL**	**µg/m³**	**% of EAL**
NO_2	40	1	27	1.78	4.45	28.78	71.9
	200	2	27	16.59	8.29	35.29	17.6

The process contribution for PM10 and PM2.5 are predicted to be well below 1% of the EU EQS and can therefore be considered insignificant.

Emissions of NO_2 cannot be screened out as insignificant, however the Applicant's modelling shows that the Installation is unlikely to result in a breach of the EUEQS within the AQMA.

We carried out an audit of the AQ assessment, findings relating to NO_2 were:-

- A background value of 27µg/m^3 had been used for all receptors (obtained from an average of 9 different grid squares from the 2011 Defra background maps).
- Adcock Green monitoring site (2.6km away from the site) has recorded measurements of 36ug/m^3 in 2014 – which would otherwise represent a worst case assessment.
- We contacted Birmingham City council to discuss background values and they do not have confidence in the measurements from this particular site. Overall they commented that there were no problems with NO_2 in that area and as a result - no diffusion tubes present in that location.

Using the unlikely high background of 36ug/m3 there is unlikely to be an exceedance of the long term NO_2 EQS however the background is likely to be less and therefore there is still some headroom.

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

We have included an improvement condition within the permit which requires the applicant to review NOx emissions from the Installation using monitoring data obtained during the first 12 months of Operation. This will allow actual data to be used and compared to theoretical data used within the application. The applicant is also required to update the Air Quality Report – for NOx impacts and carry out a review of BAT. We may change ELVs in response to the data provided by this condition.

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

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

i) Applying Statutory Controls

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

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

circumstances dictate tighter emission limits and controls than those set out in Chapter IV of IED on waste incineration and co-incineration plants. The assessment of BAT for this installation is detailed in section 6 of this document.

ii) Environmental Impact Assessment

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

iii) Expert Scientific Opinion

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

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

HPA (now PHE) in 2009 states that "The Health Protection Agency has reviewed research undertaken to examine the suggested links between emissions from municipal waste incinerators and effects on health. While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable". Revision to statement in 2011.....

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

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

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

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

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

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

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

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

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

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

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

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

iv) Health Risk Models

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

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

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

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

In addition to an assessment of risk from dioxins 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 and PCB's. In principle, the respective EQS for these metals are protective of human health. It is not therefore necessary to model the human body intake.

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

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

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

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

v) Consultations

As part of our normal procedures for the determination of a permit application, we have consulted Public Health England and Food Standards Agency. All issues raised by these consultations are considered in determining the Application as described in Annex 4 of this document.

5.3.2 Assessment of Intake of Dioxins and Furans

For dioxins 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 significantly below the recommended TDI levels.

We also carried out a separate assessment for dioxins and furans (report AQMAU_C1181a_RP) which agreed that the contribution COT-TDI is likely to be no greater than those predicted in the Application. The predictions are highly conservative and based on dietary intake entirely sourced from the peak impact from the plant.

Receptor	Total Depsotion Rate * (Gaseous & Particulate) µg m^{-2} s^{-1}	Annual Deposition Rate (ng m^{-2} annum $^{-1}$)	% of TDI (adult)	% of TDI (infant)
Fordrough 1	5.244E-13	0.017	2.0 %	1.8 %
Fordrough 2	4.845E-13	0.015	1.9 %	1.7 %
George Rd	4.795E-13	0.015	1.9 %	1.7 %
School, Francis Rd	3.363E-13	0.011	1.5 %	1.4 %
Shipway Rd	3.389E-13	0.011	1.5 %	1.4 %

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 $PM_{0.1}$.

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

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

5.3.4 Assessment of Health Effects from the Installation

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

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

In carrying out air dispersion modelling as part of the H1 Environmental Impact assessment and comparing the predicted environmental

concentrations with European and national air quality standards, the Applicant has effectively made a health risk assessment for many pollutants. These air quality standards have been developed primarily in order to protect human health.

The Applicant's assessment of the impact from $PM_{10,}$ $PM_{2.5}$, HF, HCl, CO, PAH, $NH_{3,}$ PCB, Tl, Hg, Sb, Pb, Co, Cu, Mn, V, and Cr (II)(III) have all indicated that the emissions screen out as insignificant; where the impact of emissions of SO_2, TOC, Cd, As, Ni and Cr(VI) have not been screened out as insignificant, the assessment still shows that the predicted environmental concentrations are within air quality standards or environmental action levels. For the impact from NO_2 following further consideration; the assessment indicates that there will not be an exceedance of the EQS as a result of emissions from the facility. Our detailed assessment of this is set out above.

The Environment Agency has reviewed the methodology employed by the Applicant to carry out the health impact assessment. We agree with the conclusions presented in the assessment.

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 the Food Standards Agency were consulted on the Application. No concerns were raised during the consultation process. Details of the responses can be found in Annex 4.

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

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

5.4.1 Sites Considered

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:

- Stockfield Road to Golden Hillock Road
- Lincoln Road North to Stockfield Road

- Golden Hillock Road to the city centre
- Grand Union Canal
- Alexander Road Railway Siding
- The Ackers

We have included the assessment for the most impacted non-statutory site which is 'The Ackers'. If the impact at this receptor is considered to be acceptable then it follows that the impact at the other receptors will also be acceptable as the impact at these sites will be considerably lower.

Assessment of Emissions to Air – Non-Statutory

Pollutant	Critical Level		Back-ground	Process Contribution (PC)	% of Critical Level	Predicted Environmental Concentration (PEC)	% of Critical Level
	µg/m^3		µg/m^3	µg/m^3		µg/m^3	
NOx	30	1	27.4	0.82	2.7 %	28.2	94 %
	75	2		0.86	0.86 %		
SO2	20	1		0.21	1 %		
NH_3	1	1		0.008	0.8 %		
HF	5	2		0.004	0.09 %		
	0.5	3		0.004	0.8 %		

1 Annual PC
2 Daily PC
3 Weekly PC

With the exception of NOx, all are screened as insignificant. When calculating the PEC for NOx, there are no breaches to any EQS/EALs.

Pollutant	Critical Load	Back-ground	Headroom	PC Deposition	PC Deposition as % of CL
		µg/m^3	µg/m^3		
N Deposition (KgN/ha/yr)	10 - 20	35.6	- 25.6	0.2	2 %
Acid Deposition (Keq/ha/yr)	2.79	2.54	0.25	0.07	2.5

As can be seen in the above table, the critical load for nitrogen deposition is already being exceeded at the most receptive receptor.

There is no evidence indicating that observable or measureable harm is being caused at local wildlife sites within this vicinity. The contributions from the proposed Installation (deposition) to critical loads are marginally above "insignificant" and as such we agree with the conclusion that the Installation is considered unlikely to have any significant upon the local wildlife sites.

No further assessment is required.

5.5 Impact of abnormal operations

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

For incineration plant, IED sets backstop limits for particulates, CO and TOC which must continue to be met at all times. *(This means that if CEMs fail to measure Particulates, CO or TOC then compliance with backstop limits cannot be demonstrated and so immediate shutdown must be initiated).*

The backstop limits for CO and TOC limits are the same as for normal operation, and are intended to ensure that good combustion conditions are maintained. The backstop limit for particulates is 150 mg/m^3 (as a half hourly average) which is five times the limit in normal operation.

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

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

In making an assessment of abnormal operations the following worst case scenario has been assumed (*based on reference conditions for co-incineration – 6% oxygen):*

- Dioxin emissions of 10 ng/m^3 (100 x normal)
- Mercury emissions are 15 times those of normal operation
- NO_x emissions of 825 mg/m^3 (2.75 x normal)
- Particulate emissions of 56 mg/m^3 (3.7 x normal)

- Metal emissions other than mercury are 15 times those of normal operation
- SO_2 emissions of 420 mg/m^3 (5.6 x normal)
- HCl emissions of 180 mg/m^3 (12 x normal)

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

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

Assessment of Emissions to Air **(Short term Abnormal)**

Pollutant	EQS / EAL		Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m^3		µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
NO_2	200	2	27	77	39	104	52.00
PM_{10}	50	3	16.4	0.7	1		
SO_2	266	4	2.2	67	25	69.2	26.02
	350	5	2.2	53	15	55.2	15.77
HCl	750	6	0.27	33	4		
HF	160	6	0.49	2	1		
Hg	7.5	1	0.00018	0.21	2.8		
Sb	150	1		0.22	0.1		
Cu	200	1	0.0223	0.22	0.1		
Mn	1500	1	0.0062	0.22	0.1		
Cr (II)(III)	150	1	0.0052	0.18	0.1		

1 1-hr Maximum
2 99.79th % ile of 1-hour means
3 90.41st % ile of 24-hour means
4 99.9th % ile of 15-min means
5 99.73rd % ile of 1-hour means
6 1-hour average

From the table above the emissions of the following substances can still be considered insignificant, in that the PC is still <10% of the short-term EQS/EAL. Pm_{10}, HCL, Hg, Sb, Cu, Mn, and Cr (II)(III).

Also from the table above emissions of the following substances (which were not screened out as insignificant) have been assessed as being unlikely to give rise to significant pollution in that the predicted environmental concentration is less than 100% of short term EQS/EAL. These are NO_2 and SO2.

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 5.3.3. In these circumstances the TDI would be 1.86E-07 pg(I-TEQ/ kg-BW/day), which is 3.4% of the COT TDI. At this level, emissions of dioxins will still not pose a risk to human health.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

- The first issue we address is the fundamental choice of co-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: • NO2, SO2, TOC, Cd, As, Ni and Cr (VI).

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

Summary comparison of thermal treatment technologies (reproduced from the Waste Incineration BREF)

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

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Gasification Ash Quality	Cost
Rotary Kiln	Can accept liquids and pastes □□solid feeds more limited than grate (owing to refractory damage) □□□ applied to hazardous Wastes	<10 t/h	Very well proven with □□ broad range of wastes and [out even of HW	Throughputs lower than grates	TOC <3 %	Higher specific cost due to reduced capacity
Fluid bed - bubbling	Only finely divided consistent wastes. Limited use for raw MSW □often applied to sludges	1 to 10 t/h	Good mixing Fly ashes of good leaching quality	Careful operation required to avoid clogging bed. Higher fly ash quantities.	TOC <3 %	FGT cost may be lower. Costs of waste preparation
Fluid bed - circulating	Only finely divided consistent wastes. Limited use for raw MSW, often applied to sludges / RDF.	1 to 20 t/h most used above 10 t/h	Greater fuel flexibility than BFB Fly ashes of good leaching quality	Cyclone required to conserve bed material Higher fly ash quantities	TOC <3 %	FGT cost may be lower. Costs of preparation.
Oscillating furnace	MSW / □ wastes	1 – 10 t/h	Robust Low maintenance Long history □□ Low NOX level Low LOI of gasification 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	Gasification Ash Quality	Cost
Pulsed hearth	Only higher CV waste (LCV >20 GJ/t) □ used for clinical wastes	<7 t/h	can deal with liquids and powders	bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Stepped and static hearths	Only higher CV waste (LCV >20 GJ/t) Mainly used for clinical wastes	No information	Can deal with liquids and powders	Bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Spreader - stoker combustor	- RDF and other particle feeds □□ poultry manure □□ wood wastes	No information	- simple grate construction □□ less sensitive to particle size than FB	only for well defined mono-streams	No information	No information
Gasification - fixed bed	- mixed plastic wastes □□ other similar consistent streams □□ gasification less widely used/proven than incineration	1 to 20 t/h	-low leaching residue □□□ good burnout i oxygen blown □□syngas available -Reduced oxidation of recyclable metals	- limited waste feed - not full combustion - high skill level □□ tar in raw gas - less widely proven	-Low leaching gasification ash □□ good burnout with oxygen	High operation/ maintenance costs

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

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

- Moving Grate Furnace
- Pyrolysis
- Gasification

Additional information was provided alongside the application (prior to duly making) titled - "supplementary BAT Assessment for Birmingham Biomass" narrowing the selection choice between various Gasification and Pyrolysis technologies.

Gasification systems for wastes:

System 1	Fixed bed gasifier - pretreatment drying required for lumpy material
System 2	Slag bath gasifier - as fixed bed but with molten gasification ash discharge
System 3	Entrained flow gasifier - for liquid, pasty and fine granular material that may be injected to the reactor by nozzles
System 4	Fluidised bed gasifier - circulating fluid bed gasifier for pretreated municipal waste, dehydrated sewage sludge and some hazardous wastes
System 5	Bubbling bed gasifier - similar to bubbling fluidised bed combustors, but operated at a lower temperature and as a gasifier.

Pyrolysis - gasification systems for wastes:

System 1	Conversion process - pyrolysis in a rotary kiln - withdrawal and treatment of solid phase - condensation of gas phase - subsequent entrained flow gasifier for pyrolysis gas, oil and coke
System 2	Combined gasification-pyrolysis and melting - partial pyrolysis in a push furnace with directly connected gasification in packed bed reactor with oxygen addition (e.g. Thermoselect). Other systems have been developed for the purpose of pretreating wastes that are then combusted in other industrial plants. These co-incineration processes do not fall within the scope of this BREF.

These technologies are identified as being BAT in the BREF for this type of waste feed – comprising a consistent waste wood feedstock.

The Applicant has proposed to use furnace technology comprising gasification (four gasifiers) whereby syngas will be produced, combined and mixed prior to combustion in a single conventional boiler (combustion tube and boiler/turbine unit) - with natural gas as a support fuel.

The applicant has justified this choice of technology focusing on emissions performance (NOx), process efficiency, feedstock type, renewables obligations, operational experience and physical size:-

- Two stage combustion system (through gasification) is inherently efficient with a very high burnout efficiency and low carbon monoxide emissions.
- Combustion will take place in temperature ranges to those specified in IED which ensure the effective destruction of any potential VOCs and dioxins.

- The operator has expertise within this technology area – having developed, built and operated a number of timber gasification processes.
- The compact nature of the technology was particularly suitable for this urban site and location.

The Applicant proposes to use gas as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is considered BAT as it is not considered to produce emissions any worse than those from burning gas oil, as defined by Directive 75/716/EEC (as amended), liquefied gas or natural gas.

Boiler Design

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

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

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

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

6.2.2 Oxides of Nitrogen

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

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

Reagent Type: Urea	Likely to be BAT			All plant

Secondary measures

Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR) can be used with either 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 can be considered BAT, and the use of one over the other is not normally significant in environmental terms.

The Applicant proposes to implement the following primary measures:

- Use of efficient specialised burners designed for syn gas.
- 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.

The Applicant proposes to implement the following secondary measure:

- SNCR with aqueous urea as the reagent, as quoted:-

As seen earlier, emissions of NO_x could not be screened out as insignificant. The long term PC was greater than 1% - *at 5.33%,* and the short term PC was greater than 10% - *at 14%.*

We carried out an audit of the AQ assessment, and concluded that there is unlikely to be an exceedance of the long term NO_2 EQS , findings are discussed in section 5.2.4.

The Application focuses on controlling NOx by using primary measures (as detailed above), however the Installation is incorporating SNCR as a secondary measure within the design of the plant. Justification for selecting this secondary measure is based upon its appropriateness within the operating window of the gasification process.

"SNCR is designed to be included within the BBPL process – this technology is prescribed as BAT within the BREF notes and all EA Guidance notes. The NOx

abatement option of selective non catalytic reduction (SNCR) requires the careful injection of the active reagent (urea solution) into a combustion chamber in a carefully controlled mixing and temperature regime (typically in a 900 to 1,200 degree Centigrade "window"). The Nexterra technology through its use of gasification has an ideal and stable opportunity for this residence time and temperature within the secondary combustion chamber in which this reaction can take place in a controlled and efficient manner with very little slippage. This temperature zone within a gasification process is more stable than that within a combustion process and results in a more efficient use of reagent with less slippage. This SNCR reaction acts in synergy with the staged gasification combustion, and the use of BAT in the form of exhaust gas recirculation, to produce a plant with inherently low emissions of NOX. This inherent stability and synergy was one of the prime reasons the use of gasification is considered BAT for this location."

Based upon our experiences of SCR we believe that the additional financial costs involved (start-up and operational costs) plus potential implications of reheating gas streams (reducing energy efficiency), and periodic replacement of catalysts (hazardous waste) would provide less benefit to the plant than the use of SNCR.

As a result of the above, we are satisfied that SNCR is considered BAT for this 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. An Improvement condition requires the Operator to report 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 (every 3 months for the first 12 months of operation).

6.2.3 Acid Gases, SO_x, HCl and HF

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

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**

Wet	High reaction rates Low solid residues production Reagent delivery may be optimised by concentration and flow rate	Large effluent disposal and water consumption if not fully treated for re-cycle Effluent treatment plant required May result in wet plume Energy required for effluent treatment and plume reheat		Plants with high acid gas and metal components in exhaust gas – HWIs
Dry	Low water use Reagent consumption may be reduced by recycling in plant Lower energy use Higher reliability	Higher solid residue production Reagent consumption controlled only by input rate		All plant
Semi-dry	Medium reaction rates Reagent delivery may be varied by concentration and input rate	Higher solid waste residues		All plant
Reagent Type: Sodium Hydroxide	Highest removal rates Low solid waste production	Corrosive material ETP sludge for disposal		HWIs
Reagent	Very good	Corrosive	Wide range	MWIs, CWIs

Type: Lime	removal rates Low leaching solid residue Temperature of reaction well suited to use with bag filters	material May give greater residue volume if no in-plant recycle	of uses	
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 from the national grid which is an inherently low sulphur fuel and we agree with that assessment.

- Management of heterogeneous wastes – this will disperse problem wastes such as PVC by ensuring a homogeneous waste feed.

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

The Applicant has therefore considered dry and semi-dry methods of secondary measures for acid gas abatement. Either can be BAT for this type of facility.

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

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

In this case, the Applicant proposes to manage the waste such that low acidity biomass material will be gasified and in bed injection of limestone. 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			Covered in	All plant

Particulate matter removal			section on particulate matter	
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 will either use a dedicated injection or a pre-mix carbon with lime. A pre-operational condition has been set requiring confirmation of the feed method.

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 will either use a dedicated injection or a pre-mix carbon with lime. A pre-operational condition has been set requiring confirmation of the feed method.

6.3 BAT and global warming potential

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

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

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

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

Taking this into account, the net emissions of CO_2 from the Installation are estimated at 365 kg per MWh. At this level emissions cannot be characterised as insignificant. The Installation is not subject to the

Greenhouse Gas Emissions Trading Scheme Regulations 2003; therefore it is a requirement of IED to investigate how emissions of greenhouse gases emitted from the installation might be prevented or minimised.

The Applicant has considered GWP. 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.

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 Equivalence) limit of 0.1 ng/m^3. Further development of the understanding of the harm caused by dioxins has resulted in the World Health Organisation (WHO) producing updated factors to calculate the WHO-TEQ value. Certain **PCBs** have structures which make them behave like dioxins (dioxin-like PCBs), and these also have toxic equivalence factors defined by WHO to make them capable of being considered together with dioxins. The UK's independent health advisory committee, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has adopted WHO-TEQ values for both dioxins and dioxin-like PCBs in their review of Tolerable Daily Intake (TDI) criteria. In support of the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs have been specified for monitoring and reporting purposes, to enable an evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. We specify monitoring of a range of PAHs and dioxin-like PCBs in waste incineration Permits at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs identified by Defra in their previous Environmental Permitting Guidance on the WID. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5 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 uncontaminated surface water from the yard area flows to a collective site drain where it passes to an interceptor before joining the main drainage system.

Uncontaminated roof water is harvested and collected in a tank for use in various applications including the spray drier, cooling tower, process attemporation (scrubbing purposes), dust suppression and fire control system.

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

Process effluents (namely consisting of boiler blow down) are discharged to the on-site foul drainage system through an interceptor which discharges to the main town sewer (S1) as consented by Severn Trent Water. Treatment is provided at Minworth sewage treatment works.

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.

There is potential for fugitive dust emissions to be generated from low speed shredding operations (quadruple shaft shredder) or from handling pre-shredded feedstock. To minimise fugitives from such processes, operations will take place internally (within buildings) and will be controlled by dust suppression systems / controlled air extraction systems. Ventilation systems will filter air prior to discharge from the building.

The transfer of feedstock will take place using enclosed conveyors.

APC reagents will be stored appropriately (containment / bunding). A limited number of liquids will be stored onsite, and these are considered unlikely to generate any VOC emissions. There are no underground sumps / tanks. Underground pipework will consist of the district heating system for water re-circulation.

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

The Application states that there are no potential odour sources at the Installation. The timber raw materials brought to the site are considered non-odorous. All gases generated during the thermal treatment process are inherently odourless.
Based upon the information in the application we are satisfied that the appropriate measures will be in place to prevent or where that is not practicable to minimise odour and to prevent pollution from odour.

6.5.5 Noise and vibration

The site is located within a designated industrial development site. A noise assessment is included within appendix 9 of the Application.

Potential noise sources from within the Installation have been identified as:-

- Vehicle movements
- Mechanical handler
- Conveyors
- Separation equipment
- Thermal treatment plant (including fans)
- Exhaust stack
- Cooling system

- Building ventilation

Mitigation measures include building orientation (positioned away from nearest receptors), and acoustic shielding / housing for any noisy equipment (e.g. the turbine generator).

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

The Application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures. We have carried out a detailed audit of the noise assessment, and happy with the conclusions drawn.
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 proposed plant will lie within a newly constructed building. The closest residential property is around 0.2km from the Installation. Acceptability for both daytime and night time periods have been made against the comparative targets of BS4142, and absolute targets of BS8233 and WHO guidelines. An assessment of predicted noise against criteria confirms that the residual noise at the residential properties will be within all design criteria during both day and night. The report concludes that the facility will have a negligible impact on closest residential properties.

We have set an improvement condition in order to validate the assessment once the plant is operational.

6.6 Setting ELVs and other Permit conditions

6.6.1 Translating BAT into Permit conditions

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

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

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

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

(i) Local factors

We have considered the location of the Installation to the AQMA declared for NO2, in Section 5 of this document. We have also considered the controls in place to prevent and minimise emissions of NO2 in Section 6.2.2.

Regarding the technology proposed, we have not required the Applicant to go beyond what is BAT for this type of facility; however we have set an improvement condition requiring the operator to re-evaluate the impacts from NOx using actual emissions data – which will be more accurate than those predictions within the application. Following this, we may revise ELVs stated in the permit.

(ii) National and European EQSs

As detailed in section 5.1 the environmental impact of the Installation has been assessed against relevant EQS, at the levels of performance required by EPR / IED. The installation will not result in the breach of any EQSs. We accept that the applicants proposals are BAT and that there is no justification to reduce ELVs below WID levels in these circumstances.

(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 set a pre-operational condition which requires the operator to provide a written commissioning plan for approval by the Environment Agency, prior to the start of commissioning. The commissioning plan will address the expected emissions to the environment associated with the different stages of commissioning and the duration and timelines for completion of each stage. The purpose of this pre-operational condition is to ensure that the risks to the environment continue to be minimised throughout the commissioning process. As such, the operator is required to describe the actions that will be taken to protect the environment and also to inform the Environment Agency in the event of actual emissions exceeding expected emissions. The operator will be required to carry out commissioning in line with the commissioning plan, once it is approved by the Environment Agency.

We have also set an improvement condition which requiring the Operator to submit a written report for approval on the commissioning of the Installation. The purpose of this condition is to provide a comparison of the environmental performance of the plant as installed against the original design parameters which were set out in the Application. The report shall also review the performance of the Installation against the permit conditions and shall include details of any procedures developed during commissioning for achieving and demonstrating compliance with Permit conditions. This will provide an accurate picture of the plant's performance in its "as built" state and the response to this improvement condition will be incorporated into Table S1.2 of the Permit as an operating technique.

6.7 Monitoring

6.7.1 Monitoring during normal operations

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

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

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

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

The application includes a request for provision of “abnormal allowances”.

The Operator has stated that they will not have a backup CEMS unit on site, but do have provisions for CEM hire. This hire contract is with CBISS and will be all inclusive (24 hours/7 days) covering all parts and labour (including routine maintenance and repairs). CBISS engineers carry stock of critical parts and in the unlikely event that the CEMs is non-repairable, a spare full back-up replacement system is available.

In the unlikely event that CEMS fail, condition 2.3.10 of the permit requires that the abnormal operating conditions apply. If CEMS cannot be repaired or replaced within the relevant timescale, then the plant must be shut down in a controlled manner so that emissions cease within the timescale of 4 hours as stated within that condition.

Section 2.8 of the application confirms that shutdown of the gasifiers can take place in less than 30 minutes in the event of a plant failure.

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

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

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

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

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The decision of Birmingham City Council to grant planning permission on 20th August 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.

Our decision in this case has been reached following a programme of extended public consultation, on the original Application. A summary of the responses received to our consultation and our consideration of them is set out in Annex 4.

7.2 National primary legislation

7.2.1 **Environment Act 1995**

(i) Section 4 (Pursuit of Sustainable Development)

We are required to contribute towards achieving sustainable development, as considered appropriate by Ministers and set out in guidance issued to us. The

Secretary of State for Environment, Food and Rural Affairs has issued *The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002)*. This document:

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

In respect of regulation of industrial pollution through the EPR, the Guidance refers in particular to the objective of setting permit conditions "*in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters…*". The Environment Agency considers that it has pursued the objectives set out in the Government's guidance, where relevant, and that there are no additional conditions that should be included in this Permit to take account of the Section 4 duty.

(ii) Section 7 (Pursuit of Conservation Objectives)

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

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

(iii) Section 81 (National Air Quality Strategy)

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

7.2.2 **Human Rights Act 1998**

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

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

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

7.2.4 **Wildlife and Countryside Act 1981**

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

There are no SSSIs within the screening distance, and thus no assessment required.

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.

There are no European Site's within the screening distance, and thus no assessment is required.

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

S23 of the Local Democracy, Economic Development and Construction Act 2009 require us where we consider it appropriate to take such steps as we consider appropriate to secure the involvement of interested persons in the exercise of our functions by providing them with information, consulting them

or involving them in any other way. S24 requires us to have regard to any Secretary of State guidance as to how we should do that.

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2.2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 4. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. 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 of the Permit
45(1)(c)	The permit shall include the limit values for emissions into air and water.	Schedule 3 of the Permit.
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	There are no discharges of waste water other than limited discharges of boiler blowdown emissions – covered by trade effluent consent.
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, S3.1(a), S3.2, S3.3 and S3.4. 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 2.3.8 to 2.3.11
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
46(3)	Relates to conditions for water discharges from the cleaning of	There are no such discharges as

IED Article	Requirement	Delivered by
	exhaust gases.	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.	Conditions 2.3.6, 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 6 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), and S3.4
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Tables S3.1, S3.1(a) and S3.4
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Schedule 4 of the Permit
49	The emission limit values for air and water shall be regarded as being	Condition 3.5.5 (b) to (e)

IED Article	Requirement	Delivered by
	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%.	Conditions 3.5.1 and Table S3.5
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Pre-operational condition (CFD modelling). 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.	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 (pre-operational condition) and then every 2 years (Condition 1.3. 3)
50(6)	Relates to the feeding of infectious clinical waste into the furnace.	No infectious clinical waste will be burnt
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
51(2)	Changes in operating conditions do not cause more residues or residues with a higher content of organic polluting substances compared to those residues which could be expected under the conditions laid down in Articles 50(1), (2) and (3).	Schedule 3, Table S3.5
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	- EPR require prevent or minimise pollution. -- conditions 2.3.1, 2.3.3, 3.2, 3.3 and 3.4
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Volume 2 of the application describes procedures for the reception and monitoring of incoming waste
52(3)	Prior to accepting hazardous waste, the operator shall collect available information about the waste for the purpose of compliance with the permit requirements specified in Article 45(2).	Not authorised to accept hazardous waste
52(4)	Prior to accepting hazardous waste, the operator shall carry out the procedures set out in Article 52(4).	Not authorised to accept hazardous 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.
55(1)	Application, decision and permit to be publicly available.	All documents are accessible from the Environment Agency Public Register.
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Condition 4.2.2

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.

Ref	Pre-operational measures
PO1	Prior to the commencement of commissioning, the Operator shall send a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with the requirements set out in Section 1 of How to comply with your environmental permit The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.
PO2	Prior to the commencement of commissioning, the Operator shall send a report to the Environment Agency which will contain a comprehensive update of the options available for utilising the heat generated by the waste co-incineration process in order to ensure that it is recovered as far as practicable. The report shall detail any identified proposals for improving the recovery and utilisation of waste heat and shall provide a timetable for their implementation.
PO3	Prior to the commencement of commissioning, the Operator shall submit to the Environment Agency for approval a protocol for the sampling and testing of incinerator gasification ash for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.
PO4	Prior to the commencement of commissioning, the Operator shall provide confirmation of the Activated Carbon dosing method (i.e. whether this is injected separately or mixed with acid gas reagent). Justification shall be provided for the chosen method and the Operator shall seek written approval from the Environment Agency prior to commencing commissioning.
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 co-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 Industrial Emissions Directive.

PO8	The Operator shall submit the written protocol referenced in condition 3.2.4 for the monitoring of soil and groundwater for approval by the Environment Agency. The protocol shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The procedure shall be implemented in accordance with the written approval from the Agency.
PO9	Prior to commencing commissioning, the Operator shall submit a written report to the Environment Agency detailing the storage arrangements for feedstock on site. The storage arrangements shall have specific regard to TGN 7.01, or other such appropriate guidance as is adopted, for the storage of combustible materials and include specific details of the odour and dust control measures to be implemented. The report shall seek written approval from the Environment Agency. Storage arrangements and control measures shall be implemented from such approval.

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.

Ref	Improvement Measure	Completion Date
IC1	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.
IC2	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.

IC3	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.
IC4	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.
IC5	The Operator shall submit a written proposal to the Environment Agency to carry out tests to determine the size distribution of the particulate matter in the exhaust gas emissions to air from emission point A1, identifying the fractions within the PM_{10}, and $PM_{2.5}$ ranges. The proposal shall include a timetable for approval by the Environment Agency to carry out such tests and produce a report on the results. On receipt of written agreement by the Environment Agency to the proposal and the timetable, the Operator shall carry out the tests and submit to the Environment Agency a report on the results.	Within 6 months of the completion of commissioning.
IC6	The Operator shall undertake a noise assessment during normal operations in accordance with the procedures given in BS4142:2014 (Rating industrial noise affecting mixed residential and industrial areas) and BS7445: 2003 (Description and measurement of environmental noise) or other methodology as agreed with the Environment Agency - in order to validate the assessment provided within the application. The assessment shall include, but not be limited to: • A review of the noise sources from the facility. Where any noise source(s) are identified as exhibiting tonal contributions, they shall be quantified by means of frequency analysis. • A review of noise levels from static plant. • Considerations of on-site vehicle movements. A report shall be provided to the Agency detailing the findings of the assessment.	Within 6 months of the completion of commissioning.
IC7	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 certfified.	Within 12 months of the date on which waste is first burnt.
IC8	The Operator shall carry out an assessment of the impact of emissions to air of the following component metals subject to emission limit values:- • Arsenic (As). • Chromium.	15 months from commencement of operations

	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.	
IC9	The Operator shall conduct a review of NOx emissions from the Installation using emissions monitoring data obtained during the first year of operation. The review shall cover the following :- • A comparison of actual NOx emissions to those assumed within the application. • An updated Air Quality Report (for NOx emissions) using actual emissions data. • A re-appraisal of Best Available Techniques' (BAT) for preventing, and where that is not possible minimising emissions of NOx. A report detailing the review and its findings shall be submitted to the Environment Agency. Where any improvements are identified, the Operator shall submit proposals for their implementation including timescales to be agreed in writing by the Environment Agency. The findings shall be used to determine whether a reduction to the NOx Emission Limit Value is required.	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 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 13 May to 12 June 2014. Copies of the Application were placed on the Public Register.

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

- *Food Standards Agency (FSA)*
- *Public Health England (PHE)*
- *Birmingham City Council - Environmental Health (EH)*
- *Birmingham City Council - Planning*
- *Health and Safety Executive (HSE)*
- *Sewage Undertaker - Severn Trent Water Limited*

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from *Public Health England on 5th June 2014*	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Based solely on the information contained in the application provided, PHE has no significant concerns regarding risk to health of the local population from this proposed activity, in accordance with the relevant sector technical guidance or industry best practice.	*No additional action required.*

Response Received from *Severn Trent Water Limited on 9th June 2014*	
Brief summary of issues raised:	Summary of action taken / how this has been covered
The site has a discharge to sewer which is subject to a Trade Effluent Consent issued by Severn Trent Water Ltd. However, as of 02/06/2014, operator has not started discharging and therefore cannot comment on compliance.	*No additional action required.*

Response Received from *Birmingham City Council on 11th June 2014*	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Questionnaire completed and returned with copy of planning permission. No additional comments raised.	*No additional action required.*

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

We received no consultation responses from members of the public / community organisations.

a) **Representations from Local MP, Councillors and Parish / Town / Councils**

We received no consultation responses from local the MP / councils.

b) Representations from Community and Other Organisations

We received no consultation responses from community or other organisations.

c) Representations from Individual Members of the Public

We received no consultation responses from members of the public.