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

Decision document recording our decision-making process

The Permit Number is:	EPR/UP3231NQ
The Operator is:	Tyseley Urban Resources Centre Limited
The Installation is located at:	Tyseley Urban Resources Centre, Hay Hall Road, Tyseley, Birmingham, B11 2AU

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/UP3231NQ/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/UP3231NQ. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 19 December 2013.

The Applicant is Tyseley Urban Resources Centre Limited. We refer to Tyseley Urban Resources Centre Limited as "the **Applicant**" in this document. Where we are talking about what would happen after the Permit is granted, we call Tyseley Urban Resources Centre Limited "the **Operator**".

The facility proposed by Tyseley Urban Resources Centre Limited is located at the Tyseley Urban Resources Centre in Hay Hall Road, Tyseley, Birmingham . We refer to this as “the **Installation**” in this document.

How this document is structured

- Glossary of acronyms
- Our proposed decision
- How we reached our decision
- The legal framework
- The Installation
    - Description of the Installation and general issues
    - The site and its protection
    - Operation of the Installation – general issues
- Minimising the Installation's environmental impact
    - Assessment Methodology
    - Air Quality Assessment
    - Human health risk assessment
    - Impact on Habitats sites, SSSIs, non-statutory conservation sites etc.
    - Impact of abnormal operations
    - Other emission points
- Application of Best Available Techniques
    - Scope of Consideration
    - BAT and emissions control
    - BAT and global warming potential
    - BAT and POPs
    - Other Emissions to the Environment
    - Setting ELVs and other Permit conditions
    - Monitoring
    - Reporting
- Other legal requirements
    - The EPR 2010 and related Directives
    - National primary legislation
    - National secondary legislation
    - Other relevant EU legislation
    - Other relevant legal requirements
- Annexes
    - Application of the Industrial Emissions Directive
    - Pre-Operational Conditions
    - Improvement Conditions
    - Consultation Reponses

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	I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
AQS	Air Quality Standard	LCPD	Large Combustion Plant Directive (2001/80/EC)
BAT	Best Available Technique(s)	LCV	Lower calorific value – also termed net calorific value
BAT-AEL	BAT Associated Emission Level	LfD	Landfill Directive (1999/31/EC)
BREF	BAT Reference Note	LHB	Local Health Board
CCW	Countryside Council for Wales	NR	Local Nature Reserve
CEM	Continuous Emissions Monitor	LOI	Loss on Ignition
CFD	Computerised fluid dynamics	LWS	Local Wildlife Site
CHP	Combined heat and power	MSW	Municipal Solid Waste
COMEAP	Committee on the Medical Effects of Air Pollutants	MWI/CWI	Municipal/Clinical waste incinerator
CROW	Countryside and rights of way Act 2000	Opra	Operator Performance Risk Appraisal
CV	Calorific value	PC	Process Contribution
CW	Commercial waste	PHE	Public Health England
DAA	Directly associated activity	PEC	Predicted Environmental Concentration (i.e. PC plus background)
DD	Decision document	PPS	Public participation statement
EAL	Environmental Assessment Level	PR	Public register
EfW	Energy from Waste	RDF	Refuse derived fuel
EIAD	Environmental Impact Assessment Directive (85/337/EEC)	RGS	Regulatory Guidance Series
ELV	Emission limit value	SAC	Special Area of Conservation
EMS	Environmental Management System	SED	Solvent Emissions Directive (1999/13/EC)
EMAS	EU Eco Management and Audit Scheme	SCR	Selective catalytic reduction
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended	SGN	Sector guidance note
EQS	Environmental quality standard	SHPI(s)	Site(s) of High Public Interest
EU-EQS	European Union Environmental Quality Standard	SNCR	Selective non-catalytic reduction
EWC	European waste catalogue	SPA	Special Protection Area

FSA	Food Standards Agency	SS	Sewage sludge
GWP	Global Warming Potential	SSSI	Site of Special Scientific Interest
HHRAP	Human Health Risk Assessment Protocol	SWMA	Specified waste management activity
HMIP	Her Majesty's Inspectorate of Pollution	TDI	Tolerable daily intake
HPA	Health Protection Agency	TEF	Toxic Equivalent Factors
HRA	Human Rights Act 1998	TGN	Technical guidance note
HW	Hazardous waste	UHV	Upper heating value – also termed gross calorific value
HWI	Hazardous waste incinerator	UN-ECE	United Nations Environmental Commission for Europe
IBA	Incinerator Bottom Ash	US EPA	United States Environmental Protection Agency
IED	Industrial Emissions Directive (2010/75/EU)	WFD	Waste Framework Directive (2008/98/EC)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC)	WHO	World Health Organisation
I-TEF	Toxic Equivalent Factors set out in Annex VI of IED	WID	Waste Incineration Directive (2000/76/EC)
Chemical substances/types			
Cd, Tl	Group 1 metals: cadmium, thallium respectively	POP(s)	Persistent organic pollutant(s)
Hg	Group 2 metal: mercury	PAH	Polycyclic aromatic hydrocarbons
As, Co, Cr, Cu, Mn, Pb, Ni, Sb, V	Group 3 metals: arsenic, cobalt, chromium, copper, manganese, lead, nickel, antimony, vanadium, respectively	PCB PXDD PXB PXDF	Polychlorinated biphenyls Poly-halogenated di-benzo-p-dioxins Poly-halogenated biphenyls Poly-halogenated di-benzo furans respectively
CrVI	Chromium VI,	NOx	Oxides of nitrogen (NO plus NO2 expressed as NO2)
TOC	Total Organic Carbon	N_2O	Nitrous oxide
HF	Hydrogen fluoride	NH3	Ammonia
HCl	Hydrogen chloride	SO_2	Sulphur dioxide
CO_2	Carbon dioxide	CO	Carbon monoxide
BaP	Benzo[a]pyrene *(a PAH)*		

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 19 December 2013. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

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

2.2 Consultation on the Application

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

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

We placed a paper copy of the Application and all other documents relevant to our determination (see below) on our Public Register at the Environment Agency, Sentinel House, 9 Wellington Crescent, Fradley Park, Lichfield, WS13 8RR and also sent a copy to Birmingham City Council, 581 Tyburn Road, Erdington, Birmingham, B24 9RX, for its own Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made.

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

- Birmingham City Council Environmental Health
- Birmingham City Council Planning Authority
- Food Standards Agency
- Health and Safety Executive
- Public Health England
- Director of Public Health
- Severn Trent Limited (Sewerage Undertaker)

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

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

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we received additional information during the determination from the Applicant as follows:

- Email #1 received 19/12/13 in respect of air quality assessment
- Email #2 received 07/01/14 containing a revised air quality assessment and air quality modelling files
- Email #3 received 22/01/14 in respect of mass and energy balance information, a CHP-Ready assessment and general clarification about BAT for the technology selected
- Email #4 received 23/01/14 clarifying air modelling aspects
- Email #5 received 27/01/14 clarifying and amending energy balance information
- Email #6 received 27/01/14 clarifying abnormal operation assessment
- Email #7 received 29/01/14 clarifying general aspects of the application
- Email #8 received 13/02/14 regarding dioxin formation
- Email #9 received 24/02/14 clarifying further air quality aspects
- Email #10 received 04/03/14 clarifying aspects of abnormal operation
- Email #11 received 12/03/14 containing CO_2 balance information
- Email #12 received 13/03/14 submitting further information on noise issues
- Email #13 received 08/04/14 submitting further information on noise issues

- Email #14 received 11/04/14 submitting further information on noise issues
- Email #15 received 14/04/14 submitting further information on noise issues

We made a copy of this information available to the public.

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 Installation is:

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

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

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

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

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

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

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

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

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

Many activities which would normally be categorised as “directly associated activities” for EPR purposes (see below), such as air pollution control plant, (including storage and preparation of treatment chemicals) and the storage of ash (which in this process is vitrified slag), are therefore included in the listed activity description.

An installation may also comprise "directly associated activities", which at this Installation include:

- in the event of a supply failure, the back-up production of electricity using a generator and back-up production of steam using a natural gas boiler;
- for the recovery of additional electrical power from residual energy in the exhaust gases from the gas engines, the use of an Organic Rankine cycle generator.

Electrical generation from the energy derived from the plasma gasifier is from gas engines which form part of the installation and are not directly associated activities.

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

4.1.2 The Site

The site is within the Tyseley Industrial Regeneration Area and the surrounding land uses are mainly industrial in nature. The proposed gasification facility will occupy approximately 2.4 hectares, is relatively flat and roughly rectangular in shape.

The site lies within an Air Quality Management Area. There are no designated European sites (Ramsar, SPAs, SACs) within 10 km of the Site. Furthermore there are no SSSI's or LNRs within 2 km of the Site. There are several Local Wildlife Sites within 2 km of the site.

The nearest human sensitive receptors are about 150m to the south and east of the site.

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

Further information on the site is addressed below at 4.3.

4.1.3 What the Installation does

The Applicant has described the facility as a Renewable Energy Facility by Plasma Gasification and known as the Gasplasma process. Our view is that for the purposes of IED and EPR, the Installation is an incinerator because the plant does not produce a material output, energy is recovered from the waste being thermally treated in the form of electrical power which is exported to the National Grid and waste is the principal source of fuel.

The facility can accept 50,000 tonnes per year (tpa) of non-hazardous mixed waste which, following processing to remove metals, plastic and other recyclates, residual moisture and reject materials, will produce 35,000 tpa of RDF as feedstock for the Gasplasma process and will produce approximately 3.0 MWe electricity from each of two gas engines.

Fuel preparation takes place in a plant with a nominal design processing rate of 12 tonnes per hour (tph) allowing up to 50,000 tpa of material to be processed. The first stage of the fuel preparation system is size classification of material through a rotary screen to remove the fine material (-15 mm). The remaining material then passes by overband magnets to remove ferrous metals and through eddy current separators to remove non-ferrous metals. The remaining metal-free stream is shredded to <50 mm and it is this undried RDF that is fed to the RDF store.

The RDF is then dried using a band drier with steam batteries providing the heat source; the steam used for this operation is recovered from the Gasplasma process. The moisture laden air removed from the RDF is treated to remove odour before release to atmosphere by passing it through a bag filter for particulate removal and a regenerative thermal oxidiser (RTO) for the destruction of odorous components within the exhaust gas.

The fines separated earlier are fed with the dried RDF stream into the Gasifier together with steam and oxygen to provide the required chemicals to convert the mixed materials into useful gases. The process conditions are maintained by automated control of oxygen, steam and RDF feed rate. This process provides sufficient heat to maintain the fluid bed temperature and produce a “crude syngas”. The crude syngas contains significant quantities of long chain hydrocarbons which would condense as tars and residues if it was allowed to cool.

The ash component of the RDF is automatically removed from the base of the Gasifier through the bed screening process and conveyed to a hopper where it is metered into the plasma converter. There are no residues, chars or ash removed at this stage of the process.

The crude syngas is transferred from the Gasifier to the plasma converter in the centre of which is a graphite electrode. A plasma arc is generated between the tip of the electrode and the molten slag bath contained in the converter hearth. The crude syngas is exposed to elevated temperatures and intense ultra violet light in order to “crack” it and reform the tars and residues into the basic composition of hydrogen (H_2), carbon monoxide (CO), carbon dioxide (CO_2) and water (H_2O). This product is known as syngas.

The design of the plasma converter enables optimal residence time for the syngas within the converter and allows time for ash and dust particles to drop out of the gas stream into a molten slag pool which builds up in the base of the plasma converter. This molten material is continuously removed from the plasma converter via an overflow weir and cooled for use as a vitrified and stable material. This material has been accepted as a product following an End of Waste Submission and is now trademarked under the name Plasmarok. This would be the equivalent of Incinerator Bottom Ash (IBA) of a traditional mass burn incinerator (except that it is no longer classified as a waste material).

The syngas is then drawn to the inlet of the gas cooling system which is a heat recovery boiler designed to reduce syngas temperatures from about 1,200°C to 160°C and generate saturated steam at 10 bar(g) pressure. The steam generated is used in the Gasplasma process and for drying.

The dry gas cleaning system, operating at 150°C to 180°C, removes fine particulate materials from the syngas stream, neutralises acid gases and removes heavy metal vapour. The syngas passes to the ceramic particulate filter into which the reagents sodium bicarbonate and activated carbon are injected. The reagents build up on the ceramic filter elements providing a barrier for the syngas to pass through. This barrier provides sufficient residence time to allow good reaction, providing high capture rates for acidic components and volatile metals. Particulate matter, including the by-products from the reagent reactions, is trapped on the ceramic filter elements and periodically removed using a nitrogen reverse pulse system. These residues are the equivalent to the APC Residues collected in a conventional mass burn incineration plant.

From the dry gas phase, the syngas is cooled by direct contact with scrubbing liquor in a condenser scrubber. The unit is used to drop the syngas temperature to about 35°C. The condenser operates as an acid scrubber, absorbing ammonia. The gases are passed through a second, alkaline, scrubber to remove acid gases – in particular sulphur dioxide and hydrogen sulphide. The syngas leaving the wet cleaning system is clean syngas ready for use in power generation. The effluent from this scrubber and the condensate from the condenser scrubber are discharged from the system for treatment and discharge to sewer as a trade effluent.

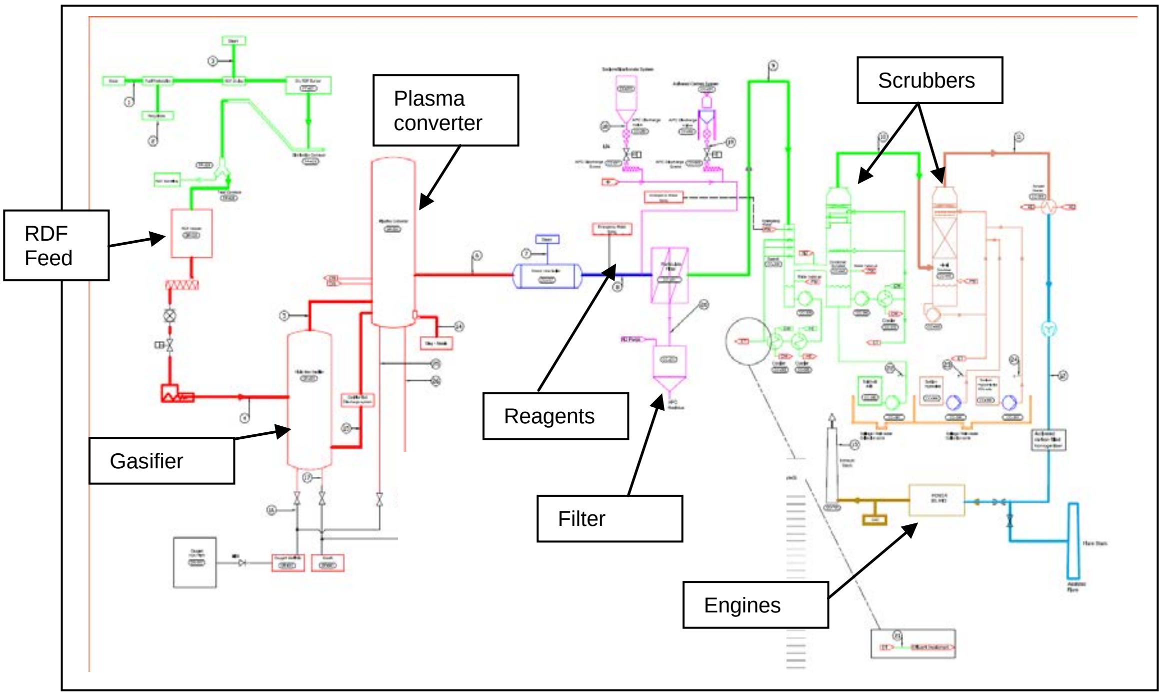
The gas engines are fed by the clean syngas from the gas production system generating electrical power from direct combustion of the clean syngas. There are two nominally 3.0 MWe output reciprocating gas engines with a thermal input rating of 8.5 MWth per engine. The exhaust gases from the engines pass through a system of emissions control catalysts which ensure that the emissions of nitrogen oxides and carbon monoxide comply with the IED. Heat is recovered from the engine exhaust system by an organic fluid for use in an Organic Rankine cycle to generate electricity. The exhaust gases from each engine pass through separate flues that are jointly housed in a single stack.

During start up and shutdown the combustion gas is diverted to a flare to ensure it is oxidised prior to release to atmosphere. The flare is supported by the use of natural gas. The flare also treats the clean syngas where it may not meet the required specification for the engines or the engines are unavailable to take the clean syngas. The flare is rated for the design output of the Gasplasma process and is used as a control during normal operation of the Gasplasma process.

The Gasplasma plant requires oxygen as a gasification medium, injected directly into the gasifier and a smaller stream into the plasma converter. The system uses nitrogen as a sealing gas around penetrations into the gasifier and plasma converter.

Process Flow Diagram

The process is illustrated in the following simplified flow diagram:



The key features of the Installation can be summarised in the following table:

Key Features		
Parameter	**Detail**	
Waste throughput, Tonnes/line	50,000 tpa waste 35,000 tpa dry RDF	12 tph waste
Number of lines	1	
Typical operating hours	16 h/day; 6 day/wk; 7446 h/annum (85% availability)	
Waste processed	MSW, CW	
Calorific value of waste	10.5 MJ/kg raw input; 15 MJ/kg as RDF	
IBA produced	Approximately 5,300 tpa as vitrified slag	
APCR produced	Approximately 1,200 tpa	
Metals recovered	Approximately 2,500 tpa	
Furnace technology	Plasma gasification	
Auxiliary Fuel	Natural Gas (for plant pre-heating, RTO and flare) (but see section 6.1.1 below) Diesel (for emergency generator)	
Acid gas abatement	Dry	Sodium bicarbonate
NOx abatement	SCR	Urea
Dioxin abatement	Activated carbon	
Reagent consumption (typical values)	Auxiliary Fuel (Diesel)) Urea Sodium bicarbonate Activated carbon Sulphuric (or nitric) acid Sodium hypochlorite Sodium hydroxide Process water	75 m^3/annum 40 tpa 225 tpa 62 tpa 250 tpa 675 tpa 105 tpa 13,500 tpa
Flue gas recirculation	No	
Stack	Height 40 m	Two flues of 0.8m diameter each, combined equivalent diameter 1.13m

Key Features		
Parameter	**Detail**	
Flue gas	Flow, 17.44 m^3/s (combined flow of both engines)	Velocity, 11.8 m/s
Electricity generated	3.0 MWe per engine (2 engines)	44,750 MWh/a total
	0.58 MWe from Organic Rankine cycle	4,320 MWh/a
Electricity exported	4.23 MWe	31,497 MWh/a
Steam exported	0 tonnes/hour	0 MWh
Steam conditions	Temperature, 184°C	Pressure 10 barg
Waste heat use	Waste heat will not be utilised on completion of the plasma gasifier build. The Applicant is exploring opportunities for the use of waste heat.	

4.1.4 Key Issues in the Determination

The key issues arising during this determination were the emissions to air and the impact on human health and we therefore describe how we determined these issues in most detail in this document.

4.2 The site and its protection

4.2.1 Site setting, layout and history

The site is centred at Grid Reference SP 10902 84192. Hay Hall Road lies to the north of the site with commercial units beyond. Kings Road lies to the east and the main Birmingham to London railway line and station (Tyseley Station) to the south / south-east. To the west of the Site is a lorry park.

The site has no watercourses within its Boundary. The main river catchments within the local area belong to the River Cole and Spark Brook. The site is located within Flood Zone 1 and is thus classified as being of low risk of fluvial flooding. The River Cole flows in a northwest direction approximately 145m to the northwest of the site. Spark Brook is a tributary of the River Cole and flows in a north east direction approximately 200m to the north west of the site. Spark Brook joins the River Cole approximately 700m to the north of the site. The Grand Union Canal is located approximately 130m to the north of the Site. Both the River Cole and Spark Brook pass beneath the canal to the north west of the Site.

The site is located within an existing industrial area that was established in the early 1900s. It has previously been used for a number of activities by multiple tenants such as wood pallet storage and recycling, materials storage and small office space. There is a permitted incinerator (Tyseley Incinerator) about 200m to the north of the site.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

Physical prevention measures	
Substance or scenario	**Prevention measures**
Water run off	The plant is constructed on hardstanding and constructed of materials resistant or impervious to the substances being handled.

Physical prevention measures	
Substance or scenario	**Prevention measures**
	All surfaces are designed to direct rain and storm water runoff to the surface water drainage system and to the public sewer via an interceptor. Any contaminated water arisings can be removed and tankered off site.
Storm waters	Storm water storage on site, of about 800 m^3 (400 m^3 in a tank and 400 m^3 within the rest of the drainage system), has been designed and sized to accommodate surface water flows after rain for events up to and including a 1 in 100 year flood event (+20% climate change event). This will allow controlled discharge to the public sewer and avoid localised flooding.
Flood risk	The site is located within the Environment Agency designated Flood Zone 1, which is outside the 1 in 1000 annual probability of river flooding. There is therefore a low probability of flooding and no specific flood defence measures are present or proposed. There are no recorded historical flooding incidents in this area.
Firewater	In the event of a fire, the surface water system is isolated and flow diverted to a FW pump station and tank. Retained water is discharged to the site drainage system if its quality is acceptable or removed by tanker if not. The capacity of the fire water retention system is the subject of a pre-operational condition (PO6)
Spills and leaks; loss of containment; transfer of substances; overfilling of vessels	All storage areas will be bunded and constructed from materials resistant or impervious to the substances contained. Bund capacity will be constructed to contain 110% capacity of the largest tank and 25% of the combined capacity of all the tanks in the bund whichever is the larger. Tanks and pipe-work containing potentially polluting liquids will be constructed so that any leaks / spills will be contained within a bund. In the event of a large spill the facility's drainage system will be sealed to prevent loss to the environment. The contents of the spill will be collected and removed by tanker.
Management controls	
Competent trained staff are used for handling, storage and transfer of materials. Materials are handled in contained areas to contain any spillages. Routine inspection of tanks, bunds and container vessels to check for damage and/or deterioration. Water arisings are harvested for use elsewhere in the plant. Spill kits are available to contain and collect small spillage. Condition 1.1.1 of the Permit requires that the scope of the management system shall include measures to minimise the risk of accidents and incidents using competent persons and resources. This includes an emergency action management plan which includes the handling of flood water arisings.	

We have assessed the management and physical measures described in the application and consider that the likelihood of incidents involving loss containment as low and that the overall risk to the local environment is not significant. We also consider that the proposed measures for contaminated firewater retention are sufficient to meet the requirements of the EID Article 46(5). We are satisfied that ground and ground water will be protected from the activities at the proposed installation.

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

The Applicant has submitted a site condition report which 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.

In respect of the protection of the soil and groundwater and the monitoring regime to demonstrate continued protection, pre-operational condition PO4 has been included in the Permit requiring the Operator to submit a written protocol to the Agency that shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The protocol shall be implemented in accordance with the written agreement from the Agency.

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 3.9 of the Operating Techniques part of the Application. Pre-operational condition PO1 requires the Operator to have an Environmental Management System in place before the Installation is operational, which would 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.

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

The incineration of waste is not a specified waste management activity (SWMA). The Environment Agency has considered whether any of the other activities taking place at the Installation are SWMAs and is satisfied that none is 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 (PO1) is included requiring the Operator to provide a summary of the EMS prior to commissioning of the plant and to make available for inspection all EMS documentation. The Environment Agency recognises that certification of the EMS cannot take place until the Installation is operational. An improvement condition (IC4) is included requiring the Operator to report progress towards gaining accreditation of its EMS.

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

4.3.3 Site security

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

4.3.4 Accident management

The Applicant has submitted an Accident Management Plan. Having considered the plan and other information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. An Accident Management Plan forms part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO1).

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
The Application	Section entitled Operational Techniques including a description of: ▪ plant capacity ▪ the waste feed cessation system ▪ start-up and shut-down ▪ derogation of temperature monitoring in the combustion chamber ▪ energy recovery from the installation ▪ temperature, oxygen, water vapour and pressure at Air Release sampling points ▪ continuous measurement of flow, pH and temperature at the discharge points to sewer Section entitled Environmental Risk Assessment including a description of: ▪ Odour management ▪ Noise management ▪ Fugitive emission management	These documents contain the information regarding the methods and measures used to operate the Installation
Additional information	Email #3 additional information item 12 regarding effluent treatment	
	Email #7 additional information: For incinerators, alternative arrangements for CO, TOC and dust monitoring to make use of the relevant abnormal operation condition during CEM failure	

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

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

Raw Material or Fuel	Specifications	Justification
Gas Oil – used to fuel back-up generator	< 0.1% sulphur content	As required by Sulphur Content of Liquid Fuels Regulations.

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

The waste fuel brought onto site is MSW and CW and is treated on site to remove undersize material (-15mm) and recyclables (specifically ferrous and non-ferrous metals).

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

- these wastes are categorised as municipal waste in the European Waste Catalogue or are non-hazardous wastes similar in character to municipal waste;
- the wastes are all categorised as non-hazardous in the European Waste Catalogue and are capable of being safely burnt at the Installation.
- these wastes are likely to be within the design calorific value (CV) range for the plant;
- these wastes are unlikely to contain harmful components that cannot be safely processed at the Installation.

The Installation will take residual waste, i.e. that which is not separately collected or otherwise recovered, recycled or composted. Waste codes for separately collected fractions of waste (with the exception of waste wood classified under EWC code 20 01 38) are not included in the list of permitted wastes, except that separately collected fractions which prove to be unsuitable for recovery may be included.

We have limited the capacity of the Installation to 50,000 tonnes per annum of untreated waste. This is based on the Installation operating 7446 hours per year at a nominal capacity of 12 tonnes per hour.

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

4.3.7 Energy efficiency

(i) Consideration of energy efficiency

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

1. The use of energy within, and generated by, the Installation which are normal aspects of all EPR determinations. This issue is dealt with in this section.
2. The extent to which the Installation meets the requirements of Article 44(b) of the IED, which requires that “the heat generated during the 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. These include:

- Producing an energy management policy
- Setting energy management performance targets to reduce parasitic loads; reduce and optimise maintenance and downtime; optimise of thermal processes and performance; continually explore opportunities to utilise heat off-site
- Using good maintenance and operating techniques to ensure efficient use of energy
- Selecting energy efficient equipment, building materials etc
- Training and educating staff on energy matters
- Metering of important energy consumers on site
- Recovering the energy in low pressure steam for drying RDF
- Recovering waste heat in the engine exhaust gases to generate more electricity in the Organic Rankine cycle equipment

The Application states that the specific energy consumption, a measure of total energy consumed per unit of waste processed, will be 502 kWh/t. Of this, about 155 kWh/t is consumed in respect of the feed preparation and ash vitrification. The Installation capacity is 50,000 tpa (of which 35,000 tpa feeds into the gasplasma process).

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

MSWI plant size range (tpa)	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

In the case of this Application, this is a very small plant in comparison with mass burn incinerators although the specific energy consumption is in line with that of the smaller plant size.

The BREF says that it is BAT to reduce the average installation electrical demand (excluding pretreatment and residues treatment) to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. In this case the LCV of the incoming (pretreated) waste is expected to be 10.5 MJ/kg and of the RDF (after treatment) is 15 MJ/kg.

Taking account of the difference in LCV, the specific energy consumption (excluding pretreatment and residues treatment) indicated in the Application is 347 kWh/t (ie 502 - 155 kWh/t) and is significantly higher than that indicated by the BREF. However, the BREF does not take account of the use of Plasma technology and the higher conversion efficiencies achieved. We agree that the higher SEC is compensated by the higher generation of electricity per tonne of waste processed.

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

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

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

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

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

The BREF says that where a plant generates electricity only, it is BAT to recover 0.4 – 0.65 MWh/t 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 tpa of waste (which equates to 0.4 – 0.72 MWh/t of waste).

The Installation will generate electricity only and has been specified to maximise electrical output with little or no use of waste heat. The revised Sankey diagram in section 3.5 of the Operational Techniques part of the Application shows 6.59 MW of electricity produced for an annual burn of 35,000 tonnes of dry waste, which represents 18.8 MW per 100,000 tpa of waste burned (1.40 MWh/t of waste burned). However not all of the electrical energy generated is being exported as the parasitic energy (the energy required to start up and keep the plant operating) is included in the generated figure. The adjusted net power output would be 4.23 MW, which represents 12.09 MW per 100,000 tonnes/yr of waste burned (0.90 MWh/t of waste). The Installation is therefore beyond the top end of the indicative BAT range, ie very efficient.

The SGN and the IED both require that, as well as maximising the primary use of heat to generate electricity, waste heat should be recovered as far as practicable, i.e. by identifying and utilising opportunities for Combined Heat and Power (CHP) and district heating. The Applicant has shown, by means of an energy balance, that of the sensible heat available for recovery after the electricity generation by the two syngas engines, a large proportion is used in the Organic Rankine Cycle to generate 0.58 MW of electricity (this contribution is included in the calculations above) and another proportion is used to heat feedwater and in the syngas generator. The remaining 1.52 MWth of sensible heat is available for export as steam. The Applicant has identified no local market for this energy but will review the situation on a continuous basis during the life of the plant.

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. There is provision within the design of the steam turbine to extract low-grade steam for a district heating scheme. Establishing a district heating network to supply local users would involve significant technical, financial and planning challenges such that this is not seen as a practicable proposition at present.

Our draft CHP guidance also states that opportunities to maximise the potential for heat recovery should be considered at the early planning stage, when sites are being identified for incineration facilities. In our role as a statutory consultee on the planning application, we ensured that the issue of energy utilisation was brought to the planning authority's attention.

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

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

The R1 calculation does not form part of the matters relevant to our determination. It is however a general indicator 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.

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) Permit conditions concerning energy efficiency

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

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

4.3.8 Efficient use of raw materials

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

The Operator is required to report with respect to raw material usage under condition 4.2 and Schedule 4, including consumption of oxygen, sodium bicarbonate, activated carbon and urea used per tonne of waste burned. This will enable the Environment Agency to assess whether there have been any changes in the efficiency of the air pollution control plant and the operation of the SCR to abate NOx. 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 4.2.2. 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 air pollution control residues and recovered metals. Another stream from the process is vitrified slag.

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree of burnout of the ash in the furnace, which results in a material that is both reduced in volume and in chemical reactivity. Most incinerator bottom ash (IBA) is likely to be classified as non-hazardous waste. However, in this facility the bottom ash stream is in the form of vitrified slag and satisfies end-of-waste criteria. This meaning that it is of a quality that de-classifies it as a waste. It is trademarked by the Operator under the name Plasmarok.

Air pollution control (APC) residues from the syngas treatment are hazardous waste and sent off site for disposal to a landfill site permitted to accept hazardous waste, or to an appropriately permitted facility for hazardous waste treatment.

In order to ensure that the vitrified slag and APC residues are adequately characterised, pre-operational condition PO2 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.6 requires the Operator to carry out an ongoing programme of monitoring.

The Application states that metal fractions will be recovered from the incoming MSW by the use of magnetic separation (for ferrous metals) and eddy current separation (for non-ferrous metals) and sent for recycling.

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

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

5. Minimising the Installation's environmental impact

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

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

This section of the 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 the 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. The Applicant has the choice to use either method.

5.1.2 Use of Air Dispersion Modelling

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

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

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

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

PCs are considered **Insignificant** if:

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

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

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

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

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

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

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

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

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

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

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in the revised (by Email #2 dated 07/01/14) Appendix B of the Air Quality Assessment part of the Environmental Risk Assessment of the Application. The assessment comprises:

- An H1 screening assessment of emissions to air from the operation of the incinerator
- Dispersion modelling of emissions to air from the operation of the incinerator
- A study of the impact of emissions on nearby sensitive conservation sites
- Dispersion modelling of odour impacts

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

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS 5 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at Birmingham Airport between 2004 and 2008 with the worst case year being 2008. This weather station was selected because of its proximity to the application site. The impact of the terrain surrounding the site upon plume dispersion was not considered in the dispersion modelling as a sensitivity test showed that its influence was negligible.

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:
  - o Oxides of nitrogen (NO_x), expressed as NO_2
  - o Particulate matter
  - o Carbon Monoxide (CO)
  - o Sulphur dioxide (SO_2)
  - o Hydrogen chloride (HCl)
  - o Hydrogen fluoride (HF)
  - o Metals (Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium)
  - o Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)
  - o 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

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

The Applicant has obtained background air quality data from the local authority monitoring stations and from Defra for metals and dioxins. This data is summarised in the Application and has been used by the Applicant to establish the background (or existing) air quality against which to measure the potential impact of the incinerator.

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 <u>Assessment of Air Dispersion Modelling Outputs</u>

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. Where a PC is indicated as being less than the relevant insignificance threshold, no further analysis of PEC has been carried out.

Predicted Long Term Impacts

Pollutant	EQS / EAL	PC ($\mu g/m^3$)	PC as % of EQS / EAL	Background Conc	PEC	PEC as % EQS / EAL
NO_2	40	0.6	1.5	32.7	33.3	83.25
PM_{10}	40	0.5	1.25	20.1	20.6	51.5
$PM_{2.5}$	25	0.5	2.00	14.1	14.6	58.4
TOC	5	0.1	2.0	0.37	0.47	9.4
HF	16	0.002	0.01	--	--	--
Cadmium	0.005	0.00052	10.4	0.00149	0.002	40.17
Mercury	0.25	0.00052	0.21	--	--	--
Antimony	5.0	0.00523	0.1	--	--	--
Arsenic	0.003	0.00058	19.4	0.00086	0.00144	48.0
Chromium	5.0	0.00523	0.1	--	--	--
Chromium VI	0.0002	0.401 E-6	0.2	--	--	--
Copper	10	0.04232	0.052	--	--	--
Lead	0.5	0.03744	2.09	0.03744	0.0427	17.07
Manganese	0.15	0.00974	3.49	0.00974	0.015	9.98
Nickel	0.02	0.00218	26.15	0.00218	0.0074	37.09
Vanadium	5.0	0.00094	0.1	--	--	--
PAH (BaP)	0.00025	--	--	--	--	--
Ammonia	180	0.07	0.04	--	--	--

Predicted Short Term Impacts

Pollutant	EQS / EAL	PC	PC as % of EQS / EAL	Background Conc (LTx2)	PEC	PEC as % EQS / EAL
NO_2	200	17.0	8.5	--	--	--
PM_{10}	50	2.2	4.4	--	--	--
SO_2 (15 min)	266	25.1	9.4	--	--	--
SO_2 (1 hr)	350	24.3	6.9	--	--	--
SO_2 (24 hr)	125	1.6	1.3	--	--	--
CO (8 hr)	10000	0.01	0.1	--	--	--
HCl (1 hr)	750	7.3	9.7	--	--	--
HF	160	0.5	0.3	--	--	--
Mercury	7.5	0.010	0.127	--	--	--
Antimony	150	0.095	0.063	--	--	--
Chromium	150	0.095	0.063	--	--	--
Copper	200	0.095	0.048	--	--	--
Manganese	1500	0.095	0.006	--	--	--
Vanadium	1	0.095	9.522	--	--	--
Ammonia	2500	--	--	--	--	--

(i) Screening out emissions which are insignificant

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

- In respect of long term impacts: HF, Hg, Sb, total Cr, CrVI, Cu and V
- All emissions giving rise to short term impacts

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.

- In respect of long term impacts: NO_2, PM_{10}, $PM_{2.5}$, TOC, Cd, As, Pb, Mn and Ni
- In respect of short term impacts: none applicable

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.

Thallium and Cobalt do not have an EAL. As shown below, the process contribution of these metals is similar to that of the other metals and we consider the emissions of these metals to be not significant.

Pollutant	EQS / EAL	Background Conc	PC (Long Term)	PC (Short Term)
Cobalt	None	None available	0.00523	0.095
Thallium	None	None available	0.00052	0.010

(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 <u>Consideration of key pollutants</u>

(i) Nitrogen dioxide (NO_2)

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

The above tables show that the peak long term PC is greater than 1% of the EUEQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EUEQS being exceeded. The peak short term PC is below the level we would consider insignificant (>10% of the EUEQS) and 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 limit value to be achieved by 2015, 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 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 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 below the level we would consider insignificant (>10% of the EUEQS) and it is not expected to result in the EUEQS being exceeded.

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

There is currently no emission limit prescribed nor any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition has been included (IC1) that will require a full analysis of particle size distribution in the flue gas, and hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions.

(iii) Acid gases, SO_2, HCl and HF

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

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

Emissions of SO_2 can also be screened out as insignificant in that the short term process contribution is also <10% of each of the three short term EUEQS values. Therefore, generally, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

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

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

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

The Applicant has used the EQS for benzene for their assessment of the impact of TOC. This is based on benzene having a low EQS in the range of organic species likely to be present in TOC (other than PAH, PCBs, dioxins and furans).

PAHs and dioxin-like PCBs: The Applicant has not assessed the emissions of PAHs or PCBs. This is because they claim that the gasplasma method of waste consumption completely destroys these substances and that there is no opportunity for the molecule to reform later in the process. This is new technology and there are no operating plants available to make comparative checks.

Elsewhere we have assessed the PAH impact of emissions from MWI. Data extracted from monitoring at a number of regulated sites between 2009 and 2011 (totalling 13 samples) for the PAH species Benzo[a]pyrene (BaP) results in a worst case predicted impact of substantially less than 1% of the EQS. We take the view that if these highly conservative checks result in an insignificant impact, the risk of exceedence is low. We therefore consider the risk is sufficiently low not to require the Applicant to provide their own predictions in this instance.

In any case, the Permit requires that a regime of monitoring for PAHs and dioxin-like PCBs is carried out during normal operation.

Dioxin: 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.

NH_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 SCR NOx abatement system. The Applicant did not assess the short term impact of ammonia, but taking into account the long term impact, we consider that there is unlikely to be a breach of the EAL.

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, NH3, 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 emission limits for metals along with the Application of BAT also ensures that these requirements are met.

Where Annex VI of the IED sets an aggregate limit, the Applicant's assessment assumes that 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 the metals not considered to be insignificant by this method of screening, where Annex VI of the IED sets an aggregate limit, the Applicant's assessment assumes that for cadmium and thallium each metal is emitted individually at half of the aggregate limit value and for the other metals that each metal is emitted as the proportion of metals in its group (i.e. one ninth of the limit for each of the group 3 metals). Historical data for Municipal Waste Incinerators indicates that 1/9th of the limit is an over estimate of actual emissions, and so we are satisfied that the Applicant's proposal is reasonable in this context.

For chromium, it was assumed that Cr(VI) would constitute 2.1% of the total release of this metal. This follows the approach in the Environment Agency's "Guidance to Applicants on Impact Assessment for Group 3 Metals Stack Releases – V.3 September 2012" At *http://www.environment-agency.gov.uk/static/documents/Business/Interim_Metals_Guidance.pdf*.

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

- On a short term basis: All metals.
- On a long term basis: Hg, Sb, total Cr, CrVI, Cu and V.

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

- On a long term basis: Cd, As, Pb, Mn and Ni

There were no metal emissions requiring further assessment. From this assessment the Applicant has concluded that exceedences of the EAL for all metals are not likely to occur. The Installation has been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document. The Environment Agency's experience of regulating incineration plant is that emissions of metals are in any event below the limits set in IED, and that the above assessment is an over prediction of the likely impact. We therefore agree with the Applicant's conclusions. Improvement condition IC5 has been included in the Permit to verify that the emissions of Cd, As, Pb, Mn and Ni are, in practice, unlikely to give rise to significant pollution.

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:

- The mean proportion of CrVI to total Cr is less than 1%. There are two outliers at 2%.
- The mean total Cr emission from these plants is 0.006 mg/m^3 (max 0.03 mg/m^3).
- The mean CrVI 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 CrVI emission concentration will be 0.401 x 10^{-9} mg/m^3.

There is little data available on the background levels of CrVI; so we have assumed this to be 20% of the total Cr background level, 20% is the typical value of CrVI in total Cr reported in the environment in the EPAQS Guidelines.

The Applicant has used the above data to model the predicted CrVI impact. The PC is predicted as 0.2% of the EAL which shows that the emissions of chromium VI are likely to be insignificant.

We agree with the Applicant's conclusions.

5.2.4 Impact on Air Quality Management Areas (AQMAs)

Birmingham City Council has declared an Air Quality Management Area (AQMA) with respect to oxides of nitrogen covering the whole of the city.

The long term and short term impacts of NOx are described in the tables in 5.2.1 above. Overall, whilst emissions cannot be screened out as insignificant, the Applicant's modelling shows that the Installation is unlikely to result in a breach of the EUEQS within the AQMA

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

5.3 Human health risk assessment

5.3.1 Our role in preventing harm to human health

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

i) Applying Statutory Controls

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

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

ii) Environmental Impact Assessment

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

iii) Expert Scientific Opinion

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

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

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

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

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

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

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

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

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

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

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

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

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

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

iv) Health Risk Models

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

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

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

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

In addition to an assessment of risk from dioxins 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 (NO2, SO2 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 NOx, SO2 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 would consult Public Health England, LHB (Wales), The Director of Public Health and FSA. We also consult the local communities who may raise health related issues. All issues raised by these consultations are considered in determining the application as described in Annex 4 of this document.

5.3.2 <u>Assessment of Intake of Dioxins and Furans</u>

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

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

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

Receptor	Maximum predicted intake (pg/kg bw/d)
Breast fed infant	0.16
Child resident	0.0014
Adult resident	0.0043
Farmer's child	0.020
Farmer	0.013

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

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

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

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

5.3.3 Particulates smaller than 2.5 microns

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

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

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

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

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

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

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

5.3.4 Assessment of Health Effects from the Installation

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

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

In carrying out air dispersion modelling as part of the H1 Environmental Impact assessment and comparing the predicted environmental concentrations with European and national air quality standards, the 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 HF, Hg, Sb, total Cr, CrVI, Cu and V have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions of NO_2, PM_{10}, $PM_{2.5}$, TOC, Cd, As, Pb, Mn and Ni have not been screened out as insignificant, the assessment still shows that the predicted environmental concentrations are well within air quality standards or environmental action levels.

The Environment Agency has reviewed the methodology employed by the Applicant to carry out the health impact assessment. 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 Director of Public Health were consulted on the Application and concluded that they had no significant concerns regarding the risk to the health of humans from the Installation. The Food Standards Agency was also consulted during the Permit determination process and it concluded that it is unlikely that there will be any unacceptable effects on the human food chain as a result of the operations at the Installation. Details of the responses provided by PHE, the Director of Public Health and FSA to the consultation on this Application can be found in Annex 2.

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

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

5.4.1 Sites Considered

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

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

The following non-statutory local wildlife and conservation sites are located within 2 km 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

5.4.2 Assessment of Non-Statutory Sites

The Applicant's assessment of non-statutory local wildlife and conservation sites was reviewed by the Environment Agency's technical specialists for modelling, air quality, conservation and ecology technical services.

Parameter	EAL (Ecology)	Process Contribution (PC)	PC as % of EAL (Ecology)
NH_3	1 (LT)	0.06	6
SO_2	20 (LT)	0.3	1.5
NOx	75 (ST)	9.3	12.4
	30 (LT)	1.1	3.7
HF	5 (ST)	0.05	1
	0.2 (LT)	0.03	0.15
Parameter	**Critical Load**	**Process Contribution (PC)**	**PC as % of CL**
Acid Deposition	5.23 keq/ha/yr	0.08 keq/ha/yr	1.5
Nutrient Nitrogen	10-20 kgN/ha/yr	0.6 kgN/ha/yr	6

Note 1 All the above concentration figures are in µg/m^3
Critical load figures units as shown

In the above table, the Applicant has demonstrated that the worst predicted impact on a non-statutory conservation site will not exceed the ecological EAL or critical load for any of the parameters. We therefore agree with the assessment's conclusions and consider that the proposal will not damage the special features of the sites.

5.5 Impact of abnormal operations

Article 50(4)(c) of IED requires that waste incineration and co-incineration plants shall operate an automatic system to prevent waste feed whenever any of the continuous emission monitors show that an emission limit value (ELV) is exceeded due to disturbances or failures of the purification devices.

Notwithstanding this, Article 46(6) allows for the continued incineration and co-incineration of waste under such conditions provided that this period does not (in any circumstances) exceed 4 hours uninterrupted continuous operation or the cumulative period of operation does not exceed 60 hours in a calendar year. This is a recognition that the emissions during transient states (e.g. start-up and shut-down) are higher than during steady-state operation, and the overall environmental impact of continued operation with a limited exceedance of an ELV may be less than that of a partial shut-down and re-start.

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

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.

The Applicant has stated that there is no data available on the emissions that might arise during abnormal operations as the facility represents the use of new technology for processing municipal and commercial waste. The levels of abnormal operation emissions are considered as being worst-case on the basis of the development of the Gasplasma process using data from the development facility and data and operational experience from the key relevant plant and equipment suppliers.

For this plant, the only scenario where abnormal operation arises as the result of abatement plant failure is when the SCR element (NOx abatement) of the process fails. SCR failure invokes a state of abnormal operation as it is required to abate NOx formed in the incineration process in the gas engines. The other abatement techniques (acid gas capture, particulates and heavy metal filtration, dioxin and mercury adsorption) are required to clean the syngas prior to incineration in the gas engines to protect the engines from being harmed by the contaminants in the syngas stream. In the event of one of the abatement techniques fails, the engines are required to shut down to prevent damage. As the contaminants are not formed as the result of the incineration process, this abatement failure does not invoke a state of abnormal operation. Additionally, in the event of abatement plant failure the uncleaned syngas is released to air via the flare stack to prevent untreated emissions to the environment.

In any case, the Applicant considers that the emissions are likely to be well below the IED limits in the majority of foreseeable ‘abnormal’ scenarios and therefore the data used for the normal air emissions assessment is also valid in assessing the impact during ‘abnormal’ operations. For those pollutants not specifically addressed below, the abnormal emissions will be no higher than the limits set for normal operation, thus meaning that the worst-case impacts have already been assessed. In making an assessment of abnormal operations the following worst case scenario has been assumed:

- NOx emissions of 500 mg/m^3 (1.25 x normal)
- Particulate emissions of 150 mg/m^3 (5 x normal)
- SO_2 emissions of 300 mg/m^3 (1.5 x normal)
- NH_3 emissions of 15 mg/m^3 (1.5 x normal)

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

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

Predicted Short Term Impacts under abnormal conditions

Pollutant	EQS / EAL	PC	PC as % of EQS / EAL	Background Conc (LTx2)	PEC	PEC as % EQS / EAL
NO_2 [1]	200	21.28	10.64	65.4	86.68	43.34
PM_{10} [2]	50	6.12	12.24	40.2	46.32	92.64
SO_2 (1 hr) [3]	350	36.48	10.42	9.36	45.84	13.10

Note [1] for NO_2 comparison with ST normal operation impact, the PC is based on 100^{th} percentile of 1 hour means.
Note [2] for PM_{10} comparison with ST normal operation impact, the PC is based on 90.4^{th} percentile of 24 hour means.
Note [3] for SO_2 comparison with ST normal operation impact, the PC is based on 100^{th} percentile of 1 hour means.

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: NO_2, PM_{10} and SO_2.

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 80% in the TDI reported in section 5.3.2. In these circumstances the TDI would be 0.0156 pg(I-TEQ)/kg-BW/day, for a farmer receptor, which is 0.78% of the COT TDI. At this level, emissions of dioxins will still not pose a risk to human health.

5.6 Other Emission Points

There are other emission points to air in addition to those associated with the gasplasma process. They are summarised in the following table, which also shows the parameters of concern:

Point source emissions to air (non-incineration plant)	
Emission point	**Parameter**
A1: Waste reception and fuel preparation area vent	Particulate matter
A2: RDF Drier exhaust air treatment (RTO)	Particulate matter, TOC, Odour
A3, A4: Local extraction	None specified
A5, A6: Oxygen and Nitrogen plant vents	None specified
A7: Flare	None specified
A9: Back-up steam boiler vent	None specified
A10: Emergency generator vent	None specified

A1: The waste reception and fuel preparation area vent is a local area exhaust which passes through a fabric filtration unit to capture particulate matter. The limits specified in the Permit are BAT for this type of abatement plant.

A2: The regenerative thermal oxidiser (RTO) is gas fired and is used to destroy odours and TOC that may arise in the drying operation. Particulate matter is removed from the gas stream by means of a fabric filtration unit. The limits specified in the Permit are BAT for this type of abatement plant.

A7: The flare is an emergency release point in the event the gas engines cannot operate but that supply of syngas to the engines cannot be stopped instantly. The flare is also required for start up and shut down operations when heat from the process is not available for gasifier operation. It is not anticipated to operate for more than 10% of the year, but there is a reporting condition to monitor the frequency and duration of flare operation.

A3, A4, A5, A6, A9, A10: there are no anticipated issues with emissions from these emission points.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

- The first issue we address is the fundamental choice of incineration technology. There are a number of alternatives, and the Applicant has explained why it has chosen one particular kind for this Installation.
- We then consider in particular, control measures for the emissions which were not screened out as insignificant in the previous section on minimising the Installation's environmental impact. They are: NO_2, PM_{10}, $PM_{2.5}$, TOC, Cd, As, Pb, Mn and Ni.

- We also have to consider the combustion efficiency and energy utilisation of different design options for the Installation, which are relevant considerations in the determination of BAT for the Installation, including the Global Warming Potential of the different options.
- Finally, the prevention and minimisation of Persistent Organic Pollutants (POPs) must be considered, as we explain below.

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

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

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

6.1.1 Consideration of Furnace Type

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

The Waste Incineration BREF elaborates the furnace selection criteria as:

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

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

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

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

Comparison of thermal treatment technologies

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
Moving grate (air-cooled)	Low to medium heat values (LCV 5 – 16.5 GJ/t); Municipal and other heterogeneous solid wastes; Can accept a proportion of sewage sludge and/or medical waste with municipal waste; Applied at most modern MSW installations	1 to 50 t/h with most projects 5 to 30 t/h. Most industrial applications not below 2.5 or 3 t/h.	Widely proven at large scales; Robust; Low maintenance cost; Long operational history; Can take heterogeneous wastes without special preparation.	Generally not suited to powders, liquids or materials that melt through the grate.	TOC 0.5 % to 3 %	High capacity reduces specific cost per tonne of waste
Moving grate (liquid cooled)	Same as air-cooled grates except: LCV 10 – 20 GJ/t	Same as air-cooled grates	As air-cooled grates but: higher heat value waste treatable; better combustion control possible.	As air-cooled grates but: risk of grate damaging leaks and higher complexity	TOC 0.5 % to 3 %	Slightly higher capital cost than air-cooled
Rotary Kiln	Can accept liquids and pastes. Solid feeds more limited than grate (owing to refractory damage) often applied to hazardous wastes	<10 t/h	Very well proven with broad range of wastes and good burn out even of HW	Throughputs lower than grates	TOC <3 %	Higher specific cost due to reduced capacity
Fluid bed - bubbling	Only finely divided consistent wastes. Limited use for raw MSW often applied to	1 to 10 t/h	Good mixing; Fly ashes of good leaching quality	Careful operation required to avoid clogging bed;	TOC <3 %	FGT cost may be lower; Costs of

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
	sludges			Higher fly ash quantities.		waste preparation
Fluid bed - circulating	Only finely divided consistent wastes; Limited use for raw MSW, often applied to sludges / RDF.	1 to 20 t/h most used above 10 t/h	Greater fuel flexibility than BFB Fly ashes of good leaching quality	Cyclone required to conserve bed material; Higher fly ash quantities	TOC <3 %	FGT cost may be lower. Costs of preparation
Oscillating furnace	MSW / heterogeneous wastes	1 – 10 t/h	Robust; Low maintenance; Long history; Low NOX level; Low LOI of bottom ash	Higher thermal loss than with grate furnace; LCV under 15 G/t	TOC 0.5 – 3 %	Similar to other technologi es
Pulsed hearth	Only higher CV waste (LCV >20 GJ/t) mainly used for clinical wastes	<7 t/h	Can deal with liquids and powders	bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Stepped and static hearths	Only higher CV waste (LCV >20 GJ/t); Mainly used for clinical wastes	No information	Can deal with liquids and powders	Bed agitation may be lower	Dependent on waste type	Higher specific cost due to reduced capacity
Spreader – stoker combustor	RDF and other particle feeds, poultry manure, wood wastes	No information	simple grate construction; less sensitive to particle size than FB	Only for well defined mono-streams	No information	No information
Gasification - fixed bed	mixed plastic wastes; other similar consistent streams; gasification less widely used/proven than incineration	1 to 20 t/h	Low leaching residue; good burnout if oxygen blown; syngas available; Reduced oxidation of recyclable metals	Limited waste feed; not full combustion; high skill level; tar in raw gas; less widely proven	Low leaching bottom ash; good burnout with oxygen	High operation / maintenan ce costs
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/ maintenan ce 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	~ 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	limited wastes; process control and engineering critical; high skill req. not widely proven;	Dependent on process temperature; Residue produced requires further	High pre-treatment, operation and capital costs

Technique	Key waste characteristics and suitability	Throughput per line	Advantages	Disadvantages / Limitations of use	Bottom Ash Quality	Cost
	than incineration		possible; syngas available	need market for syngas	processing, sometimes combustion	

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

- Fixed stepped hearth;
- Moving grate;
- Pulsed hearth;
- Rotary kiln;
- Fluidised bed;
- Gasification; and
- Pyrolysis.

The Waste Incineration BREF provides a comparison of combustion and thermal treatment technologies and factors affecting their applicability and operational suitability used in the EU and for all types of wastes In general, fixed and pulsed hearth, and rotary kilns have not been used for this type of waste stream in the UK and have more commonly been used for the treatment of hazardous and clinical wastes. The most common and established incineration technology in the UK for treating the types of wastes to be processed at the TURC facility is moving grate technology. However there are several advanced thermal treatment technologies under various stages of development and commercial demonstration which utilise pyrolysis and/or gasification. Some of these include the use of fluidised bed technology as part of the thermal process.

Whilst less well demonstrated than moving grate, these technologies are seen as potentially being able deliver advanced operational performance by way of improved levels of emissions, energy recovery, and their modularity to achieve commercial operation at smaller scales than has been generally common with incineration.

Whilst a number of these plants rely on steam cycle for energy production, one of the recognised key benefits and objectives of advanced thermal technology is to produce a user gas which can be used directly in gas turbines or reciprocating engines to maximise power production, which for gasification BREF states as being BAT. The TURC facility will utilise the Gasplasma process comprising a fluidised bed gasifier combined with a plasma convertor. The combination of these two units produces a valuable user syngas with a CV typically in the range of 8 to 10 MJ/kg, which following cleaning can be used to directly fuel high efficiency gas engines or turbines to generate electricity.

The Applicant has proposed to use a technology comprising the Gasplasma process which is a proprietary process to the Operator, to process the delivery of two primary outputs:

- A syngas of the quality to be used directly as fuel directly in a reciprocating gas engine; and,

- Vitrification of the resulting ash to produce a product, that is not classified as a waste, for use in industry.

The Applicant proposes that the new technology is BAT by consideration of the aspects described prior to the thermal technology comparison table, above:

Consideration	BAT: Justification
Nature/physical state of the waste and its variability	BAT: front end is processed prior to gas plasma treatment to produce RDF. Treatment involves removal for recycle, metals, plastics, glass; shredding and drying using heat generated later in the process.
Proposed plant throughput	BAT: gas plasma process treats 35,000 tpa; usually too low a throughput for mass burn technologies
Preference and experience of chosen technology including plant availability	Limited experience; this plant will demonstrate effectiveness of technology
Nature and quantity/quality of residues produce.	BAT: About 10-15% of the input waste will become vitrified, inert and recyclable aggregate. This is not a waste material having met end-of-waste criteria. This will have extremely low leaching properties and any heavy metal contaminants will be locked into the material and will not leach. About 2-4% of the input waste will end up as APCR
Emissions to air – usually NOx	BAT: SCR will be used to capture NOx emissions. The engine exhaust system is fitted with an oxidation catalyst to control CO and TOC emissions.
Energy consumption	BAT: Although energy is required for the plasma process the process is more efficient than other technologies and there is more energy exported than others technologies of similar size.
Need for further processing of residues to comply with TOC	BAT: No further processing is required.
Costs	BAT: competitive at scale proposed.

In consideration of the key issues above, the Gasplasma process can be seen to compare favourably against the technology types considered. Whilst the technology would not score well in terms of operational experience in comparison to traditional moving grate, the technology represents new advanced thermal treatment with a number of operational advantages, and this facility represents is the first of its type in the UK. As such the technology selected for the facility can therefore be considered as achieving BAT.

Although this is emerging technology and there is limited experience of its performance, we agree that the technology appears to represent BAT for the incineration of waste. Proposed abatement techniques are in accordance with our guidance. Emission levels are predicted to comply with IED requirements and the environmental impacts are not likely to cause significant harm to the environment.

Auxiliary burners

It is the nature of the gasplasma process, where the syngas produced at the gasifier is combusted in a gas engine, that an auxiliary burner for the purposes of complying with IED conditions is not required. In a mass burn incinerator auxiliary burners are required to ensure temperatures in the combustion chamber do not fall below a minimum level. In a gas engine this cannot happen – when ignition is lost, the operation ceases to function. The gasifier is not the combustion chamber and its temperature control is not required as a condition of the IED. If the gasifier temperature falls syngas generation ceases there are no releases to atmosphere and there are no environmental implications.

The Applicant proposes to use gas as support fuel for gasifier start-up, shut down, flare operation and the regenerative thermal oxidiser (RTO) for the destruction of odours. The choice of support fuel is based on its availability.

Derogation from Operational Parameters

Paragraphs 4.31 to 4.36 of the DEFRA EPR WID Guidance (version 3.1) describe the requirements for derogation of the combustion chamber temperature (minimum 850^{O}C) and residence time (minimum 2 seconds) requirements of Article 50(2) of the IED.

The gas engines are incapable themselves of delivering this residence time, due to the nature of engine operation. This is common to all gasification processes which employ gas turbines or engines to combust the syngas produced. The combustion takes place at very high temperatures over very short periods of time. Therefore derogation of the requirements of Article 50(2) is authorised under Article 51(1) of the IED.

There is no derogation for TOC emission levels; other emission limits, specified under IED, are not compromised; residues are not produced in greater quantities or lower quality as the result of the derogation for temperature and residence time.

6.1.2 Boiler Design

The gas cooling system comprises a heat recovery boiler designed to reduce syngas temperatures from about 1,200°C to 160°C and generate saturated steam at 10 bar(g) pressure. The basis of the design is a water tube boiler using proven techniques employed in the energy from waste industry with specific attention given to the materials of construction to ensure long service life and to minimise the likely down time caused by fouling and corrosion. The steam generated is used in the Gasplasma process and for drying and not for the generation of electricity.

As the hot gases passing through boiler undergo cleaning *after* the boiler, to enable them to be used safely in the gas engines, confirmation of certain design criteria for the avoidance of de-novo dioxin formation is not required.

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

6.2 BAT and emissions control

The prime function of flue gas treatment is to reduce the concentration of pollutants in the exhaust gas as far as practicable. In this case this is being achieved by minimising the level of pollutants in the syngas - prior to combustion and release of flue gas. 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

Note: Particulates abatement is required to clean the syngas prior to incineration in the gas engines to protect the engines from being harmed by the contaminants in the syngas stream. As particulate matter is prevented from entering the gas engines, there are no particulate emissions from the engines to the environment.

Comparison of particulate matter abatement techniques

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	Max temp 250°C	Multiple compartments; Bag burst detectors	Most plants

Particulate matter				
	5mg/m^3			
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 three levels of particulate abatement to clean the syngas prior to combustion in the gas engines:

- The primary control is the plasma converter where particulates are captured in the molten slag pool to form the vitrified slag known by the trade name Plasmarok and then removed from the syngas stream.
- The secondary control is particulate capture in a ceramic filtration unit. Fabric filters are unsuitable for this duty because of the high temperature of the gas at this stage.
- The tertiary and final control is the wet scrubbing stage which will remove any residual particulate that may have passed through the earlier stages.

Emissions of particulate matter have been previously assessed as insignificant for short term impacts (section 5.2.1 above). Although the long term impact is marginally above the threshold of insignificance, emissions of particulate matter in respect of long term impacts cannot be screened out as insignificant. The Environment Agency has therefore considered whether other available techniques should be considered:

- Electrostatic Precipitators – this technique is not BAT by itself, but can be used in combination with bag filters to reduce the energy consumption of the induced draft fan, which might be overall beneficial.

In this case, it is not considered that the alternate technique offers any advantage in comparison with the Applicant’s preferred option of ceramic filters and wet scrubbing and so agrees that the Applicant’s proposed technique is BAT for the Installation.

6.2.2 Oxides of Nitrogen

Comparison of nitrogen oxide abatement techniques

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

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

The Applicant proposes to implement the following primary measures:

- The syngas generating process operates using oxygen and steam rather than air, which minimises the potential to for NOx in the syngas, prior to it being combusted in the gas engines.

- Primary NOx control measures, which are normally applied to standard incineration processes are not applicable to gas engines (which is the main combustion device). The gas engines have a sophisticated control system to enable them to run with a relatively lean fuel mixture, which supports low NOx generation from the gas engine.

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

SCR can reduce NOx 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 NOx levels to between 150 and 180 mg/m^3, it relies on an optimum temperature of around 900^{o}C and sufficient retention time for reduction. SNCR is more likely to have higher levels of ammonia slip. The technique can be applied to all plant unless lower NOx releases are required for local environmental protection. Urea or ammonia can be used as the reagent with either technique, urea is somewhat easier to handle than ammonia and has a wider operating temperature window, but tends to result in higher emissions of N_2O. Either reagent is BAT, and the use of one over the other is not normally significant in environmental terms.

The Applicant proposes to use SCR with urea as the reagent. Although this entails higher equipment and operating costs the Applicant considers this to be acceptable as:

- The plant is located in an Air Quality Management Area (for NOx)
- SCR has a better NOx abatement capability
- Urea has lower handling and storage hazards than ammonia.

Emissions of NOx have been previously assessed as insignificant for short term impacts (section 5.2.1 above). Although the long term impact is marginally above the threshold of insignificance, emissions of NOx in respect of long term impacts cannot be screened out as insignificant. The Environment Agency considers that SCR is BAT for the Installation for the reasons given above.

The amount of urea used for NOx abatement will need to be optimised to maximise NOx reduction and minimise NH_3 slip. Improvement condition IC2 requires the Operator to report to the Environment Agency on optimising the performance of the NOx abatement system. The Operator is also required to monitor and report on NH_3 and N_2O emissions every 6 months.

6.2.3 Acid Gases, SO_x, HCl and HF

Note: Acid gas abatement is required to clean the syngas prior to incineration in the gas engines to protect the engines from being harmed by the contaminants in the syngas stream. As acid gases are prevented from entering the gas engines, there are no emissions from the engines to the environment.

Comparison of acid gas abatement techniques

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 Type: Lime	Very good removal rates; Low leaching solid residue; Temperature of reaction well suited to use with bag filters	Corrosive material; May give greater residue volume if no in-plant recycle	Wide range of uses	MWIs, CWIs
Reagent Type:	Good removal rates;	Efficient temperature range may be at upper	Not proven at large plant	CWIs

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Sodium Bicarbonate	Easiest to handle; Dry recycle systems proven	end for use with bag filters; Leachable solid residues; Bicarbonate more expensive		

The Applicant proposes to implement the following primary measures of acid gas abatement to clean the syngas prior to is combustion in the gas engines:

- Use of low sulphur fuels for start up and auxiliary burners – gas should be used if available, where fuel oil is used, this will be low sulphur (i.e. <0.1%), this will reduce SOx at source. The Applicant has justified its choice of gas as the support fuel on the basis of its availability 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.

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 use two more levels of control: injection of sodium bicarbonate followed by wet alkaline scrubbing:

- The first level of control, dry sodium bicarbonate injection, was chosen because at the temperature at the injection point (150 – 180^oC) this material has a more efficient acid gas removal capability than lime. After injection and sufficient time to allow reaction, the solids in the gas stream are collected in the ceramic filter and collected as APC residues.
- The second level, wet alkaline scrubbing using sodium hydroxide and sodium hypochlorite, cleans the gases of residual SO_2 and hydrogen sulphide (H_2S) that may have passed through the first level. H_2S is not captured by sodium bicarbonate and needs to be removed to protect the engines and meet SO_2 limits. Being an alkaline solution it will also capture any residual acids within the syngas that have passed uncaptured by the dry scrubbing phase. This however is very much a consequence of its nature and not its primary function.

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**
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)

Note: Dioxin and furan abatement is required to clean the syngas prior to incineration in the gas engines to protect the engines from being harmed by the contaminants in the syngas stream. As dioxins and furans are prevented from entering the gas engines, there are no emissions from the engines to the environment.

Comparison of dioxin and furan abatement techniques

Dioxins and furans				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN**
Optimise combustion control	All measures will increase oxidation of these species.		Covered in section on furnace selection	All plants
Avoid *de novo* synthesis			Covered in boiler design	All plant
Effective Particulate matter removal			Covered in section on particulate matter	All plant

Dioxins and furans				
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 Applicant proposes to implement the following measures to clean the syngas of dioxins and furans prior to combustion in the gas engines:

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

In this case the Applicant proposes separate feed.

As part of the gas engine exhaust control, the gases pass through an SCR (discussed elsewhere) and an oxidation catalyst. The oxidation catalyst primary function is to oxidise CO but it has a secondary function of destroying any dioxins and furans that may remain in the exhaust gas stream.

We are satisfied their proposals are BAT.

Optimisation of combustion control has not been considered here. As discussed in section 6.1.1 above, we have given a derogation of the temperature and residence time requirements of IED.

6.2.6 Metals

Note: Heavy metals abatement is required to clean the syngas prior to incineration in the gas engines to protect the engines from being harmed by the contaminants in the syngas stream. As heavy metals are prevented from entering the gas engines, there are no emissions from the engines to the environment.

Comparison of metals abatement techniques

Metals				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Effective Particulate matter removal			Covered in section on particulate matter	All plant
Activated Carbon	Can be combined with	Combined feed rate usually		All plant; Separate feed

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

The following describes the provisions made by the Applicant for the abatement of heavy metals in preparation for the syngas feed to the gas engines.

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

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

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

6.3 BAT and global warming potential

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

The principal greenhouse gas emitted is CO_2, but the plant also emits small amounts of N_2O arising from the operation of secondary NOx 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 NOx 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.

Parameter	GWP (tonnes CO2 equivalent per annum)	
	Released	**Saving/offset**
Direct CO_2 emissions (auxiliary fuel)	592	---
Direct CO_2 emissions (imported electricity)	166	---
CO_2 emissions from the process	35,292	---
N_2O from the process (urea method)	589	---
Total released	**36,639**	---
Energy recovered (electricity)	---	12,548
Energy recovered (heat)	---	0
Total offset	---	**12,548**
Net GWP	**24,091**	---

Taking this into account, the net emissions of CO_2 from the installation are estimated at 24,091 tonnes per annum. At this level emissions cannot be characterised as insignificant. The Installation is not subject to the Greenhouse Gas Emissions Trading Scheme Regulations 2003; therefore it is a requirement of IED to investigate how emissions of greenhouse gases emitted from the Installation might be prevented or minimised.

The Applicant has considered GWP as part of its BAT options appraisal. There are a number of areas in which a difference can be made to the GWP of the Installation. 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. Taking all these factors into account, the Operator's assessment shows their preferred option is best in terms of GWP. The Environment Agency agrees with this assessment and that the chosen option is BAT for the Installation.

6.4 BAT and POPs

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

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

The unintentionally-produced POPs addressed by the Convention are:

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

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

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

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

The 1998 Protocol to the Convention recommended that unintentionally produced should be controlled by imposing emission limits (eg 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°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°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 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. EPR requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be specified for monitoring and reporting purposes, to enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. We require 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 the Environmental Permitting Guidance on the IED. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

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

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

Pentachlorobenzene (PeCB) is another of the POPs list to be considered under incineration. PeCB has been used as a fungicide or flame retardant, there is no data available however on production, recent or past, outside the UN-ECE region. PeCBs can be emitted from the same sources as for 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

Only clean uncontaminated surface water runoff from buildings and hardstanding will be discharged off site through a single surface water discharge point (SW1), via the internal drainage system and an oil interceptor and into the 225mm diameter public surface water sewer to the north of the site. This discharges into the River Cole to the northwest of the site. There will be some rainwater harvesting for use in flushing WC's in the office and staff welfare accommodation.

In the event of a large spill, the facility's drainage will be sealed in order to contain any contaminants on site. The contents of the spill will then be pumped into a tanker and removed off site to an appropriately authorised facility. The drainage infrastructure will then be thoroughly cleaned prior to any site run-off being discharged to surface waters.

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

6.5.2 Emissions to sewer

The primary discharge to sewer (Emission Point FW1) will be process effluent discharges from the facility, which will arise via the proposed effluent treatment plant (ETP). The ETP will receive all process effluent from the following key process areas:

- Syngas quench system
- Syngas acid and alkali wet scrubbers
- Boiler feed water preparation plant reject
- Syngas cooling boiler blown down
- Gasplasma plant cooling system blow down
- Fuel preparation plant wash down water
- Gas engine power island

The effluent treatment plant will comprise of a holding tank to enable pH control and temperature correction and where solids will be allowed to settle and removed for offsite disposal at an appropriately regulated facility.

Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and /or minimise emissions to 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 contaminated water of Article 46(5) must be arranged.

The Applicant employs a number of measures to minimise fugitive emissions at the site that include:

- All vehicles delivering or removing wastes and other materials are covered.
- Main activities associated with the storage, and fuel preparation process take place within the confines of a building.
- The main waste reception building is kept under negative pressure to prevent the escape of dust and odours through the use of an extraction system.
- The access doors of the waste reception hall are fast activating roller doors.
- APC handling is enclosed and discharged through silos to a sealed tanker.
- Site management procedures, which include spill kits, are in place for good housekeeping and vehicle loading procedures
- Regular inspections / maintenance of equipment will be undertaken to ensure optimum operational conditions are maintained.
- Level detection will be provided for storage tanks to prevent overfilling.
- All chemicals in tanks/storage to have appropriately designed bunds/containment.
- Appropriately impervious and drained surfaces are used for chemical, oil and waste storage.
- Any moisture within the incoming fuel is collected to a sump for discharge to foul sewer
- The building is designed to ensure containment of firewater.

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 Applicant employs a number of measures to prevent and minimise odour emissions at the site that include, in addition to the measures describes above for fugitive emission prevention:

- Each waste type and potential odour risk rating are considered within the Odour Management Plan.
- Particularly odorous waste is immediately processed as a priority.
- The waste storage and fuel preparation areas are kept under negative pressure to prevent the escape of odours through the use of an extraction system. The extracted air is exhausted to atmosphere through a bag filter and a carbon filter to minimise odour emissions. The abatement system has been designed and sized to accommodate the anticipated volume of air to be treated, prior to discharge into the atmosphere.
- Air from the fuel drying plant will be treated in a Regenerative Thermal Oxidiser to destroy odours prior to discharge through a bag filter.
- Alternative temporary odour controls will be employed if necessary such as sprays and masking agents.

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 Applicant employs a number of measures to prevent and minimise noise and vibration at the site that include:

- During the selection process for procurement and of new equipment and plant, due consideration will be given to the minimisation of noise from operational plant. All new Plant and equipment will meet all legislation and statutory guidance on noise levels.
- A full Noise Impact Assessment has been undertaken to fully determine the operational impact of noise from the proposed Facility on nearby sensitive noise receptors.
- All relevant plant equipment is fitted with appropriate sound attenuation and acoustic insulation, and is subject to regular inspection and maintenance schedules to maintain operational performances.
- Any plant vibration issues will be resolved during the plant commissioning period and will be controlled under the plant preventative maintenance schedules.
- Vehicle movements into and out of the site during operational phase and other external activities only take place during the normal working day opening hours.
- Vehicles are subject to regular maintenance and service schedules. All roadways and car park surfaces are smooth with no significant undulations and with non-squeal surfaces. Reversing alarms have been selected on noise emission grounds and where possible, the broadband type used.

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.

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. Prior to the Application being made, the Applicant was unable to carry out the noise survey at a small number of preferred locations because access had been restricted and this resulted in an incomplete noise impact assessment. The Applicant was required to complete the survey and assessment and a series of emails listed in section 2.3 of this document describes the outcome of the additional survey and assessment.

The techniques for the two parts of the survey and assessment were the same: measurements were taken of the prevailing ambient noise levels to produce a baseline noise survey and the assessment was carried out in accordance with BS4142 to compare the predicted plant rating noise levels with the established background levels. Our audit and check modelling agrees with the Applicant that the noise emissions from the proposed facility are unlikely to give rise to noise complaints.

Pre-operational condition PO5 has been included in the Permit requiring the Operator to design, for approval by the Environment Agency, a comprehensive noise and vibration survey for implementation after plant commissioning. Condition 3.3.1 and Table S3.4 require that the survey as designed and approved is carried out.

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 emissions 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

Although there are a few substances that do not have insignificant impact on the local environment (section 5.2.1 above), we consider that they are unlikely to give rise to significant pollution locally.

(ii) National and European EQSs

There are no additional National and European EQSs that need to be considered other than the limits in the IED to protect the local environment.

(iii) Global Warming

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

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

(iv) Commissioning

The proposed Installation will undergo a period of commissioning before the plant becomes fully operational. The IED and the conditions set out in the Permit cover activities at the Installation once the plant is fully operational destroying waste and providing electricity to the grid. Before commissioning the Operator shall submit a commissioning plan (required under pre-operational condition PO3) to the Agency for approval outlining the expected emissions during different stages of commissioning, the expected duration and timeline for completion of activities and any necessary action to protect the environment in the event that actual emissions exceed expected emissions in accordance with the approved commissioning plan.

It is recognised that certain information provided in the application is based upon design data or data from similarly designed operational plant. The commissioning stage provides an early opportunity to verify much of this information and the following points will be verified by the Applicant:

- development of procedures to demonstrate process control of expected emissions under different operating conditions (required under IC2);
- plant operation conforms to conditions set out in the Permit (required under IC2);

- abatement plant optimisation (required under IC2);
- calibration of CEMs equipment (required under IC3);

6.6.2 Emissions not subject to Chapter IV of IED:

A1 (waste reception area) and A2 (drier exhaust): These emission points are protected by fabric filters with particulate ELVs. Our guidance indicates an ELV of 5 mg/m^3 is appropriate for fabric filter abatement techniques however the Operator based his abatement design on the *Common Waste Water and Waste Gas Treatment* BRef which indicates an achievable ELV of <10 mg/m^3. On the basis of the impact of particulate matter assessed as being nearly insignificant for an emission of 10 mg/m^3, we have set particulates emission limits at 10 mg/m^3.

A2 (drier exhaust): this point has an ELV for TOC set at 20 mg/m^3, the same limit as the incinerator stack gas emission.

A3, A4 (local exhausts), A5 (oxygen), A6 (nitrogen plant vents), A9 boiler vent) and A10 (emergency generator vent): no limits are set for these emission points as the emissions are not pollutants or are to enable work place comfort.

A7 (flare): this device is not anticipated to operate for many hours each year and the impact of any combustion products is considered negligible. There is an operational monitoring requirement so that the frequency and overall duration of operation can be monitored.

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 of the Permit 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 SCR system; to deliver the EPR requirement that dioxin-like PCBs and PAHs should be monitored and to deliver the requirements of Chapter IV of IED for monitoring of residues and temperature in the combustion chamber.

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

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

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

The Operator is providing a CEM for each of the two stacks that are the emission points (A8a and A8b) for the gas engines. The Operator will not provide back-up CEMs to work in parallel to the operating CEMs. In the event that one or both of the on-line CEMs fails, condition 2.3.9 of the Permit requires that the abnormal operating conditions apply for the affected stacks. In practice this means that, as soon as is practicable, waste shall cease to be gasified in the affected gasifier.

6.7.3 Continuous emissions monitoring for dioxins and mercury

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

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

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

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

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

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

6.8 Reporting

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

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

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

In determining the Application we have considered the following documents:

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The decision of the Birmingham City Council to grant planning permission on 4 December 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.

From our 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 <u>Schedule 9 to the EPR 2010 – **Waste Framework Directive**</u>

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:

- the types and quantities of waste that may be treated;
- for each type of operation permitted, the technical and any other requirements relevant to the site concerned;
- the safety and precautionary measures to be taken;
- the method to be used for each type of operation;
- such monitoring and control operations as may be necessary;
- 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 public consultation on the original application. The way in which this has been done is set out in Section 2 above. A summary of the responses received to our consultations and our consideration of them is set out in Annex 4 below.

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 2 km 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 is no SSSI which could be affected by the Installation and we concluded that the Installation will not damage the special features of any SSSI.

7.2.5 **Natural Environment and Rural Communities Act 2006**

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

7.3 National secondary legislation

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

We have assessed the Application in accordance with guidance agreed jointly with Natural England / CCW and concluded that there will be no likely significant effect on any European Site. There is no Habitat which could be affected by the Installation and there was no consultation with Natural England.

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 EU legislation

None applies

7.5 Other relevant legal requirements

7.5.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 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.	Condition 3.3.1 and Tables S3.1, S3.1(a), S3.2, S3.3
45(1)(d)	The Permit shall include the requirements for pH, temperature and flow of waste water discharges.	Not applicable
45(1)(e)	The Permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Condition 3.3.1 and Tables S3.1, S3.1(a), S3.2, S3.3, S3.4 and S3.5; also compliance with Articles 46 and 48
45(1)(f)	The Permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.6 to 2.3.10
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(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/m^3), CO and TOC not to be exceeded during this period.	Conditions 2.3.9, 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/m^3), CO and TOC not to be exceeded during this period.	Conditions 2.3.9, 2.3.10, and Table S3.1(a)
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Conditions 3.3.3, 3.3.5 and tables S3.1, S3.1(a), S3.2 and S3.4; Schedule 6 details this standardisation requirement.
48(2)	Installation and functioning of the	Improvement Condition 3 (IC3);

IED Article	Requirement	Delivered by
	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 3.3.3, and tables S3.1, S3.1(a), and S3.5
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 S3.2
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.	Schedules 4 and 5
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Condition 3.3.1 and Table S3.6 (although N/A as in this facility this is not a waste.)
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Derogation for these conditions authorised – see 6.1.1 above
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.	Not required for situation where gas engines used for energy recovery
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Derogation for these conditions authorised – see 6.1.1 above
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Derogation for these conditions authorised – see 6.1.1 above
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.	The plant will generate electricity for export to the Grid. There is currently insufficient surplus heat for use elsewhere as steam.
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 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 met.	Derogation for these conditions authorised – see 6.1.1 above
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)	Derogation for these conditions authorised – see 6.1.1 above

IED Article	Requirement	Delivered by
	and (3).	
52(1)	Take all necessary precautions concerning delivery and reception of wastes, to prevent or minimise pollution.	Conditions 2.3.1, 2.3.3, 3.2, 3.4 and 3.5
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Section 4.1 of the operational techniques part of the application describes procedures for the reception and monitoring of incoming waste
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Conditions 3.3.1 and 1.4.1
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	Conditions 1.4.1, 2.3.1 and 3.2.1
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.3.1 and pre-operational condition PO2
55(1)	Application, decision and Permit to be publicly available.	Section 2 of the decision document
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Condition 4.2.2; Schedule 4

ANNEX 2: Pre-Operational Conditions

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

Reference	Pre-operational measures
PO1	Prior to the commencement of commissioning, the Operator shall submit a 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* (EPR1.00). 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 submit to the Environment Agency for approval a protocol for the sampling and testing of the vitrified slag for the purposes of assessing its hazard status. Sampling and testing shall be carried out in accordance with the protocol as approved.
PO3	Prior to the commencement of commissioning the Operator shall provide a written commissioning plan for approval by the Agency. The plan shall include: • the expected emissions to the environment during the different stages of commissioning, • the expected durations of commissioning activities and estimated timeline for completion • the actions to be taken to protect the environment and report to the Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.
PO4	Prior to the commencement of commissioning the Operator shall submit the written protocol referenced in condition 3.1.4 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 protocol shall be implemented in accordance with the written agreement from the Agency.
PO5	Prior to the commencement of commissioning the Operator shall provide the Environment Agency with a written report for approval describing the detailed programme of noise and vibration monitoring that will be carried out at the site at the commissioning stage and also when the plant is fully operational as proposed in the Application. The report shall include confirmation of locations, time, frequency and methods of monitoring. The monitoring programme shall be carried out in accordance with the Environment Agency's written approval.
PO6	Prior to the commencement of commissioning the Operator shall provide the Environment Agency with a written report for approval describing the detail of the fire water retention system – its capacity and the design criteria for such capacity.

ANNEX 3: Improvement Conditions

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

Reference	Improvement measure	Completion date
IC1	The Operator shall carry out a programme of tests, in accordance with a method to be agreed with the Environment Agency, to determine the size distribution of the particulate matter in the exhaust gas emissions to air from emission points A8a and A8b, identifying the fractions within the PM_{10} and $PM_{2.5}$ ranges. The programme shall conclude with the submission of a report on the results.	Programme to commence within 6 months of the completion of commissioning and be completed within 6 months of this date.
IC2	The Operator shall submit a written post-commissioning report to the Environment Agency which shall include: • a review of performance of the facility during the commissioning phase against the conditions of this Permit. • details of optimisation of acid gas, dioxin and mercury emission abatement systems including reagent dosing rates. • details of optimisation of the NOx emission abatement system; how the Selective Catalytic Reduction (SCR) system and combustion settings are controlled to optimise NH_3, NOx and N_2O emissions. • details of procedures developed during commissioning for achieving and demonstrating satisfactory process control and covering the range of designed operating rates.	Within 6 months of the completion of commissioning.
IC3	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. • A full summary evidence compliance report	• Within 4 months of the completion of commissioning. • Within 18 months of completion of commissioning
IC4	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 accreditation of the system by an external body or if appropriate submit a schedule by which the EMS will be subject to accreditation.	Within 15 months of the completion of commissioning.

IC5	The Operator shall carry out an assessment of the impact of emissions to air of Cd, As, Pb, Mn and Ni. The assessment shall predict the impact of the metal against the relevant EQS/EAL through the use of emissions monitoring data obtained during the first year of operation and air dispersion modelling. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work. A report of the assessment shall be made to the Environment Agency.	Within 15 months of the commencement of operations

ANNEX 4: Consultation Reponses

Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website from 10 January 2014 to 7 February 2014. Copies of the Application were placed in the Environment Agency's Public Register at Sentinel House, 9 Wellington Crescent, Fradley Park, Lichfield, WS13 8RR and the Birmingham City Council Public Register at 581 Tyburn Road, Erdington, Birmingham, B24 9RX.

The following statutory and non-statutory bodies were consulted:

- Birmingham City Council Environmental Health
- Birmingham City Council Planning Authority
- Food Standards Agency
- Health and Safety Executive
- Public Health England
- Director of Public Health
- Severn Trent Limited (Sewerage Undertaker)

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Public Health England; 04/02/14 and 06/02/14	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
Based on the information provided PHE has no significant concerns regarding risk to health of the local population.	No action required
PHE recommended that further consideration is given to the implementation of additional fire prevention measures to minimise the public health impacts in the event of a fire incident.	Applicant requested to confirm quality of fire prevention precautions taken in design of plant. They responded that they had sought advice from specialist consultants. We are satisfied that this meets the recommendation of PHE.
PHE provided their Position Statement regarding emissions from MWI and their view that the risk of adverse health impacts from modern well managed incinerators is very low.	No action required

Response Received from Severn Trent Water Limited; 07/02/14	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
STW confirms there is a discharge to sewer for which a discharge consent will be required. As there had been no discharges made to date, they had no comment to make on the quality of discharges.	No action required

The following bodies did not respond to our invitation to comment on the Application:

- Birmingham City Council Environmental Health
- Birmingham City Council Planning Authority
- Food Standards Agency
- Health and Safety Executive
- Director of Public Health

2) <u>Consultation Responses from Members of the Public and Community Organisations</u>

a) <u>Representations from Local MP, Councillors and Parish / Town / Councils</u>

No representations were received.

b) <u>Representations from Community and Other Organisations</u>

No representations were received.

c) <u>Representations from Individual Members of the Public</u>

No representations were received.