Determination of an Application for a Substantial Variation to an Environmental permit under the Environmental permitting (England & Wales) Regulations 2010

Decision document recording our decision-making process

The permit Number is: EPR/CP3737CV

The Applicant / Operator is:	Thames Gateway Waste to Energy Limited
The Installation is located at:	London Sustainable Industries Park Choats Road Dagenham Essex RM9 6LF

What this document is about

This is a decision document, which accompanies a Variation and consolidated permit.

It explains how we have considered the Applicant's application, and why we have included the specific conditions in the consolidated 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/CP3737CV/V003. We refer to the application as "the **Application**" in this document in order to be consistent.

The number we have given to the consolidated permit is EPR/CP3737CV.

The Application was duly made on 18/03/2015.

The Applicant is Thames Gateway Waste to Energy Limited. We refer to Thames Gateway Waste to Energy Limited as "the **Operator**" in this document because this is an application to vary a permit that has already been granted.

The proposed facility is located on a brownfield site within an Air Quality Management Area at the London Sustainable Industries Park (LSIP) development, Dagenham and is centred on National Grid Reference TQ 4834 8289. We refer to this as "the **Installation**" in this document.

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Glossary of acronyms used in this document

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

AAD	Ambient Air Directive (2008/50/EC)
APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BREF	BAT Reference Note
CEM	Continuous emissions monitor
CFD	Computerised fluid dynamics
CHP	Combined heat and power
COMEAP	Committee on the Medical Effects of Air Pollutants
CROW	Countryside and rights of way Act 2000
CV	Calorific value
CW	Clinical waste
CWI	Clinical waste incinerator
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
EAL	Environmental assessment level
EIAD	Environmental Impact Assessment Directive (85/337/EEC)
ELV	Emission limit value
EMAS	EU Eco Management and Audit Scheme
EMS	Environmental Management System
EPR	Environmental permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended
EQS	Environmental quality standard
EU-EQS	European Union Environmental Quality Standard
EWC	European waste catalogue
FSA	Food Standards Agency
GLA	Greater London Authority
GWP	Global Warming Potential
HHRAP	Human Health Risk Assessment Protocol
HMIP	Her Majesty's Inspectorate of Pollution
HPA	Health Protection Agency (now PHE – Public Health England)

HRA	Human Rights Act 1998
HW	Hazardous waste
HWI	Hazardous waste incinerator
IBA	Incinerator Bottom Ash
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
I-TEF	Toxic Equivalent Factors set out in Annex VI Part 2 of IED
I-TEQ	Toxic Equivalent Quotient calculated using I-TEF
LADPH	Local Authority Director(s) of Public Health
LCPD	Large Combustion Plant Directive (2001/80/EC) – now superseded by IED
LCV	Lower calorific value – also termed net calorific value
LfD	Landfill Directive (1999/31/EC)
LOI	Loss on Ignition
LSIP	London Sustainable Industries Park
MBT	Mechanical biological treatment
MSW	Municipal Solid Waste
MWI	Municipal waste incinerator
NGR	National Grid Reference
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
Opra	Operator Performance Risk Appraisal
PAH	Polycyclic aromatic hydrocarbons
PC	Process Contribution
PCB	Polychlorinated biphenyls
PEC	Predicted Environmental Concentration
PHE	Public Health England
POP(s)	Persistent organic pollutant(s)
PPS	Public participation statement
PR	Public register
PXDD	Poly-halogenated di-benzo-p-dioxins
PXB	Poly-halogenated biphenyls
PXDF	Poly-halogenated di-benzo furans
RDF	Refuse derived fuel
RGS	Regulatory Guidance Series

SAC	Special Area of Conservation
SED	Solvent Emissions Directive (1999/13/EC) – now superseded by IED
SCR	Selective catalytic reduction
SGN	Sector guidance note
SHPI(s)	Site(s) of High Public Interest
SNCR	Selective non-catalytic reduction
SPA(s)	Special Protection Area(s)
SS	Sewage sludge
SSSI(s)	Site(s) of Special Scientific Interest
SWMA	Specified waste management activity
TDI	Tolerable daily intake
TGW2E	Thames Gateway Waste to Energy Limited
TEF	Toxic Equivalent Factors
TGN	Technical guidance note
TOC	Total Organic Carbon
UHV	Upper heating value –also termed gross calorific value
UN_ECE	United Nations Environmental Commission for Europe
US EPA	United States Environmental Protection Agency
WFD	Waste Framework Directive (2008/98/EC)
WHO	World Health Organisation
WID	Waste Incineration Directive (2000/76/EC) – now superseded by IED

1 Our decision

We have decided to grant the Variation to the Operator. This will allow it to operate the Installation, subject to the conditions in the Consolidated permit.

We consider that, in reaching that decision, we have taken into account all relevant considerations and legal requirements and that the consolidated 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 Consolidated 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 consolidated 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 18/03/2015. 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.

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

2.2 Consultation on the Application

We carried out consultation on the Application in accordance with the EPR, our statutory PPS and our own RGS Note 6 for Determinations involving Sites of High Public Interest. We consider that this process satisfies, and frequently goes beyond the requirements of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, which are directly incorporated into the IED, which applies to the Installation and the Application. We have also taken into account our obligations under the Local Democracy, Economic Development and Construction Act 2009 (particularly Section 23). This requires us, where

we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of representatives of interested persons in the exercise of our functions, by providing them with information, consulting them or involving them in any other way. In this case, our consultation already satisfies the Act's requirements.

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

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

Apollo Court
2 Bishops Square Business Park
St. Albans Road West
Hatfield
Herts
AL10 9EX

Anyone wishing to see these documents could do so and arrange for copies to be made.

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

London Borough of Barking & Dagenham (Environmental Protection)
London Borough of Barking & Dagenham (Planning)
London Fire Brigade - Barking & Dagenham
Director of Public Health - London Borough of Barking & Dagenham
NHS- Barking & Dagenham
Foods Standards Agency
Health & Safety Executive
Public Health England
Thames Water (Sewerage Undertaker)

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

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

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it, and issued an information notice on 25/06/2015. A copy of the information notice was placed on our public register as was the response when received.

[In addition to our information notice, we received additional information during the determination from the operator on 14/07/2015 and 22/07/2015. We made a copy of this information available to the public in the same way as the responses to our information notice.]

3 The legal framework

The Variation Notice and consolidated permit will be granted under Regulation 20 of the EPR. The Environmental permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

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

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

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

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

- Section 5.1 Part A(1)(b) – incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity of 3 tonnes or more per hour. Prior to the Variation, the Installation carried out an activity listed in Part 1 of Schedule 1 to the EPR as Section 5.1 Part A(1)(a) which was the incineration of hazardous waste in an incineration plant.

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, such as air pollution control plant, (including storage and preparation of treatment chemicals), and the ash storage bunker, are therefore included in the listed activity description.

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

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

4.1.2 The Site

The Installation is located on a brownfield site within an Air Quality Management Area at the London Sustainable Industries Park (LSIP) development, Dagenham and is centred on NGR: TQ 4834 8289.

There are no European Sites within 10 kilometres of the Installation. There are no Sites of Special Scientific Interest (SSSI’s) within 2 kilometres. There are 2 Local Nature Reserves (LNR) within 2 kilometres, the nearest of which is Scrattons Ecopark and Extension, approximately 370 metres to the northwest of the site. There are also 15 Local Wildlife Sites (LWS) within 2 kilometres of the site. The nearest of these is Goresbrook and the ship and shovel sewer, 66 metres to the north of the boundary. There are a number of industrial sites within 400 metres of the Installation, the nearest of which is 100 metres to the southeast. The nearest residential property is 350 metres to the northwest.

The Operator 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 consolidated Permit, and the Operator is required to carry on the permitted activities within the site boundary.

4.1.3 What the Installation does

The Operator has described the facility as Waste to Energy. Our view is that for the purposes of IED (in particular Chapter IV) and EPR, the Installation is a waste incineration plant because, notwithstanding the fact that energy will be recovered from the process, the process is never the less 'incineration' because it is considered that its main purpose is the thermal treatment of waste.

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

This application is for a variation to the permit to enable:

- a change in gasification technology from Cyclamax's SBOS technology to Chinook Sciences RODECS® technology

- an increase in the tonnage of waste processed from 120,000 tonnes /year to 180,000 tonnes / year

- a change to the waste to be processed to remove hazardous and clinical wastes from the list of acceptable wastes.

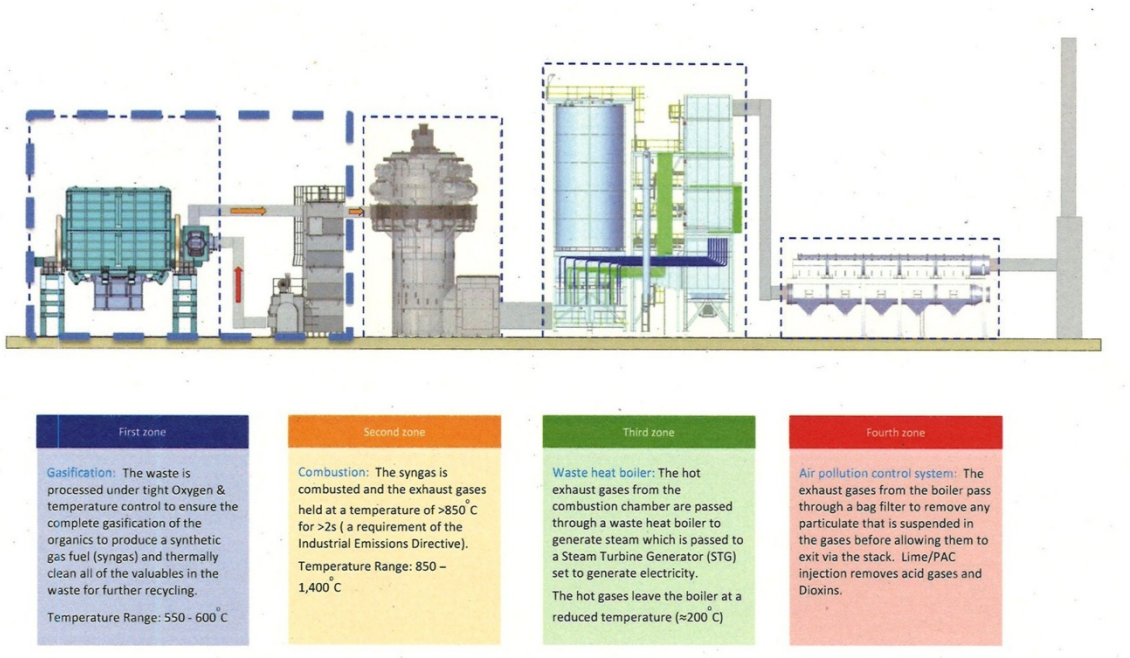
The proposed technology involves the treatment of waste at controlled temperatures, under a non-oxidative atmosphere which enables the organic content of the waste to be degraded and transformed into gaseous components known as synthetic gas or 'syngas'. A solid residue is also produced, which remains in the processing bin. The initial heat source is provided by a natural gas burner housed within the combustion chamber.
The basic stages of the previous Cyclamax SBOS technology, and the Chinook RODECS® technology are exactly the same in that they will involve the following stages:

- Gasification of the feedstock to produce syngas
- Combustion of the syngas in a secondary combustion chamber
- Utilisation of the heat generated through a waste heat boiler in order to generate steam
- Use of this steam in a steam turbine to generate electricity with a small amount of the electricity generated used for the Installation itself and the remainder exported to the grid.

However, the Operator considers the RODECS technology differs from the previous Cyclamax SBOS technology in that it is able to separate each of the above stages into distinct units making the overall process more efficient and less prone to downtime.

Details of the principal activities undertaken at the Installation are summarised below.

Process Overview



Receipt of residual wastes at the Installation

The Installation will treat residual commercial and industrial (C&I) waste only. No waste will be accepted at the Installation unless suitable pre-acceptance details have been provided. All pre-acceptance details will be assessed to confirm the acceptability against the permitted EWC codes and other permit conditions. All waste accepted at the Installation must be pre-booked for delivery prior to arrival at the site.

Un-processed material will be delivered to site by HGV. On entering the site, all vehicles will pass over the weighbridge. Each vehicle will be weighed. Duty of Care paperwork for each load will be delivered to the weighbridge office. The vehicles will then proceed to the waste reception area and discharge their load via the back-end tipping facility incorporated within each truck. Once emptied, the trucks will exit the site via an out-feed weighbridge. Unladen vehicle weight on exit will be used to record the mass of waste deposited.

Storage of waste at the Installation

The maximum quantity of waste for treatment to be stored at the Installation will be 1,980 tonnes. All incoming waste will be stored in the reception building. This storage capacity represents approximately 3.5 days input based on 7,500 hours operation/year. Wastes will not be stored for a period of greater than seven days from the day of receipt.

General commercial and industrial wastes will be offloaded in the waste reception area and inspected for compliance with permit conditions; any bulky or non-conforming wastes will be removed at this time and placed in a dedicated quarantine area pending removal. Front-end loaders will push/mix the un-processed material against a wall ready for transfer to the RODECS® processing bin. This material will then be fed, using a grabber system, into a RODECS® bin. The RODECS® bin will be positioned in the filling area using an automated trolley car system combined with bin location stands.

Shredding of waste (if required)

A mobile shredder will be available in the reception area for exceptional, permitted bulky waste items such as mattresses or large pieces of wood, which have been pre-booked for acceptance.

Raw materials storage and handling

A list of the raw and auxiliary materials to be used in the Installation is provided in Appendix 21 of the supporting document. Drawing 040-A62 identifies where these materials will be stored within the Installation boundary.

Gasification of waste at the Installation

The Installation will use a batch gasification process called the RODECS® system. There will be two process lines, each with a design capacity of 90,000 tonnes/year. Because the system is a batch process, pre-mixing of wastes is not considered necessary.

Each process line comprises a RODECS processor, combustion chamber, waste heat boiler, steam turbine and air pollution control system and discharge. The use of 2 process lines with dedicated air pollution control, allows the process to continue at 50% capacity should one line need to be shut down. Each processing bin is fitted with a natural gas fired Thermal Reactor to supply the primary heat for the gasification process.

A 100m^3 volume bin, which is an integral part of the gasifier system, will be filled with waste to a target weight of approximately 24 tonnes per batch. The bins will be filled to a measured weight using a weigh scale located on the bin stands. Should the waste in the bin be of a density lower than 300 kg/m^3, the waste will be pressed in the bin and more loaded into it until the weight reaches the target weight. The filled bin is located on a movable trolley car designed to hold two bins. The trolley will then move the freshly filled feed bin towards the RODECS® processor immediately next to the position in which the processed bin is removed. The processed bin will then be unlatched from the RODECS® processor, and the trolley moved into a position such that the fresh feed bin is in place to be latched to the RODECS® processor. After the fresh bin has been attached, the RODECS® will then rotate 180 degrees so that the bin will be at the top of the RODECS® and inverted, starting the process cycle. Changing bins takes approximately three minutes.

The energy-containing materials in the feed are converted into a synthesis gas or syngas consisting primarily of Carbon Monoxide (CO), Hydrogen (H_2),

Carbon Dioxide (CO_2), Methane (CH_4), Water (H_2O) and Nitrogen (N_2) from the controlled air fed into the process. The temperature inside the gasifier (550-600°C) is maintained below the melting temperatures of the metals to be recovered. The rate at which the batch is heated is determined by the process chamber movement, volume of gases and temperature of the recycled hot gases sent to the RODECS® processor from the Thermal Reactor chamber. The preheated gases provide sensible heat required for heating and enhance the rate of production of the syngas in the RODECS® processor. The remaining material, metal, glass, dirt and sand are mechanically retained inside the RODECS® processing chamber. At the end of the batch processing, the RODECS® will be rotated such that the bin is back at the bottom with the inert materials falling back into the bin for removal. The bin will be unlatched and the contents taken to the process material separation area, after which the separated materials will be taken to the process material storage area.

The total cycle time will be approximately 120 minutes for a 24 tonnes batch. The time required reaching threshold syngas production is expected to be in the region of 25 minutes. The cool down time before unlatching the bin where the average syngas production rate has declined below the threshold value to the complete depletion of syngas is expected to take 10 to 15 minutes. The bin will only un-latched after full depletion of the syngas.

The syngas produced in the gasifier passes to a dedicated natural gas fired combustion chamber where it is combusted. The exhaust gases will be held at a temperature of 900^{o}C for more than 2 seconds. The exhaust gases pass through a single pass boiler for the generation of steam.

Energy generation at the Installation

The gasification plant is provided with a steam turbine package, designed to utilise the superheated steam from the boiler to generate (in the first instance), electrical power for export to the local distribution network. Steam turbine power is optimised by condensing the steam in an air cooled condenser (ACC) after it leaves the last stage of the turbine. The entire volume of steam is condensed and recirculated to the boiler,

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Flue gas treatment at the Installation

Flue Gas Recirculation (FGR) is employed as a primary NOx control measure and is supported by Selective Non Catalytic Reduction (SNCR) using ammonia solution as a secondary measure.

Acid gases will be removed from the flue gas by injection of hydrated lime using a dry system. The hydrated lime and reaction products are subsequently collected at the Air Pollution Control (APC) device, using bag filters.

Powdered Activated Carbon (PAC) is used for the removal of dioxins/ furans and metals of low melting points, which include mercury, cadmium and lead. The PAC and reaction products are subsequently collected at the Air Pollution Control (APC) device, using bag filters. The relatively low primary gasification

temperature means that most metals are not volatilised to a large extent, which will lead to relatively low metal concentrations in the syngas and flue gas.

Waste production and handling

The principal residue streams arising from the Installation are from the RODECS® processing bin and air pollution control residues. Bin residues comprise metals, aggregates and glass. These will be subjected to conventional separation processes (e.g. trommels/screens, magnetic and eddy current separation) to segregate the residue into ferrous and non-ferrous metals and aggregates/glass before being taken off site for further processing and recovery. The APC residue will be subject to an initial detailed analysis during commissioning (in accordance with Article 53 of IED) to identify its chemical composition, followed by periodic testing of key contaminants (total soluble fraction and heavy metals soluble fraction) for monitoring purposes. APC residue is designated for disposal at landfill unless an alternative use is identified.

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

Waste throughput, Tonnes/line	90,000 tonnes/annum	12.00 tonnes/hour
Waste processed	Residual Commercial and Industrial Waste	
Number of lines	2	
Furnace technology	Gasification	
Auxiliary Fuel	Natural Gas	
Acid gas abatement	Dry	hydrated lime
NOx abatement	SNCR	Ammonia
Reagent consumption	Auxiliary Fuel 16.99million m^3/annum Ammonia(25%) : 3,100 te/annum Lime (Hydrated) : 1,932 te/annum Activated carbon: 57 te/annum Process water: 20,920 m^3/annum	
Flue gas recirculation	Yes	
Dioxin abatement	Activated carbon	
Stack	NGR 548484 182905	
	Height, 55.0m	Diameter, 1.10 m
Flue gas	Flow,28.4 Am^3/s	Velocity, 30.0m/s
	Temperature 150°C	
Electricity generated	19.60MWe	147,000MWh
Electricity exported	15.17MWe	113,775MWh

Comparison of the key features of the proposal with the original application is given in the Table below:

Parameter	Cyclamax system	Chinook system
Assumed feedstock processed (tonnes/year)	120,000	180,000
Assumed Calorific Value (MJ/kg)*	16.90	10.47
Annual Availability (hours)	8,000	7,500
Total Power Generated (total MWh)	136,000	147,000
Total Power Generated (MWe per hour)	17.0	19.6
Power Consumed (total MWh)	22,800	33,195
Net Power Exported to Grid (total MWh)	113,200	113,805
Net Power Exported to Grid (MWe per hour)	14.20	15.17
Residue Sent to Landfill (tonnes/year)	7,200	Note1 4,809
Recovery of Metal Contained in Feedstock?	No	Yes
Tonnes of carbon dioxide reduced (net figure)	46,000	Note2 146,177

Notes.

1. Assumes all material remaining in the RODECs processing bins after processing will be recycled. As such, the only material to landfill will be the APC Residue.
2. This figure is based on direct emissions of CO_2 to atmosphere from the stack minus landfill gas avoidance (assuming material is 50% biodegradable) minus grid electricity displacement minus avoidance of replacing metals through primary smelting.

4.1.4 Key Issues in the Determination

The key issues arising during this determination were the major differences between the original and proposed technologies and the impacts of emissions on the environment from the proposed Installation. 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 largely rectangular in shape and slopes gently from the Northwest to the Southeast from a maximum elevation of approximately 1.6m to 1.35m above Ordnance Survey Datum (AOD). The Site is bounded to the West and North by Gores Brook, which flows from North to South towards the nearby River Thames, over 600m to the South of the Site boundary.

The site has been developed from green field status, in late part of the 19th Century, to its current unoccupied status. Since 1920 it has had various uses; sewerage treatment works; railway sidings; and storage depots (oil and coal). More recently, it was used as a set down for storage of plant and materials for the Channel Tunnel Rail Link and, with the exception of a utilities cabinet, all major features and structures associated with the former uses have now been removed.

The land is currently derelict vacant land and is generally covered by hard standing and hard-core with localised areas of tarmacadam and concrete with patches of overgrown vegetation. There are multiple pylons situated across

the site with an existing building situated along the southern perimeter of the site boundary.

Based on survey data the geological sequence can be summarised as:

“Alluvium, River Terrace Gravels, Lambeth Group, Thanet Sand and Chalk Formation.”

The made ground has been remediated to remove the presence of previous industrial use and there is no evidence to suggest that the perched groundwater in the made ground is hydraulically connected to deeper hydro geological environment.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The proposed Installation will be a newly constructed facility with a sealed drainage system to reduce the risk of contamination to underlying soils and groundwater. There is no significant risk of pollution occurring from normal operations at the site if the plant is built as designed. The pre-operational condition PO3 will be used to confirm that the sealed drainage system is satisfactory.

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

The Operator 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.

4.2.3 Closure and decommissioning

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place for the closure and decommissioning of the Installation, as referred to in section 2.11 of the supporting document of the Application. Pre-operational condition PO1 requires the Operator to have an Environmental Management System in place before the Installation is operational, and this will include a site closure plan.

At the definitive cessation of activities, the Operator has to satisfy us that the necessary measures have been taken so that the site ceases to pose a risk to soil or groundwater, taking into accounts both the baseline conditions and the site’s current or approved future use. To do this, the Operator will apply to us

for surrender of the consolidated permit, which we will not grant unless and until we are satisfied that these requirements have been met.

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Operator is the sole Operator of the Installation.

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

We are satisfied that the Operator'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 Operator has stated in the Application that they will implement an Environmental Management System (EMS) that will be certified under ISO14001 or EMAS. 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 (IC1) is included requiring the Operator to report progress towards gaining accreditation of its EMS.

We are satisfied that appropriate management systems and management structures will be in place for this Installation, and that sufficient resources are available to the Operator to ensure compliance with all the Consolidated 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 Operator has submitted a draft Accident Management Plan as Appendix 6 of the Application. Having considered the Plan and other information submitted in the Application, we are not fully satisfied the draft fully reflects the technology and layout changes and that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. An Accident Management Plan will form part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO1).

4.3.5 Off-site conditions

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

4.3.6 Operating techniques

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

Description	**Parts Included**	**Justification**
The Application	The responses to questions in Section 3 of Part C3.	The responses include descriptions relating to operating techniques
Response to Schedule 5 Notice dated 19/06/2015	Responses to questions 1-10 inclusive	
Additional information received 14/07/2015	Response to request for information dated 14/07/2015 detailing APC dosing arrangements	Details on the addition of lime and PAC
Additional information received 22/07/2015	Response to request for information dated 20/07/2015 detailing process controls to ensure syngas production is fully depleted.	Controls are designed to be 'fail-safe' and ensure the bins cannot be physically nor inadvertently 'unlatched' until it is safe to do so.

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 Consolidated permit through permit condition 2.3.1 and Table S1.2 in the Consolidated 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
Diesel	< 0.1% sulphur content	As required by Sulphur Content of Liquid Fuels Regulations.

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

Appendix 1 of the application states that low Calorific Value (CV) high moisture wastes will not be treated as the Installation is designed to maximise energy generation. The Operator described how incoming wastes shall be assessed for moisture content and how the results shall be applied to determine the acceptance of waste categories in response to a Schedule 5 Notice dated 19/06/2015. Because a number of waste descriptions in the application were likely to be high moisture wastes, the same Schedule 5 Notice required the Operator to review the proposed waste types submitted in Appendix 7 of the Application and explain the reasons for the inclusion of the following:

Waste code	Description
02 01 01	sludges from washing and cleaning
02 03 01	sludges from washing, cleaning, peeling, centrifuging and separation
05 01 10	sludges from on site effluent treatment other than those mentioned in 05 01 09
07 02 12	sludges from on site effluent treatment other than those mentioned in 07 02 11
07 03 12	sludges from on site effluent treatment other than those mentioned in 07 03 11
07 04 12	Sludges from on site effluent treatment other than those mentioned in 07 04 11
07 05 12	sludges from on site effluent treatment other than those mentioned in 07 05 11
07 06 12	sludges from on site effluent treatment other than those mentioned in 07 06 11
07 07 12	sludges from on site effluent treatment other than those mentioned in 07 07 11
08 01 14	sludges from paint or varnish other than those mentioned in 08 01 13
08 03 15	ink sludges other than those mentioned in 08 03 14
08 04 12	adhesive and sealant sludges other than those mentioned in 08 04 11
12 01 15	machining sludges other than those mentioned in 12 01 14
16 01 07	oil filters
19 02 06	sludges from physico/chemical treatment other than those mentioned in 19 02 05
19 06 04	digestate from anaerobic treatment of municipal waste
19 06 06	digestate from anaerobic treatment of animal and vegetable waste
19 11 06	sludges from on site effluent treatment other than those mentioned in 19 11 05

Note: Waste code 16 01 07 is a hazardous waste code included in the original permit issued

The operator submitted an amended list of wastes in a response to the Schedule 5 Notice dated 25/06/2015.

The approach taken by the Operator in developing the list of proposed waste types for treatment was merely to remove hazardous / clinical waste codes from the list already approved by the Environment Agency under the original application. However, having reviewed the list further, the Operator has concluded that there is no need to include those wastes listed above. To that end, a revised list of proposed waste types has been prepared, which excludes those wastes given above, as well as 03 03 05 (de-inking sludges from paper recycling) and 03 03 10 (fibre rejects, fibre-, filler-, and coating sludges). The revised list of wastes, submitted as an amended Appendix 7 identifies the following:

Table S2.2 Permitted Non-Hazardous Residual Commercial & Industrial waste	
The maximum quantity of waste to be disposed is 180,000 tonnes per annum	
Waste code	**Description**
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING**
02 01	**wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 03	plant-tissue waste
02 01 04	waste plastics (except packaging)
02 01 07	wastes from forestry
02 01 09	agrochemical waste other than those mentioned in 02 01 08
02 02	**wastes from the preparation & processing of meat, fish & other foods of animal origin**
02 02 03	materials unsuitable for consumption or processing
02 03	**wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation**
02 03 02	wastes from preserving agents
02 03 03	wastes from solvent extraction
02 03 04	materials unsuitable for consumption or processing
02 05	**wastes from the dairy products industry**
02 05 01	materials unsuitable for consumption or processing
02 06	**wastes from the baking and confectionery industry**
02 06 01	materials unsuitable for consumption or processing
02 06 02	wastes from preserving agents
02 07	**wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)**
02 07 01	wastes from washing, cleaning and mechanical reduction of raw materials
02 07 02	wastes from spirits distillation
02 07 03	wastes from chemical treatment
02 07 04	materials unsuitable for consumption or processing

03	**WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD**
03 01	**wastes from wood processing and the production of panels and furniture**
03 01 01	waste bark and cork
03 01 05	sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04
03 03	**wastes from pulp, paper and cardboard production and processing**
03 03 01	waste bark and wood
03 03 07	mechanically separated rejects from pulping of waste paper and cardboard
03 03 08	wastes from sorting of paper and cardboard destined for recycling
04	**WASTES FROM THE LEATHER, FUR AND TEXTILE INDUSTRIES**
04 01	**wastes from the leather and fur industry**
04 01 02	liming waste
04 01 08	waste tanned leather (blue sheetings, shavings, cuttings, buffing dust) containing chromium
04 01 09	04 01 09 wastes from dressing and finishing
04 02	**wastes from the textile industry**
04 02 09	wastes from composite materials (impregnated textile, elastomer, plastomer)
04 02 10	organic matter from natural products (for example grease, wax)
04 02 15	wastes from finishing other than those mentioned in 04 02 14
04 02 17	dyestuffs and pigments other than those mentioned in 04 02 16
04 02 21	wastes from unprocessed textile fibres
04 02 22	wastes from processed textile fibres
05	**WASTES FROM PETROLEUM REFINING, NATURAL GAS PURIFICATION AND PYROLYTIC TREATMENT OF COAL**
05 01	**wastes from petroleum refining**
05 01 16	sulphur-containing wastes from petroleum desulphurisation
05 01 17	bitumen
07	**WASTES FROM ORGANIC CHEMICAL PROCESSES**
07 02	**wastes from the MFSU of plastics, synthetic rubber and man-made fibres**
07 02 13	waste plastic
07 02 15	wastes from additives other than those mentioned in 07 02 14
07 05	**wastes from the MFSU of pharmaceuticals**
07 05 14	solid wastes other than those mentioned in 07 05 13
08	**WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVES, SEALANTS, AND PRINTING INKS**
08 01	**wastes from MFSU and removal of paint and varnish**
08 01 12	waste paint and varnish other than those mentioned in 08 01 11
08 01 18	wastes from paint or varnish removal other than those mentioned in 08 01 17
08 02	**wastes from MFSU of other coatings (including ceramic materials)**
08 02 01	waste coating powders
08 03	**wastes from MFSU of printing inks**
08 03 13	waste ink other than those mentioned in 08 03 12
08 03 18	waste printing toner other than those mentioned in 08 03 17

08 04	**wastes from MFSU of adhesives and sealants (including waterproofing products)**
08 04 10	waste adhesives and sealants other than those mentioned in 08 04 09
09	**WASTES FROM THE PHOTOGRAPHIC INDUSTRY**
09 01	**wastes from the photographic industry**
09 01 08	09 01 08 photographic film and paper free of silver or silver compounds
09 01 10	single-use cameras without batteries
12	**WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS**
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastics**
12 01 05	plastics shavings and turnings
15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 01	paper and cardboard packaging, but only when contaminated and otherwise destined for landfill
15 01 02	plastic packaging, but only when contaminated and otherwise destined for landfill
15 01 03	wooden packaging, but only when contaminated and otherwise destined for landfill
15 01 04	metallic packaging, but only when contaminated and otherwise destined for landfill
15 01 05	composite packaging, but only when contaminated and otherwise destined for landfill
15 01 06	mixed packaging, but only when contaminated and otherwise destined for landfill
15 01 09	textile packaging, but only when contaminated and otherwise destined for landfill
15 02	**absorbents, filter materials, wiping cloths and protective clothing**
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
16	**WASTES NOT OTHERWISE SPECIFIED IN THE LIST**
16 01	**end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**
16 01 03	end-of-life tyres
16 01 19	plastic
16 01 22	components not otherwise specified
16 03	**off-specification batches and unused products**
16 03 06	organic wastes other than those mentioned in 16 03 05
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 02	**wood, glass and plastic**
17 02 01	wood, but only when contaminated and otherwise destined for landfill
17 02 03	plastic, but only when contaminated and otherwise destined for landfill
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 02	bituminous mixtures other than those mentioned in 17 03 01

17 09	**Other construction and demolition wastes**
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03
18	**WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (except kitchen and restaurant wastes not arising from immediate health care)**
18 01	**wastes from natal care, diagnosis, treatment or prevention of disease in humans**
18 01 01	sharps (except 18 01 03)
18 01 04	wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers)
18 01 09	medicines other than those mentioned in 18 01 08
18 02	**wastes from research, diagnosis, treatment or prevention of disease involving animals**
18 02 01	sharps (except 18 02 02)
18 02 03	wastes whose collection and disposal is not subject to special requirements in order to prevent infection
18 02 08	medicines other than those mentioned in 18 02 07
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 02	**wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)**
19 02 03	premixed wastes composed only of non-hazardous wastes
19 02 10	combustible wastes other than those mentioned in 19 02 08 and 19 02 09
19 03	**stabilised/solidified wastes**
19 03 05	stabilised wastes other than those mentioned in 19 03 04
19 03 07	solidified wastes other than those mentioned in 19 03 06
19 05	**wastes from aerobic treatment of solid wastes**
19 05 01	non-composted fraction of municipal and similar wastes
19 05 02	non-composted fraction of animal and vegetable waste
19 05 03	off-specification compost
19 08	**wastes from waste water treatment plants not otherwise specified**
19 08 01	screenings
19 08 09	grease and oil mixture from oil/water separation containing only edible oil and fats
19 09	**wastes from the preparation of water intended for human consumption or water for industrial use**
19 09 05	saturated or spent ion exchange resins
19 10	**wastes from shredding of metal-containing wastes**
19 10 04	fluff-light fraction and dust other than those mentioned in 19 10 03
19 10 06	other fractions other than those mentioned in 19 10 05
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 01	paper and cardboard
19 12 04	plastic and rubber
19 12 07	wood other than that mentioned in 19 12 06
19 12 08	textiles

19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**separately collected fractions (except 15 01 packaging)**
20 01 01	separately collected fractions of paper and cardboard, but only when contaminated and otherwise destined for landfill
20 01 08	separately collected fractions of biodegradable kitchen and canteen waste, but only when contaminated and otherwise destined for landfill
20 01 10	separately collected fractions of clothes, but only when contaminated and otherwise destined for landfill
20 01 11	separately collected fractions of textiles, but only when contaminated and otherwise destined for landfill
20 01 25	separately collected fractions of edible oil and fat, but only when contaminated and otherwise destined for landfill
20 01 28	separately collected fractions of paint, inks, adhesives and resins other than those mentioned in 20 01 27, but only when contaminated and otherwise destined for landfill
20 01 32	separately collected fractions of medicines other than those mentioned in 20 01 31, but only when contaminated and otherwise destined for landfill
20 01 38	separately collected fractions of wood, other than that mentioned in 20 01 37, but only when contaminated and otherwise destined for landfill
20 01 39	separately collected fractions of plastics, but only when contaminated and otherwise destined for landfill
20 02	**garden and park wastes (including cemetery waste)**
20 02 01	biodegradable wastes
20 03	**other municipal wastes**
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues
20 03 07	bulky waste

We are satisfied that the Operator can accept these wastes because:-

(i) These wastes are likely to be in the design calorific value (CV) range for the plant, the mean net CV, adjusted for ash and water content, was calculated to be 10.47/Kg of waste. The calculations are provided in the Sankey diagram and an amended Table 1 of the supporting document submitted in response to a Schedule 5 Notice dated 19/06/2015.

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

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

(iv) These wastes will be subjected to pre-acceptance and acceptance checks to ensure that they can be processed at the Installation without compromising the emission limit values that have been set.

Pre-operational condition 5 is included to ensure that these checks are acceptable to the Environment Agency.

The Installation will take residual waste, 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 180,000 tonnes per annum. This is based on the Installation operating 7,500 hours per year at a nominal capacity of 24 tonnes per hour. This is based on the plant design, throughput capacity and average calorific value of the input waste included in the Application.

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

4.3.7 Energy efficiency

(i) Consideration of energy efficiency

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

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

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

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

(ii) Use of energy within the Installation

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

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

- Through the use of waste heat boilers and steam turbines, the heat generated by the facility will be used to generate electricity both for export to the grid (off-site use) as well as for the parasitic load (on-site use)
- Wherever possible, ordering flue-gas treatment systems in such a way that flue gas reheating is avoided (i.e. those with the highest operational temperature before those with lower operation temperatures)
- Minimising the need for flue gas reheating energy demand. There is no requirement for flue gas reheating during any part of the process.

The Operator argues there is a net positive impact with respect to energy efficiency as the proposed technology is more efficient with respect to energy generation compared with the current permitted technology. The proposed technology results in an estimated 35,000 tonnes CO_2/year which is considerably less than the surrogate level of 150,000 tonnes CO_2/year given in paragraph A6.2 of the Regulatory Guidance Note RGN8 (Version 3.0, March 2011), which corresponds to the approximate level of releases that would result from a coal-fired power station with a rated thermal input of 50 MW. Releases above this level are considered substantial. This calculation, however, is based on reductions in ash wastes destined for landfill, which identifies the proposed technology will result in less than 12,000 tonnes/year of fly ash/APC residue for disposal, based on 180,000 tonnes of waste/year processed. This compares with 12,829 tonnes/year based on 120,000 tonnes of waste processed in the original application.

Table 12 in the supporting document of the application states that the specific energy consumption (SEC), a measure of total energy consumed per unit of waste processed, will be 180kWh/tonne, which compares with 0.185 kWh/tonne in the original determination. However, this is electricity only. Natural gas consumption accounts for a further 980kWh/tonne making the total 1,160kWh/tonne, which is significantly higher than 890kWh/tonne in the original application.

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

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

The BREF says that it is BAT to reduce the average installation electrical demand to generally below 150 kWh/tonne of waste with an LCV of 10.4 MJ/kg. The LCV in this case is expected to be 10.47 MJ/kg. Whilst this is not municipal waste, taking account of the small difference in LCV, the specific energy consumption of 1,180 kWh/tonne of waste in the Application is not in line with that set out above. The Operator was required to describe how this electrical consumption represents BAT for the Installation in response to a Schedule 5 request for information dated 19/07/2015. The Operator identified that the specific energy consumption of 0.89 MWh/tonne reported in the Decision Document of the original application is incorrect as it fails to include the 696m^3 of gas oil consumed as supplementary fuel. The Operator has not identified the SEC in the original application but even with the supplementary fuel, it is lower than 1,180kWh/tonne. Instead, the Operator has pointed out that Permit reference EPR/LP3239NX/A001 was issued on 21 April 2015 for an Installation utilising the RODECS technology. The SEC in this case, which has been accepted by the Agency as BAT, is 1,590 kWh/tonne processed i.e. higher than that proposed in this application. It is clear that the SEC of both the RODECS and CYCLAMAX technologies are well beyond the BAT range of 150 – 500 kWh/t waste input and this is a consequence of the batch process. Nevertheless, given a batch approach represents BAT for reasons other than SEC, we are satisfied that appropriate measures will be in place to ensure that energy is used efficiently within the Installation.

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

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

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

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

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

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

At this stage, the Installation will generate electricity only and has been specified to maximise electrical output with little or no use of waste heat. The Sankey diagram in Figure 2 of the supporting statement of the Application shows 19.6 MW of electricity produced for an annual burn of 180,000 tonnes, which represents 10.89 MW per 100,000 tonnes/yr of waste burned (0.816MWh/tonne of waste). The Installation is therefore beyond the upper limit in the indicative BAT range. However, this is partly the result of the auxiliary fuel used rather than a measure of energy recovery.

The Operator has submitted a CHP-R assessment as Appendix 13 of the application. This was accompanied a CHP-R report' as Appendix 12, which considered the applicant's demonstration of the use of 'Best Available Techniques' (BAT) in the context of power plants and energy-from-waste plants. These were the following:

- BAT-1 – by using heat recovery and re-using the recovered heat;
- BAT-2 - where re-use is not possible or viable, when the plant is first consented, constructed and commissioned, prepare for CHP at some future time;
- BAT-3 - once the Environmental Permit has been issued for a plant, the operator should periodically review opportunities for CHP.

The Operator undertook a desk study of existing heat demands around the site of the new EfW plant in Dagenham to identify possible heat loads (to address the BAT-1 test, above). Where no suitable heat loads can be found, the heat-load survey should assess how to prepare for CHP in future (to address the BAT-2 test).

The London Sustainable Industries Park is being developed on 60 acres of land owned by Greater London Authority (GLA). Information obtained from the Housing and Land Directorate (Strategic Projects & Property) of the GLA indicates that, for the northern part of the London Sustainable Industries Park (lying north of Choats Road), the route of a district heating transmission line has been safeguarded and some preliminary pipe work has been installed. In the London Borough of Barking & Dagenham there is an outline heat plan for a district heating scheme which could serve Barking Riverside and Barking Town Centre. This district heating scheme could therefore be the customer to buy heat from this waste-to-energy project. Other prospective occupiers of vacant plots on the London Sustainable Industries Park could also connect to this district heating scheme. Some preliminary heat infrastructure is already in place and it is a condition of the planning consent for this project that heat

supply off-takes should be put in place in readiness for connection to the district heating scheme at some future date.

The Operator has adopted the BAT-2 approach because re-use of the recovered heat is not possible or viable at this stage so it shall be designed, constructed and commissioned in preparation for CHP at some future time.

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

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. The Operator carried out a feasibility study and provided a CHP-R assessment as part of their application, which showed there is potential to connect to a district heating scheme which could serve Barking Riverside and Barking Town Centre. However, 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. There is also no indication of a local district heating company being created to develop and to operate the local heat distribution network and to purchase any heat supplied from TGW2E or others. Nevertheless, these circumstances could change and a pre-operational condition, PO2, has been included for the Operator to submit a written report to the Environment Agency detailing the Cost Benefit Analysis of the operation of the Installation as a high-efficiency cogeneration installation prior to the commencement of commissioning. The analysis shall be undertaken using the methodology contained in our Guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive dated 25/10/2012.

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

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

(iv) 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 Operator 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. It is referred to as a disposal activity in the application.

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

The formula is:

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

Where:

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

The R1 factor can only be determined from operational data over a full year. At this application stage it is only possible to make a provisional assessment. Ep measures the energy recovered for use from the incinerator. This energy will have been recovered not just from the combustion of waste (Ew), but also from the combustion of the support fuel at start up and shut down and where required to maintain the 850 ºC combustion temperature (Ef). Ei is additional energy imported, which will primarily be electricity from the grid. These parameters will depend on the way in which the plant is operated, e.g. number of start ups and shut downs. Because this is a batch process, there will be approximately 24 batches each day. Based on the information contained in the application, this plant can achieve an R1 factor of @ 0.3, which is well below the 0.65 to consider it a 'recovery activity' for the purposes of the Waste Framework Directive.

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.

(iv) Choice of Steam Turbine

The steam turbine is designed to utilise the superheated steam to generate (in the first instance), electrical power for export to the local distribution network. The turbine power is optimised by condensing the steam after it leaves the last stage of the turbine.

(vi) Choice of Cooling System

The facility is equipped with an air cooled condenser which operates at sub-atmospheric pressure due to the condensation of the steam into water. This enhances the performance of the turbine, and the generation of electricity. As the entire volume of steam is condensed and then re-circulated to the boiler, the steam/condensate system is a closed circuit requiring minimal water supply resources. The condensate is recovered and returned to the process water treatment plant for re-use in the boiler.

(vii) Permit conditions concerning energy efficiency

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

Conditions 1.2.2 and 1.2.3 have also been included in the Consolidated 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 C&I waste burned per year, this will enable the Environment Agency to monitor energy recovery efficiency at the Installation and take action if at any stage the energy recovery efficiency is less than proposed.

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

4.3.8 Efficient use of raw materials

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

The Operator is required to report with respect to raw material usage under condition 4.2. and Schedule 4, including consumption of lime, activated carbon and ammonia used per tonne of waste burned. This will enable the Environment Agency to assess whether there have been any changes in the efficiency of the air pollution control plant, and the operation of the SNCR to abate NO_x. These are the most significant raw materials that will be used at the Installation, other than the waste feed itself (addressed elsewhere). The

efficiency of the use of auxiliary fuel will be tracked separately as part of the energy reporting requirement under condition 4.2.2. 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 bottom ash, air pollution control residues and recovered metals.

The first objective is to avoid producing waste at all. Waste production will be avoided by achieving a high degree of burnout of the ash in the furnace, which results in a material that is both reduced in volume and in chemical reactivity. Condition 3.5.1and associated Table S3.5 specify limits for loss on ignition (LOI) of <5% in bottom ash. Compliance with this limit will demonstrate that good combustion control and waste burnout is being achieved in the furnaces and waste generation is being avoided where practicable.

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

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

In order to ensure that the IBA and APC residues are adequately characterised, pre-operational condition PO4 requires the Operator to provide a written plan for approval detailing the ash sampling protocols. Table S3.5 requires the Operator to carry out an ongoing programme of monitoring.

The Application states that metal will be recovered from the processing bin residues at the end of each batch by the use of a magnetic separator and sent for recycling. The Application also proposes that, where possible, bottom ash will be transported to a suitable recycling facility, from where it could be re-used in the construction industry as an aggregate. The Operator is currently investigating options for the use of bottom ash in road construction.

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

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

5. Minimising the Installation's environmental impact

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

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

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

5.1 Assessment Methodology

5.1.1 Application of Environment Agency 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 and variations, is set out in our Horizontal Guidance Note H1 and has the following steps:

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

The H1 methodology uses a concept of "process contribution (PC)", which is the estimated concentration of emitted substances after dispersion into the receiving environmental media at the point where the magnitude of the

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

5.1.2 Use of Air Dispersion Modelling

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

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

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

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

PCs are considered **Insignificant** if:

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

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

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

- It is unlikely that an emission at this level will make a significant contribution to air quality;

- The threshold provides a substantial safety margin to protect health and the environment.

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

- spatial and temporal conditions mean that short term process contributions are transient and limited in comparison with long term process contributions;

- the threshold provides a substantial safety margin to protect health and the environment.

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

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

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

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

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

5.2 Assessment of Impact on Air Quality

The Operator's assessment of the impact of air quality is set out in Appendices 3 and 10 of the Application. The assessment comprises:

- An H1 screening assessment of emissions to air from the operation of the incinerator. (Appendix 3).

- Dispersion modelling of emissions to air from the operation of the incinerator. (Appendix 10).

- A study of the impact of emissions on nearby sensitive habitat/ conservation sites. (Appendix 10).

- Dispersion modelling of odour impacts.

- A qualitative assessment of amenity impacts during construction.

- Dispersion modelling of the impact of additional off site road traffic arising from the operation of the incinerator.

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

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the incinerator chimney and its impact on local air quality. The impact on conservation sites is considered in section 5.4 and potential odour impacts including those during plant shutdowns are considered in section 5.6.

The Operator has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the 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 Scratton's Farm between 2007 and 2011. (2012 data was not presented as 48% was missing and therefore not representative.) Scratton's Farm was selected because:

- It is located only 0.7 km from the proposed site at OS grid reference 548043,183320.
- The site is classified as 'suburban' which is typical of residential areas.
- Data from this site is considered to be more representative because of the greater accuracy of continuously monitored data and because it is more recent and located where it will be representative of the prevailing air quality.

The impact of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling. However, given the location of the proposed Installation, the Operator considered the effects of terrain will be insignificant and has not included it in the modelling.

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

- First, they assumed that, with the exception of the Oxides of Nitrogen, the ELVs in the permit would be the maximum permitted by Article 46(2) and Annex VI of the IED. These substances are:
    - Total dust
    - Carbon monoxide (CO)
    - Sulphur dioxide (SO_2)
    - Hydrogen chloride (HCl)
    - Hydrogen fluoride (HF)
    - Metals (Cadmium, Thallium, Mercury, Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium)
    - Polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo furans (referred to as dioxins and furans)
    - Gaseous and vaporous organic substances, expressed as Total Organic Carbon (TOC)
    - In the case of Oxides of nitrogen (NO_x), a lower ELV of 150 mg Nm^3 was imposed as a condition of the new planning permission.
- Second, they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate (except for emissions of arsenic, chromium and nickel, which are considered in section 5.2.3 of this decision document).
- Third, the model also considered emissions of pollutants not covered by Annex VI of IED, specifically ammonia (NH_3), nitrous oxide (N_2O), Polycyclic Aromatic Hydrocarbons (PAH) and PCB's. Emission rates used in the modelling have been drawn from data in the Waste Incineration BREF and are considered further in section 5.2.5.

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

Because this is a batch process, there are significant periods involving loading, start-up, shut-down and unloading of each batch, which are not subject to Annex VI of IED. During these periods, any emissions will be more the product of the auxiliary fuel than the waste itself. The Installation uses natural gas as auxiliary fuel but impacts have been modelled on continuous emissions at IED limits (except for NOx) so we are satisfied these represent worst-case.

The Operator has reviewed a number of NO_2 background data sources including: continuous and diffusion tube monitoring operated by the London Borough of Barking and Dagenham; estimates of annual average

concentrations modelled by the London Borough of Barking and Dagenham; and Defra's estimated background concentration data. The Operator has used the average of four grid squares from the Defra background maps of 25.5µg/m3, which is lower than other data sources listed. The borough has been designated an Air Quality Management Area (AQMA) for NOx and particulates. Considering this and a review of background data we anticipate that background concentrations are likely to be approaching or exceeding the EQS.

The Operator has used background metals data from Chadwell St Mary from 2012. We have reviewed the average background data from monitoring sites across the UK and consider the Arsenic and Cadmium background data used to calculate the PEC can be considered appropriate.

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

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

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

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

5.2.1 Assessment of Air Dispersion Modelling Outputs

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

The figures shown indicate the predicted peak ground level exposure to pollutants in ambient air.

Pollutant	EQS / EAL		Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m^3		µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
NO_2	40	1	25.5	1.9	4.75	27.4	68.5
	200	2	51	6.7	3.4	57.7	28.9
PM_{10}	40	1	19.8	0.2	0.50	20.0	50.0
	50	3	39.6	0.5	1.00	40.1	80.2
$PM_{2.5}$	25	1	19.8	0.2	0.80	20.00	80.0
SO_2	50	1	6.8	0.6	1.20	7.40	14.8
	266	4	13.6	7.4	2.8	21	7.9
	350	5	13.6	6.3	1.80	19.9	5.7
	125	6	6.8	4.2	3.4	11	8.8
HCl	750	7	0.34	2	0.2666667	2.34	0.3
HF	16	8	0.003	0.018	0.11	0.0121	0.1
	160	7		0.204	0.1275	0.20	0.1
CO	10000	9		6.4	0.06	6	0.1
	30000	10			0.00	0	0.0
TOC	2.25	1	0.8	0.003	0.38	0.803	35.7
PAH	0.00025	1		0.000018	7.20	0.000018	7.2
NH_3	180	1		0.18	0.10	0.18	0.1
	2500	10		2.04	0.08	2.04	0.1
PCBs	0.2	1	0.001724	0.00005	0.03	0.00177	0.9
	6	10	0.001724	0.001	0.02	0.00272	0.0
Dioxins			8.5E-09	1.80E-09		1.03E-08	

Notes

TOC as 1,3 butadiene

PAH as benzo[a]pyrene

1 Annual Mean

2 99.79th %ile of 1-hour means

3 90.41st %ile of 24-hour means

4 99.9th ile of 15-min means

5 99.73rd %ile of 1-hour means

6 99.18th %ile of 24-hour means

7 1-hour average

8 Monthly average

9 Maximum daily running 8-hour mean

10 1-hour maximum

Pollutant	EQS / EAL		Back-ground	Process Contribution		Predicted Environmental Concentration	
	µg/m^3		µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
Cd	0.005	1	0.00026	0.0005	10.0	0.00076	15.2
Tl						0	
Hg	0.25	1	0.002	0.001	0.40	0.00300	1.20
	7.5	2		0.01	0.13	0.01000	0.133
Sb	5	1		0.001	0.02	0.001	0.02
	150	2		0.011	0.01	0.01100	0.007
Pb	0.25	1	0.0132	0.001	0.40	0.01420	5.68
Co			0.0002	0.001		0.00120	
Cu	10	1	0.0115	0.001	0.01	0.0125	0.125
	200	2		0.011	0.01	0.01100	0.006
Mn	0.15	1	0.0047	0.001	0.67	0.0057	3.80
	1500	2		0.011	0.00	0.01100	0.0007
V	5	1	0.0027	0.001	0.02	0.0037	0.07
	1	3		0.011	1.10	0.01100	1.10
As	0.003	1	0.00085	0.00001	0.33	0.00086	28.7
Cr (II)(III)	5	1	0.0027	0.001	0.02	0.00370	0.074
	150	2	0.0027	0.011	0.01	0.01370	0.0091
Cr (VI)	0.0002	1	0.00054	0.0000007	0.35	0.00054	270.4
Ni	0.02	1	0.002	0.0010	5.00	0.00300	15.0

Notes

1 Annual Mean

2 1-hr Maximum

3 24-hr Maximum

(i) Screening out emissions which are insignificant

From the tables above, 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 except for NO_2^{LT}, PAH, Cd, and Ni.

Therefore we consider the Operator's proposals for preventing and minimising the emissions of these insignificant 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, the emissions of NO_2^{LT}, PAH, Cd, and Ni, 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.

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

5.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO_2)

The 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 screens out as insignificant (>10% of the EUEQS.

The tables show that the Operator has used a background level of 25.5$\mu g/m^3$. Section 3.3 of Appendix 10 (Air Quality Assessment) identifies that the Operator reviewed a number of NO_2 background data sources including: continuous and diffusion tube monitoring operated by the London Borough of Barking and Dagenham, estimates of annual average concentrations modelled by the London Borough of Barking and Dagenham; and Defra's estimated background concentration data. The Operator has used the average of four grid squares from the Defra 2015 background maps (see Table 3.4 of Appendix 10) of 25.5µg/m^3. This is lower than other data sources

listed. The Borough has been designated an Air Quality Management Area (AQMA). Considering this and a review of background data we anticipate that background concentration is likely to be approaching or exceeding the EQS. Nevertheless, the Operator modelled on the daily limit of 150$\mu g/m^3$ imposed as a condition of planning permission and we are satisfied the proposal will be an improvement or no worse than the currently permitted plant.

(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 achievement of a long-term annual EUEQS of 25 $\mu g/m^3$ by 2010 as a Target Value and by 2015 as a Limit Value has been used.

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

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

- It assumes that the plant emits particulates continuously at the IED Annex VI limit for total dust, 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 Operator's particulate matter impact assessment and are satisfied in the robustness of the Operator's conclusions.

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

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

There is currently no emission limit prescribed or any continuous emissions monitor for particulate matter specifically in the PM_{10} or $PM_{2.5}$ fraction. Whilst the Environment Agency is confident that current monitoring techniques will capture the fine particle fraction ($PM_{2.5}$) for inclusion in the measurement of total particulate matter, an improvement condition (IC2) has been included that will require a full analysis of particle size distribution in the flue gas, and

hence determine the ratio of fine to coarse particles. In the light of current knowledge and available data however the Environment Agency is satisfied that the health of the public would not be put at risk by such emissions, as explained in section 5.3.3.

(iii) Acid gases, SO_2, HCl and HF

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

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

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

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

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

The Operator has used the EQS for benzene for their assessment of the impact of VOC. We are satisfied this represents a conservative approach.

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

Tables 7.1 and 7.2 of Appendix 10 (Air Quality Assessment) identify that the Operator has also used the EQS for benzo[a]pyrene (BaP) for the assessment of the impact of PAH. We agree that the use of the BaP EQS is sufficiently precautionary.

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

PAH's (as BaP) is the only other pollutant that did not screen out as insignificant. The Air Quality Assessment submitted by the applicant had not considered background, and compared a PEC against the EQS.

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

Table 4.2 of Appendix 10 (Air Quality Assessment) identifies that the ammonia emission is based on a release concentration of 10 mg/m^3. We are satisfied that this level of emission is consistent with the operation of a well controlled SNCR NO_x abatement system.

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

(v) Summary

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

5.2.3 Assessment of Emission of Metals

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

Annex VI of IED sets three limits for metal emissions:

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

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

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

- As, Co, Cr(II/III), Cr(VI), Cu, Hg, Mn, Pb, Sb, 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:

- Cd, Ni.

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

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

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

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

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

The Operator has used the above data to model the predicted Cr(VI) impact. The PC is predicted as 0.35% of the EAL.

This assessment shows that emissions of Chromium (VI) screen out as insignificant. We agree with the Operator's conclusions. The Installation has

been assessed as meeting BAT for control of metal emissions to air. See section 6 of this document.

5.2.4 Consideration of Local Factors

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

The London Borough of Barnet and Dagenham declared Air Quality Management Area (AQMA) across the whole Borough with respect to Nitrogen Dioxide (NO_2) and Particulate matter (PM_{10}).

From the Operator's model, the process contribution of PM_{10} at all points within the AQMA is predicted to be well below 1% of the EUEQS and can therefore be considered insignificant. This is not the case with emissions of NO_2.

Because the application includes different technology, an increase in the tonnage of waste processed to 180,000 tonnes per year and a taller chimney stack in a different location, it was determined by the London Borough of Barnet and Dagenham as a new Planning application. The planning permission subsequently granted, included a daily limit on point source emissions of Oxides of nitrogen (NO and NO_2) expressed as NO_2 to air of 150mg/m^3, which is substantially lower than the IED limit of 200mg/m^3. The Operator's Air Quality Assessment is based on the imposed limit of 150mg/m^3.

The Operator's modelling predictions for NO_2 in the AQMA are summarised in the tables below. The figures shown indicate the predicted peak ground level impact on pollutant concentrations in ambient air on sensitive receptors within the AQMA. Table 5.2 (reproduced below) shows the predicted annual average concentration at the specific receptors for human exposure and at the monitoring locations using 2008 meteorological data.

Table 5.2 **ADMS 5.0 Predicted Annual Average Concentrations of Nitrogen Dioxide (NO_2) at Specific Receptors, 2008 Meteorological Data (NO_2, $\mu g\ m^{-3}$) Emission Concentration of 150 mg Nm^{-3} [a]**

No.	Description	Predicted Increment (Process Cont., PC)	Prevailing Conc. [b]	Predicted Increment + Prevailing (Predicted Environmental Conc. PEC)	Increment (PC) as Percentage of Objective (%)
1	Warehouse 1	0.0	33.3	33.3	0.1%
2	Dagenham Dock	1.3	33.3	34.6	3.3%
3	Allotment Gardens	0.1	33.3	33.4	0.3%
4	Property on New Road	1.0	33.3	34.3	2.4%
5	Property on New Road	0.9	33.3	34.2	2.2%
6	Beam Valley Country	0.5	33.3	33.8	1.2%
7	School - Leys Avenue	0.4	33.3	33.7	1.0%
8	School - School Road	0.5	33.3	33.8	1.3%
9	Allotment Gardens (N)	0.3	33.3	33.6	0.8%
10	School - New Road	1.0	33.3	34.3	2.5%
11	Schools - Lowen Road	0.2	33.3	33.5	0.6%
12	School - Gores Bridge	0.8	33.3	34.1	1.9%
13	PlaygroundGoresbrook	0.2	33.3	33.5	0.5%
14	Goresbrook Leisure	0.1	33.3	33.4	0.2%
15	School - Goresbrook	0.1	33.3	33.4	0.2%
16	Shaw Gardens	0.1	33.3	33.4	0.3%
17	Castle Green	0.0	33.3	33.3	0.1%
18	School - Burnham Rd	0.0	33.3	33.3	0.1%
19	School - Dawson Ave	0.0	33.3	33.3	0.1%
20	Hospital	0.0	33.3	33.3	0.1%
21	School - Sandringham	0.0	33.3	33.3	0.1%
22	Mayesbrook Park	0.0	33.3	33.3	0.1%
23	School - Cannington	0.0	33.3	33.3	0.1%
24	Parsloes Park	0.1	33.3	33.4	0.2%
25	Recreation Ground	0.2	33.3	33.5	0.6%
26	Playing Fields	0.2	33.3	33.5	0.5%
27	Allotment Gardens	0.2	33.3	33.5	0.4%
28	Allotment Gardens	0.1	33.3	33.4	0.4%
29	School - Tangmere	0.1	33.3	33.4	0.4%
30	School Heron Flight	0.2	33.3	33.5	0.4%
31	Albyns Farm	0.1	33.3	33.4	0.3%
33	Allotments - Ingreborne	0.1	33.3	33.4	0.1%
54	Diffusion Tube No 109	0.1	36.3	36.4	0.3%
55	Diffusion Tube No 110	0.1	75.6	75.7	0.3%
56	Diffusion Tube No 117	0.1	42.2	42.3	0.2%
57	Diffusion Tube No 125	1.5	39.7	41.2	3.7%
58	Diffusion Tube No 126	0.0	48.6	48.6	0.0%
59	Diffusion Tube No 127	0.1	38.9	39.0	0.4%
60	Diffusion Tube No 128	0.4	45.9	46.3	0.9%
61	Diffusion Tube No 129	0.2	46.2	46.4	0.5%
62	Scrattons Monitor	0.1	33.3	33.4	0.3%
	Assessment Criteria		**40**		

(a) Assumes 70% oxidation.
(b) Measured values.

Table 5.3 of the Operator's Air Quality Assessment identifies four specific receptors for human exposure where the Process Contribution (PC) is not insignificant. These are described as 'slight adverse' in the assessment. The highest predicted peak ground level impact is at diffusion tube 125, which is 1.5μg/m^3, representing 3.5% of the EUEQS.

Table 5.3 EPUK Significance Criteria; Nitrogen Dioxide (NO_2, $\mu g\ m^{-3}$) Emissions Concentration of 150 mg Nm^{-3}

No.	Description	Predicted Increment (PC)	Increase (%)	Magnitude of Change	Assumed Background	PEC	Impact Descriptor
4	Property on New Rd	1.0	2.4%	Small	39	40.0	Slight Adverse
5	Property on New Rd	0.9	2.2%	Small	39	39.9	Slight Adverse
7	School - Leys Ave	0.4	1.0%	Imperceptible	33.3	33.7	Negligible
8	School - School Rd	0.5	1.3%	Small	33.3	33.8	Negligible
10	School - New Rd	1.0	2.5%	Small	39	40.0	Slight Adverse
11	Schools - Lowen Rd	0.2	0.6%	Imperceptible	33.3	33.5	Negligible
12	School - Gores	0.8	1.9%	Small	39	39.8	Slight Adverse
13	PlaygroundGoresbrook	0.2	0.5%	Imperceptible	33.3	33.5	Negligible
14	Goresbrook Leisure	0.1	0.2%	Imperceptible	33.3	33.4	Negligible
15	School Goresbrook Rd	0.1	0.2%	Imperceptible	33.3	33.4	Negligible
17	Castle Green	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
18	School - Burnham Rd	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
19	School - Dawson Ave	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
20	Hospital	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
21	School Sandringham	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
23	School Cannington Rd	0.0	0.1%	Imperceptible	33.3	33.3	Negligible
26	Playing Fields	0.2	0.5%	Imperceptible	33.3	33.5	Negligible
29	School Tangmere	0.2	0.4%	Imperceptible	33.3	33.5	Negligible
30	School Heron Flight	0.2	0.4%	Imperceptible	33.3	33.5	Negligible
31	Albyns Farm	0.1	0.3%	Imperceptible	33.3	33.4	Negligible

Table 5.3 shows that there are four locations where the impact description is 'slight adverse' and the rest are 'negligible'. The 'slight adverse' impacts are a direct consequence of the assumed background concentrations.

Overall, whilst the PC of NO_2 cannot be screened out as insignificant, we agree with the Applicant's conclusions that the proposed variation will be an improvement or (at minimum) no worse than the originally permitted plant.

The Operator 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. The gathering of evidence is a continuing process. Although gathering evidence is not our role we keep the available evidence under review. The following is a summary of some of the publications which we have considered (in no particular order).

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

The European Integrated Pollution Prevention and Control Bureau stated in the Reference Document on the Best Available Techniques for Waste Incineration August 2006 "European health impact assessment studies, on the basis of current evidence and modern emission performance, suggest that

the local impacts of incinerator emissions to air are either negligible or not detectable."

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

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

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

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

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

landfill as a method of waste disposal far outweigh any possible effects on food safety and quality."

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

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

The **British Society for Ecological Medicine (BSEM) published a report in 2005** on the health effects associated with incineration and concluded that "Large studies have shown higher rates of adult and childhood cancer and also birth defects around municipal waste incinerators: the results are consistent with the associations being causal. A number of smaller epidemiological studies support this interpretation and suggest that the range of illnesses produced by incinerators may be much wider. Incinerator emissions are a major source of fine particulates, of toxic metals and of more than 200 organic chemicals, including known carcinogens, mutagens, and hormone disrupters. Emissions also contain other unidentified compounds whose potential for harm is as yet unknown, as was once the case with

dioxins. Abatement equipment in modern incinerators merely transfers the toxic load, notably that of dioxins and heavy metals, from airborne emissions to the fly ash. This fly ash is light, readily windborne and mostly of low particle size. It represents a considerable and poorly understood health hazard."

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

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

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

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

iv) Health Risk Models

Comparing the results of air dispersion modelling as part of the H1 Environmental Impact Assessment against European and national air quality standards effectively makes a health risk assessment for those pollutants for

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

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

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

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

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

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

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

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

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

v) Consultations

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

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

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

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

The Operator has submitted a Human Health Risk Assessment (HHRA) as Appendix 11 of the application. The Operator has derived the dioxin and furan congener profile using the concentrations in the HMIP model and applied the International Toxicity Equivalent Factors. Predictions are presented in Table 3.3 of Appendix 11.

The results of the Operator's assessment of dioxin intake are detailed in the table below (worst case results for each category are shown). The results showed that the predicted daily intake of dioxins, furans and dioxin like PCBs at all receptors, resulting from emissions from the proposed facility, were significantly below the recommended TDI levels. The table below shows the estimated Total PCDD/Fs Intake (pg I-TEQ/kg (body weight)/day) including the contribution of inhalation and ingestion for a Hypothetical Maximum Exposed Individual (HMEI) presented in units for comparison to the UK COT TDI.

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

Scenario	Inhalation	Ingestion	Total
Worst case	0.0005	0.0716	0.0722
Maximum theoretical worst case	0.0009	0. 1145	0.1154
UK COT/TDI	-	-	2.0000

The Operator has justified the exclusion of PCBs from the assessment, noting that plant is not sited close to an area where fishing is a common source of food. However the consultant has attempted to consider the contribution to the TDI by multiplying the intake by the difference in the predicted concentration of dioxin-like PCBs and Dioxins and Furans. This is not appropriate as different congeners are more dominant for specific pathways. We have assessed sensitivity to the intake of dioxin-like PCBs using the USEPA Human Health Risk Assessment Protocol (HHRAP). We based our checks upon conservative intake assumptions from all pathways, including inhalation, and worst case dispersion modelling; we predict that the impact is not likely to contribute significantly to the COT-TDI. For our checks, we have used an emission rate derived from the maximum dioxin-like PCB concentrations observed in 50 measurements at 20 Municipal Waste Incinerator plants between 2008 and 2010. Our check's show the Operator's worst case predictions are likely to be conservative and can therefore be considered significantly below the recommended TDI levels.

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

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

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

5.3.3 Particulates smaller than 2.5 microns

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

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

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

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

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

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

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

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

5.3.4 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 consolidated permit conditions. We are satisfied that compliance with these conditions will ensure protection of the environment and human health.

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

In carrying out air dispersion modelling as part of the H1 Environmental Impact assessment and comparing the predicted environmental concentrations with European and national air quality standards, the Operator has effectively made a health risk assessment for many pollutants. These air

quality standards have been developed primarily in order to protect human health.

The impact from dioxin-like PCBs and Dioxins, Furans and metals have all indicated that the Installation emissions screen out as insignificant; where the impact of emissions of dioxin-like PCBs and Dioxins, Furans and metals 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.

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

Public Health England and the Local Authority Director of Public Health were consulted on the Application. Public Health England concluded that they had no significant concerns regarding the risk to the health of humans from the Installation. No response was received from the Local Authority Director of Public Health. The Food Standards Agency was also consulted during the determination process but did not respond. Details of the response provided by Public Health England to the consultation on this Application can be found in Annex 2.

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

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

5.4.1 Sites Considered

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

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

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

Local Wildlife Sites

Goresbrook and the ship and shovel sewer
Mayes Brook and associated watercourses
Crossways Lake Nature Reserve

Thamesview Golf Course
Lower River Beam and Ford Works Ditches
Beam Valley South in Havering
Rainham Railsides
Beam Valley South in Dagenham and the Wantz Stream
Scratton's Farm Ecopark
Crossness Sewage Treatment Works Pond
River Thames and tidal tributaries
Dagenham Breach and the lower Beam River in Dagenham
Parsloes Park
The Ripple Nature Reserve
Crossway Park and Tump 52

Local Nature Reserves

Scratton's Ecopark and Extension
The Ripple Nature Reserve

5.4.2 Assessment of local wildlife and other conservation sites

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

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

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

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

The Operator's assessment in S 6.2 of Appendix 10 lists only 8 sites of which 3 are SSSI's beyond 2km from the site. This means there are a number of sites that have not been identified. However, in S 6.2.3 of the assessment (non-statutory sites), the operator has stated that given the number and geographic spread of the non statutory sites, a graphical assessment is presented, which assesses impacts using expected emission concentrations rather than emission limits. Figures 6.2 – 6.6 on pages 57- 61 of Appendix 10 illustrate the PC as contour plots and identify the location of max impact on the grid. This identifies that the maximum PC of annual concentrations of critical levels and loads at these locations are less than 100% of the screening criteria for LWS and LNR. We have carried out our own sensitivity checks, which reviewed the maximum on the grid and showed there was a low risk of an exceedence of the screening criteria. We have also considered the process contribution (PC) as a maximum on the grid to short term critical levels of Hydrogen Fluoride (HF) and Hydrogen Chloride (HCl) and identified that there is a low risk.

The assessment in Appendix 10 shows that the PCs are below the critical levels or loads. We are satisfied that the Installation will not cause significant pollution at the sites. The Operator is required to prevent, minimise and control emissions using BAT, this is considered further in Section 6.

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

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

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

- NO_x emissions of 653 mg/m^3 (1.5 x normal)
- SO_2 emissions of 708mg/m^3 (3.5x normal)
- HCl emissions of 219mg/m^3 (3.6x normal)
- Particulate emissions of 150 mg/m^3 (5 x normal)
- Dioxin emissions of 10 ng/m^3 (100 x normal)
- PCBs (100 x normal)
- Metal emissions are 5 times those of normal operation

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 Operator's short-term environmental impact is summarised in tables 7.1 - 7.4 of Appendix 10, which are reproduced below.

Table 7.1 Pollutant Emissions Concentrations (mg Nm^{-3}) [a]

Pollutant	Long Term	Short Term	Abnormal Operation
Oxides of nitrogen (NO_x as NO_2)	150	400	653
Sulphur dioxide (SO_2)	50	200	708
Particulate matter (PM_{10})	10	30	150
Carbon monoxide (CO)	50	50	50
Hydrogen chloride (HCl)	10	60	219
Hydrogen fluoride (HF)	1	4	22
Cadmium (Cd)	0.025 [b]	0.025	0.125
Mercury (Hg)	0.05	0.05	0.255
Eight metals (Sb, Pb, Cr, Co, Cu, Mn, Ni, V)	0.056 [c]	0.056	0.28
Arsenic (As)	0.0007 [d]	0.0007	0.0035
Chromium (VI)	0.000035 [d]	0.000005	0.000025
Dioxins and furans (I-TEQ, ng Nm^{-3})	0.1	0.1	10
PAHs (as benz(a)pyrene, ng Nm^{-3})	0.1	0.1	10
PCBs (TEQ)	0.0026 [e]	0.0026	0.26

(a) Corrected for: Temperature; 273 K; Pressure; 101.3 kPa (1 atmosphere); dry; 11% v/v O_2.
(b) Assumes that cadmium is 50% of the total of cadmium plus thallium (tl).
(c) The WID limit for nine metals including arsenic (As) and lead (pb) is 0.5 mg Nm^{-3} this assessment assumes that these metals are no more than 1/9 of this limit.
(d) Environment Agency Guidance (September 2012); Mean measured concentration from 20 WID plants used.
(e) Environment Agency (April 2014, personal communication).

Table 7.2 Pollutant Emissions Rate

Pollutant	Long Term	Short Term	Abnormal Operation	units
Oxides of nitrogen (NO_x as NO_2)	7.5	20.0	32.6	g s^{-1}
Sulphur dioxide (SO_2)	2.5	10.0	35.3	g s^{-1}
Particulate matter (PM_{10})	0.5	1.5	7.5	g s^{-1}
Carbon monoxide (CO)	2.5	2.5	2.5	g s^{-1}
Hydrogen chloride (HCl)	0.5	3.0	10.9	g s^{-1}
Hydrogen fluoride (HF)	0.0	0.2	1.1	g s^{-1}
Cadmium (Cd)	1.2	1.2	6.2	mg s^{-1}
Mercury (Hg)	2.5	2.5	12.7	mg s^{-1}
Eight metals	2.8	2.8	14.0	mg s^{-1}
Arsenic (As)	34.9	34.9	175	µg s^{-1}
Chromium (VI)	1.7	1.7	8.7	µg s^{-1}
Dioxins and furans (I-TEQ)	5.0	5.0	499	ng s^{-1}
PAHs (as benz(a)pyrene)	5.0	5.0	499	ng s^{-1}
PCBs (TEQ)	0.1	0.1	13.0	ng s^{-1}

Table 7.3 **ADMS 5.0 Maximum Predicted Incremental Concentrations due to Emissions to Atmosphere from the Proposed (μg m^{-3}, Using Short Term Emission Limits**

Pollutant	Period	Allowable Number of Exceedences per year	Predicted Concentration (μg m^{-3})	Assessment Criteria (μg m^{-3})	Percentage of Assessment Criteria (%)
Nitrogen dioxide (NO_2)	1 hour	18	19.4	200	9.7%
Particulate matter (PM_{10})	24 hour	35	2.7	50	5.4%
Sulphur dioxide (SO_2)	15 min	35	31.0	266	11.6%
	1 hour	24	26.6	350	7.6%
	24 hour	3	16.9	125	13.5%
Carbon monoxide	8 Hour	-	8.9	10,000	0.1%
Hydrogen chloride	1 Hour	-	18.4	750	2.5%
Hydrogen fluoride (HF)	1 Hour	-	1.23	160	0.8%
Antimony (Sb) [a]	1 Hour	-	0.017	150	0.0%
Chromium (Cr) [b]	1 Hour	-	0.017	150	0.0%
Copper (Cu)	1 Hour	-	0.017	200	0.0%
Manganese (Mn)	1 Hour	-	0.017	1,500	0.0%
Mercury (Hg)	1 Hour	-	0.015	7.5	0.2%
Vanadium (Vn)	1 Hour	-	0.017	1	1.7%
PCBs (TEQ, fg/m^{-3})	1 Hour		0.0008	6	0.0%

(a) Antimony and compounds (as Sb) except antimony trisulphide and antimony trioxide.
(b) Chromium, chromium (II) compounds and chromium (III) compounds (as Cr).

Table 7.4 **ADMS 5.0 Maximum Predicted Incremental Concentrations due to Emissions to Atmosphere from the Proposed μg m^{-3}, Abnormal Operation**

Pollutant	Period	Allowable Number of Exceedences per year	Predicted Concentration (μg m^{-3})	Assessment Criteria (μg m^{-3})	Percentage of Assessment Criteria (%)
Nitrogen dioxide (NO_2)	1 hour	18	31.6	200	15.8%
Particulate matter (PM_{10})	24 hour	35	13.6	50	27.2%
Sulphur dioxide (SO_2)	15 min	35	109.7	266	41.2%
	1 hour	24	94.2	350	26.9%
	24 hour	3	59.8	125	47.9%
Carbon monoxide	8 Hour	-	8.9	10,000	0.1%
Hydrogen chloride	1 Hour	-	67.2	750	9.0%
Hydrogen fluoride (HF)	1 Hour	-	6.8	160	4.2%
Antimony (Sb) [a]	1 Hour	-	0.086	150	0.1%
Chromium (Cr) [b]	1 Hour	-	0.086	150	0.1%
Copper (Cu)	1 Hour	-	0.086	200	0.0%
Manganese (Mn)	1 Hour	-	0.086	1,500	0.0%
Mercury (Hg)	1 Hour	-	0.078	7.5	1.0%
Vanadium (Vn)	1 Hour	-	0.086	1	8.6%
PCBs (TEQ, fg/m^{-3})	1 Hour		0.080	6	1.3%

(a) Antimony and compounds (as Sb) except antimony trisulphide and antimony trioxide.
(b) Chromium, chromium (II) compounds and chromium (III) compounds (as Cr).

The applicant has considered abnormal emissions of NOX, PM10, SO2, CO, HCl, HF, PCBs, B[a]P and metals against the short term EQS'. Note the Applicant has considered the 1 hour maximum value for comparison with the 24 hour vanadium, which can be considered conservative.

From table 7.4 above, the emissions of the following substances can still be considered insignificant, in that the PC is still <10% of the short-term EQS/EAL.

Carbon Monoxide (CO)

Hydrogen Chloride (HCl)

Hydrogen Fluoride (HF)

PCBs

B[a]P

Metals Sb, Vr, Cu, Mn, Hg, V.

Also from the table 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% of short term EQS/EAL.

Nitrogen Dioxide (NO_2)
Sulphur Dioxide (SO_2)
Particulates (PM_{10})

Finally, for Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Particulates (PM_{10}), we have compared the PEC using background levels from S5.2.1 of this document:

Pollutant	**EQS / EAL**	**Back-ground**	**Abnormal Emission Process Contribution (PC)**		**Predicted Environmental Concentration (PEC)**	
	µg/m^3	**µg/m^3**	**µg/m^3**	**% of EAL**	**µg/m^3**	**% of EAL**
NO_2	200	25.5	31.6	15.8	57.1	28.6
PM_{10}	50	19.8	13.6	27.2	33.4	66.8
SO_2	266	6.8	109.7	41.2	116.5	43.8

The results show that the PEC does not exceed the short term EQS.

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 5.3.3. In these circumstances the TDI would be 0.2077pg(I-TEQ/ kg-BW/day), which is 1.04% of the COT TDI. At this level, emissions of dioxins will still not pose a risk to human health.

5.6 Other Emissions

5.6.1 Emissions to water

There will be no process emissions to surface water. Details of the indicative drainage design are provided in Appendix 19 of the Application.

5.6.2 Emissions to Sewer

There will be process emissions to foul sewer which are conveyed to the Beckton Sewerage Treatment Works prior to discharge to the River Thames. Emissions from the process are limited to intermittent boiler blow-down water and intermittent, occasional maintenance drain-down from the power modules. There will also be discharge associated with drainage from waste storage areas, wash-down water from cleaning and welfare facilities. The discharge will be subject a trade effluent discharge consent issued by Thames Water. The Application included no assessment of the proposed emissions to sewer. The Operator was required provide details of the on-site arrangements designed to ensure compliance with the intended trade effluent discharge consent to foul sewer in a Schedule 5 Notice dated 19/06/2015.

Although the Operator provided some details of the proposed emissions, these did not identify whether there would be on-site provisions for flow-balancing or treatment. The response also failed to identify any control parameters, measurement and monitoring arrangements or maximum daily volumes of discharge. The response did identify that the maximum discharge rate to foul sewer from the Installation is 5l/s If the average discharge rate is 50% of this, it would represent a daily discharge limit over 200m^3. In order to be fully satisfied that discharges to sewer can be successfully dealt with through our working arrangements with Thames Water, the Operator of Beckton SWT, we have included pre-operational condition PO6 which requires the operator to submit for approval a consent to discharge trade effluent to sewer together with details of the on-site arrangements to ensure compliance. These details shall include any on-site provisions for flow-balancing and treatment, control parameters, measurement and monitoring arrangements and maximum daily volumes of effluent together with peak volumetric flows.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

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

- We then consider 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^{LT}, PAH, Cd, 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 consolidated permit conditions, so it may be possible and desirable to achieve emissions below the limits referenced in Chapter IV. However BAT Conclusions and a revised BREF for Incineration have not yet been drafted or published, so the existing BREF and Chapter IV of the IED remain relevant.

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

Should the Installation, once in operation, emit at rates significantly below the limits included in the Consolidated 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 Operator has justified it in terms of:

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

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

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

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

			Low LOI of bottom ash			

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

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

Appendix 1 of the Application identifies that the Operator first carried out a review of the following technologies:

- Conventional incineration
- Pyrolysis
- Gasification

The main issues considered in the review are summarised in the table below.

Topic for comparison	Conventional incineration	Pyrolysis	Gasification
Planning Permission Constraints	Not covered by planning permission.	Not covered by planning permission.	None.
Is the technology well established and operational?	Yes	Three examples but not known if these are currently operational.	Various plants under development in UK and various plants operational throughout the world (Norway, Iceland, Poland, Asia, Pacific Rim, USA etc.)
Optimum plant size and capital costs	Larger than the amount of waste available for this project.	More suitable for the amount of waste available for this project	More suitable for the amount of waste available for this project
Waste pre-treatment	Less required generally although recyclable material removed prior to processing.	Generally required to ensure even and rapid heat transfer to the waste.	Generally required to ensure even and rapid heat transfer to the waste although NOT required with the RODECS® system. Recyclable material such as metals can also be removed post processing. Some of these metals e.g. fine copper wire it is not possible to recover pre-processing.
Flue gas volume	Typically 4,500-6,000 m^3/tonne of waste input.	Lower than incineration	Lower than incineration
Flue gas treatment required?	Yes – in order to meet IED requirements.	Yes – in order to meet IED requirements.	Yes – in order to meet IED requirements.
Flue gas treatment residue amounts	Greater mass likely because of higher flue gas volumes.	Likely to be lower than for incineration.	Likely to be lower than for incineration
Bottom ash	20-35% by mass of dry waste input. Can be recycled subject to quality requirements.	Pyrolysis char has high carbon content and requires further treatment or needs disposal as a waste. Char % could be comparable to incineration, depending on nature	Relatively low mass and carbon content which potentially could be recycled as aggregate. Metal recyclates remaining within the bottom ash/post processing residue will not have

		of waste input.	been oxidized/ destroyed and can be recovered.
Efficiency of Electricity generation per tonne of waste processed	Range 0.4-0.7 MWh quoted, but difficult to compare directly.	Range 0.3-0.75 MWh quoted, but difficult to compare directly.	Range0.3-0.75 MWh quoted, but difficult to compare directly.
General comments	High capital costs and higher waste inputs, planning issues and the inability to remove certain recyclates from the incoming waste stream (which cannot be removed PRE processing and are destroyed during processing) make this alternative unfeasible.	Lower capital costs. Planning Issues. Char disposal costs significant if no use for char can be found.	Lower capital costs. Lower residue disposal costs. Enables valuable recyclates to be recovered and not destroyed / lost to landfill.

The Operator considered gasification to be the preferred technology because:

- Lower Capital costs
- Lower residue disposal costs
- Better recovery of recyclates.

There are a range of gasification technologies available for consideration to use as the proposed technology for the Installation. The operator considered the following:

- Fluidised Bed Gasifiers;
- Grate Gasifiers;
- Rotary Kilns;
- Other systems (RODECS®).

Fluidised Bed Gasifiers

In a fluidised bed gasifier the waste is suspended in a bubbling of hot particles (such as sand), fluidised by hot gases. The benefits of fluidised bed include turbulent mixing and hence good heat and mass transfer. However, elutriation of particles from the bubbling bed can occur and may include ash, carbon, and bed material. Fluidised bed systems are generally more tolerant of variable fuel inputs. Bed material and ash are periodically extracted and replaced with fresh bed material (normally inert sand). The consumption of bed material is fuel dependent, and in certain cases the bed material can be recovered for re-use.

All fluidised bed systems require pre-treatment of the waste to remove coarse dense material and to reduce the top size to a limit of about 300mm. A potential problem with fluidised bed systems is with wastes that have low melting point ash or large quantities of large dense particles, can result in adverse effects on the uniformity of bed fluidisation. However, fluidised bed

systems are more flexible in terms of moisture content of the waste, feed size, calorific value, density, and sulphur content. The main reason for the flexibility is that the fuel is mixed in and retained in the fluidised bed for as long as necessary until reactions are complete. Alkaline materials such as limestone can be added to the bed material to help retain acidic impurities in the solid residues.

Fluidised bed technology is well proven in other applications such as combustion of biomass and coal (but not for applications processing mixed waste). Power consumption is generally higher than non-fluidised bed systems due to the additional fan power requirements for fluidisation of the bed. The waste materials to be processed at the Installation would require significant pre-treatment to render them suitable for processing in a fluidised bed gasification system.

Grate Gasifiers

The flow of gasification medium (generally air) through the bed can be upwards (updraft) or downwards (downdraft), and there are also different mechanisms for discharging the ash. One common configuration is the grate gasification system. This system is similar to grate combustion systems but insufficient air is supplied for complete combustion (sub-stoichiometric). In a grate system, waste is fed in at one end and goes through the process of drying and gasification as it travels along the grate to the discharge end. By the time the solid mass reaches the end of the grate, only ash and un-reacted carbon should remain for discharge.

Grate systems are well proven for waste combustion applications. However, gasification reaction rates are lower than those for combustion processes due to lower temperatures and lower oxygen-fuel ratios, and solid residues may contain higher levels of un-reacted carbon. A degree of pre-treatment would be required in order to render the Thames Gateway Waste to Energy waste materials suitable for a grate gasifier.

Rotary Kilns

In a rotary kiln, the waste is fed into one end of a rotating drum. As the waste progresses through the drum, it is dried and thermally decomposed into volatiles and char. The slow rotation of the drum causes the waste to tumble, promote mixing, and to increase the exposure of the waste to contact with hot gases and with the indirect heated surface of the kiln.

Alkaline reagents such as lime can also be added to the rotary kiln to help retain acidic impurities in the solid residues. Power consumption is generally higher than static systems, due to the additional power requirements for the kiln drive motors. A degree of pre-treatment would be required in order to render the Thames Gateway Waste to Energy waste materials suitable for rotary kiln gasification, particularly in relation to the initial charging of the waste.

RODECS® Batch Gasification System

Un-segregated waste is loaded in to the RODECS® processing bin, which is an integral part of the gasifier system. The filled bin is located on a movable trolley car designed to hold two bins. The trolley will then move the freshly filled feed bin towards the RODECS® immediately next to the position in which the processed bin is removed. The processed bin will then be unlatched from the RODECS®, and the trolley moved into a position such that the fresh feed bin is in place to be latched to the RODECS®. After the fresh bin has been attached, the RODECS® will then rotate 180 degrees so that the bin will be at the top of the RODECS® and inverted, starting the process cycle. Changing bins will be accomplished in approximately three minutes.

The RODECS® gasifier uses a patented process to control both the atmospheric conditions within the RODECS® and the conversion rate of the energy-containing materials in the feed into a syngas consisting primarily of Carbon Monoxide (CO), Hydrogen (H_2), Carbon Dioxide (CO_2), Methane (CH_4), Water (H_2O) and Nitrogen (N_2) from the air fed to the process. The temperature inside the gasifier (550°C) is maintained below the melting temperatures of the metals to be recovered. The syngas is generated in the RODECS® processing chamber and the rate of reaction is controlled by an array of control parameters (which include flow, temperature, Oxygen-level).

The rate at which the batch is heated is determined by the process chamber movement, volume of gases and temperature of the recycled hot gases sent to the RODECS® from the dedicated combustion chamber. The preheated gases provide sensible heat required for heating. The gases are also used to fluidize the feed to enhance the rate of production of the syngas in the RODECS®. The remaining material e.g. metal, glass etc. are mechanically retained inside the RODECS® processing chamber. At the end of the batch processing, the RODECS® will be rotated such that the bin is back at the bottom with these materials falling back into the bin for removal. The bin will be unlatched and the contents can be sent for material separation and recovery of the recyclable material such as metals and glass. The total cycle time will be approximately 120 minutes. The time required to reach threshold syngas production is expected to be in the region of 25 minutes. The cool down time before unlatching the bin where the average syngas production rate has declined below the threshold value to the complete depletion of syngas is expected to take 10 to 15 minutes. Only after full depletion of the syngas and the raising of the Oxygen level at the end of the cycle to enable Carbon reduction, is the bin un-latched. As previously mentioned, the syngas is combusted in the secondary combustion chamber, with all of the pollution control systems to ensure compliance with the IED ELVs.

The Operator has also considered net generating efficiencies of the gasification technologies. These are summarised in the following table:

Thermal Treatment	FB Gasification	Grate Gasification	Rotary Kiln	RODECS®
Power Generation	ALL STEAM CYCLE			
Overall Net Electrical Efficiency (%)	15	14-20	20-25	25

On the basis of the above data, the overall net electrical efficiency of the RODECS® system is significantly greater than that claimed for Fluidised Bed Gasification. It is also greater than the upper end of the range quoted for grate gasification. The figures for rotary kiln appear to offer similar efficiency at the high end of the range to the RODECS® system but the data set are incomplete and there is no information on parasitic load, steam conditions or similar data. As such, the RODECS® gasification process has advantages over the alternative approaches to gasification.

From our assessment of the Sankey diagram, Energy generated is 19.6MW from 93.4 MW input (including the auxiliary fuel), which is 21% efficiency. Nevertheless, the Applicant has sufficiently demonstrated that their chosen option is expected to meet the indicative BAT and IED requirements. We accept that the proposal for gasification, using the RODECS® system is BAT for the treatment of mixed commercial and industrial residual waste in this location.

The Operator proposes to use gas as support fuel for start-up, shut down and for the auxiliary burners. The choice of support fuel is based on EPR 5.01, which notes that measures to reduce CO_2 emissions in this sector are only relevant to the support fuels used and that natural gas will be the preferred option. Diesel is used as fuel for on-site vehicles.

Boiler Design

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

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

Any of the options listed in the BREF and summarised in the tables above can be BAT. The Operator has chosen a furnace technique that is listed in the BREF and we are satisfied that the Operator has provided sufficient justification to show that their technique is BAT. This is not to say that the other techniques could not also be BAT, but that the Operator has shown that

the chosen technique is at least comparable with the other BAT options. We believe that, based on the information gathered by the BREF process, the chosen technology will achieve the requirements of Chapter IV of the IED for the air emission of TOC/CO and the TOC on bottom ash.

6.2 BAT and emissions control

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

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

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

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

6.2.1 Particulate Matter

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

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

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

6.2.2 Oxides of Nitrogen

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

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

The Operator proposes to implement the following primary measures:

- Low NOx burners will be used in the combustion chambers.
- Starved air systems – this technique also simultaneously reduces CO and is defined as BAT for gasification systems
- Optimise primary and secondary air injection – this technique is BAT for all plant.
- Flue gas recirculation – this technique reduces the consumption of reagents for secondary NO_x control and can increase overall energy recovery, although in some applications there can be corrosion problems – the technique is considered BAT for all plant.

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

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

The Operator proposes to use SNCR with ammonia as the reagent.

Emissions of NO_x cannot be screened out as insignificant. The Operator has carried out a comparison with SCR in Table 4 of the supporting document. This is not a full costs/benefits analysis. The benefits of SNCR over SCR are summarised as follows:

- Likely to be greater decrease in NOx, often >80%. However, levels of this magnitude are not required in order to achieve the ELV, which is already below the IED limit.
- reheat of gases required, hence energy efficiency potentially lower.
- A temperature of 350^{o}C is not possible for a bag filter to handle (max. continuous operating temperature of high temperature bags such as P84 is limited to 240^{o}C). As such, even more expensive ceramic candle filters would be required which also require a greater footprint
- An SCR system proposed by Lesni costs approx. £1.2M – including delivery, mechanical and electrical installation and commissioning i.e. approx. £600,000 more expensive than the YARA SNCR system.
- Requires more space for additional process unit.

Based on the information above, the Operator considers that the additional cost of SCR over SNCR is not justified. Thus SCR is not BAT in this case, and SNCR is BAT for the Installation. We have given consideration to whether a full costs/benefits analysis required by means of a Schedule 5 Notice. However, we have decided this is not necessary because emissions of NO_x from this proposal will have less impact than the existing Permit. The Operator has justified the use of ammonia as the reagent on the basis of lower nitrous oxide formation if dosing is optimised and reduced solids waste. The Environment Agency agrees with this assessment.

The amount of ammonia used for NO_x abatement will need to be optimised to maximise NO_x reduction and minimise NH_3 slip. Improvement condition IC5 requires the Operator to report to the Environment Agency on optimising the performance of the NO_x abatement system. The Operator is also required to monitor and report on NH_3 and N_2O emissions every 3 months.

6.2.3 Acid Gases, SO_x, HCl and HF

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

Acid gases and halogens : Secondary Measures (BAT is to apply Primary Measures first)				
Technique	**Advantages**	**Disadvantages**	**Optimisation**	**Defined as BAT in BREF or TGN for:**
Wet	High reaction rates Low solid residues production Reagent delivery may be optimised by concentration	Large effluent disposal and water consumption if not fully treated for re-cycle Effluent treatment plant required		Plants with high acid gas and metal components in exhaust gas – HWIs

	and flow rate	May result in wet plume Energy required for effluent treatment and plume reheat		
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: Sodium Bicarbonate	Good removal rates Easiest to handle Dry recycle systems proven	Efficient temperature range may be at upper end for use with bag filters – Leachable solid residues Bicarbonate more expensive	Not proven at large plant	CWIs

The Operator proposes to implement the following primary measures:

- Use of low sulphur fuels for start up and auxiliary burners – gas should be used if available, where fuel oil is used, this will be low sulphur (i.e. <0.1%), this will reduce SO_x at source. The Operator has justified its choice of gas as the support fuel on the basis that it is the recommended choice if available and we agree with that assessment.

- Careful control of waste inputs and hence smoothing of spikes that could be caused by burning of a particular waste with high content of acid gas precursor.

- Identification of wastes that lead to exceedances of IED limit values, and exclusion of such wastes from the Installation.

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.

The Operator considers wet scrubbing systems to be relatively complex and expensive, although it is noted that they can lead to low concentrations of acid gases. However, significant volumes of effluent would require disposal and the system is therefore not considered to be BAT for this facility. We agree with this assessment

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

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

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

The Operator considers semi-dry scrubbing systems to be more complex than dry scrubbing systems as well as more expensive to install and maintain. Consequently, the use of semi-dry scrubbing systems is rejected in favour of a dry system. The cost-benefit analysis is included in sections 2.2.20 - 2.2.29 of the supporting document.

In this case, the Operator proposes to a dry scrubber system using Lime as the neutralisation reagent. The Environment Agency is satisfied that this is BAT.

6.2.4 Carbon monoxide and volatile organic compounds (VOCs)

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

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

6.2.5 Dioxins and furans (and Other POPs)

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

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

- optimisation of combustion control including the maintenance of permit conditions on combustion temperature and residence time, which has been considered in 6.1.1 above;
- avoidance of de novo synthesis, which has been covered in the consideration of boiler design;
- the effective removal of particulate matter, which has been considered in 6.2.1 above;
- injection of activated carbon. This can be combined with the acid gas reagent or dosed separately. Where the feed is combined, the combined feed rate will be controlled by the acid gas concentration in the exhaust. Therefore, separate feed of activated carbon would normally be considered BAT unless the feed was relatively constant. Effective control of acid gas emissions also assists in the control of dioxin releases.

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

6.2.6 Metals

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

The prevention and minimisation of metal emissions is achieved through the effective removal of particulate matter, and this has been considered in 6.2.1 above. The relatively low primary gasification temperature also means that most metals (except mercury) are not volatilised to a large extent hence this will lead to relatively low metal concentrations in the syngas and flue gas, with partitioning of metals in the waste feedstock occurring mainly to the solid residue in the RODECs processing bin.

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 Operator 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 Variation. Emissions of carbon dioxide (CO_2) and other greenhouse gases differ from those of other pollutants in that, except at gross levels, they have no localised environmental impact. Their impact is at a global level and in terms of climate change. Nonetheless, CO_2 is clearly a pollutant for IED purposes.

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

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

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

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

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

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

On the credit side

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

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

The Operator considered energy efficiency and compared SCR to SNCR in its BAT assessment. This is set out in sections 4.3.7, 6.1.1 and 6.2.2 of this decision document.

Note: avoidance of methane which would be formed if the waste was landfilled has not been included in this assessment. If it were included due to its avoidance it would be included on the credit side. The Operator states there is a net positive impact with respect to the proposed technology, which results in an estimated 35,000 tonnes CO_2/year. This is considerably less than the surrogate level of 150,000 tonnes CO_2/year given in paragraph A6.2 of

RGN8, above which a release is deemed substantial. Ammonia has no direct GWP effect.

Without consideration of waste to landfill, the Operator's assessment shows that the difference in global warming potential between the best option in terms of GWP and the Operator's preferred option is minor. The purpose of a BAT appraisal is to determine which option minimises the impact on the environment as a whole. In this context the small benefit in terms of GWP of the other options is considered to be more than offset by the other benefits of the preferred option.

Taking waste to landfill into account, the Operator's assessment shows the RODECs system is better than the SBOS system 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 (e.g. 0.1 ng/m^3 for MWIs) and using BAT for incineration. UN Economic Commission for Europe (Executive Body for the Convention) (ECE-EB) produced BAT guidance for the parties to the Convention in 2009. This document considers various control techniques and concludes that primary measures involving management of feed material by reducing halogenated substances are not technically effective. This is not surprising because halogenated wastes still need to be disposed of and because POPs can be generated from relatively low concentrations of halogens. In summary, the successful control techniques for waste incinerators listed in the ECE-EB BAT are:

- maintaining furnace temperature of 850^oC 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^oC
- 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 consolidated permit ensures that the formation and release of POPs will be prevented or minimised. As we explain above, high-temperature incineration is one of the prescribed methods for destroying POPs. Permit conditions are based on the use of BAT and Chapter IV of IED and incorporate all the above requirements of the UN-ECE BAT guidance and deliver the requirements of the Stockholm Convention in relation to unintentionally produced POPs.

The release of **dioxins and furans** to air is required by the IED to be assessed against the I-TEQ (International Toxic Equivalence) limit of 0.1 ng/m^3. Further development of the understanding of the harm caused by dioxins has resulted in the World Health Organisation (WHO) producing updated factors to calculate the WHO-TEQ value. Certain **PCBs** have structures which make them behave like dioxins (dioxin-like PCBs), and these also have toxic equivalence factors defined by WHO to make them capable of

being considered together with dioxins. The UK's independent health advisory committee, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has adopted WHO-TEQ values for both dioxins and dioxin-like PCBs in their review of Tolerable Daily Intake (TDI) criteria. The Consolidated permit requires that, in addition to the requirements of the IED, the WHO-TEQ values for both dioxins and dioxin-like PCBs should be monitored for reporting purposes, to enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT. The release of dioxin-like PCBs and PAHs is expected to be low where measures have been taken to control dioxin releases. The Consolidated permit also requires monitoring of a range of PAHs and dioxin-like PCBs at the same frequency as dioxins are monitored. We have included a requirement to monitor and report against these WHO-TEQ values for dioxins and dioxin-like PCBs and the range of PAHs as listed in the Consolidated permit. We are confident that the measures taken to control the release of dioxins will also control the releases of dioxin-like PCBs and PAHs. Section 5.2.1 of this document details the assessment of emissions to air, which includes dioxins and concludes that there will be no adverse effect on human health from either normal or abnormal operation.

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

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

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

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

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

6.5 Other Emissions to the Environment

6.5.1 Emissions to water

There shall be no process emissions to water. Indicative drainage design is shown on the plans in Appendix 19. 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

There shall be process emissions to sewer. Emissions from the process itself are limited to intermittent boiler blow-down water and intermittent, and very infrequent, maintenance drain down from the power modules, both of which will be discharged to foul sewer. There will also be discharge associated with drainage from waste storage areas, wash-down water from cleaning and welfare facilities. Discharges to sewer ultimately discharge into the River Thames via the Beckton STW, operated by Thames Water. The Operator has no consent to discharge to sewer and provided little detail of on-site control and monitoring measures. Additional information was submitted in response to a Schedule 5 Notice dated 19/06/2015 to provide details of on-site arrangements designed to ensure compliance with the intended trade effluent discharge consent to foul sewer.

Based upon the information in the Application we are not fully satisfied that appropriate measures will be in place to prevent and/or minimise emissions to sewer. A pre-operational condition (PO6) has been included to ensure that prior to the commencement of commissioning, the operator to submit for approval a written consent to discharge trade effluent to sewer together with details of the on-site arrangements to ensure compliance. These details shall include any on-site provisions for flow-balancing, treatment, measurement, control and monitoring together maximum daily volumes of effluent together with peak volumetric flows.

6.5.3 Fugitive emissions

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

Potential fugitive emissions to air, water and land have been identified in the H1 screening assessment submitted as Appendix of the application. The Operator has demonstrated that with the implementation of appropriate risk

management measures, none of the potential releases is significant. Good housekeeping practices will be implemented to ensure that any spillages of potentially dusty materials are cleared up at the earliest opportunity. Spill kits will be available for clean-up of all chemicals stored and used within the Installation and will be located in close proximity to storage areas / delivery points as appropriate. Potential fugitive releases to surface water, sewer and groundwater are likely to occur only as a result of an incident or accident. Procedures will be implemented in the event of an accident.

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

6.5.4 Odour

An odour assessment has been undertaken and is contained in Appendix 10 of the application information.

Contingencies exist for removal of odorous wastes from the Installation should waste processing be delayed for a length of time that could lead to unacceptable odour emissions. Storage arrangements and maximum storage times for wastes are such that significant odours should not result from waste storage.

Odour is unlikely to give rise to environmental concern of subsequent complaints by the very nature of the wastes to be accepted at the Installation, i.e. commercial and industrial wastes which will be much drier and less odorous than biodegradable municipal waste. There will, nevertheless, be a biodegradable element to the wastes, which will need to be handled and appropriately managed to ensure no adverse odours are released.

The odour extraction system will be designed to provide up to five air changes/hour to prevent egress of odorous air. This system will comprise a filter for removal of particulate matter from the air stream, followed by a pair of adsorption vessels, consisting of carbon filters. The extraction fans will be fitted with variable speed drives to allow the extraction rate for the building to be varied in line with the operations and occupancy within the building thereby reducing the overall power demand of the system. The maximum quantity of waste for treatment to be stored at the Installation will be 1,980 tonnes. This represents less than 3.5 days. All incoming waste will be stored in the reception building. Wastes will not be stored for a period of greater than seven days from the day of receipt.

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

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

The Application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures. Measurements were taken of the prevailing ambient noise levels to produce a baseline noise survey and an assessment was carried out in accordance with BS 4142:2014 to compare the predicted plant rating noise levels with the established background levels.

The background data used in the Noise assessment was based on measurements made in 2009, which did not include week-end data. The Operator was required to provide evidence in response to a Schedule 5 Notice dated 19/06/2015 that the 2009 background data is representative of the current noise climate when the site is operating or undertake further monitoring and resubmit the BS4142 assessment. The Operator submitted an amended noise survey, which had been updated with a week long programme of monitoring, including the weekend, undertaken between 12th and 19th June 2014. This was compared with the 2009 background data to demonstrate that when the site is operating, the Installation noise still does not exceed background at any receptor.

The amended survey presented noise levels at three locations, measured during monitoring undertaken from Saturday 12th to Saturday 19th of June 2014. It presented the range and average L_{A90} values during day time and night time for both week-day and weekend. It did not present hourly measured data to demonstrate that the LA90 data is representative. It did not indicate what times were assumed for night time or day time nor did it present the reference time interval over which measurements were made. Furthermore, it did not record the weather conditions in line with BS4142 (2014).

The survey notes the monitoring locations vary slightly between the 2009 and 2014 surveys due to the access and security issues, however the 2014 locations were selected to be representative of the existing background noise climate at noise sensitive receptors around the proposed Installation. We have reviewed their locations and agree with their selection.

Table 4a included in the schedule 5 response outlines a summary of the results of the 2009 and 2014 surveys. The 2014 data does not include measurements for monitoring location 3, which is not a noise sensitive receptor. The data suggests no changes at location 1; a reduction in weekday day-time and night time levels at location 2; and no change in daytime levels at receptor 4, but an increase in night-time levels.
The applicant has carried out a revised BS4142 assessment for the weekday day-time and night-time using the updated data. Results indicate a less than marginal significance at all receptors assessed.

We note that the Applicant has not undertaken a BS4142 assessment during the weekend. Based on their results and background data presented, we have undertaken a BS4142 assessment background, the results of which do not affect the conclusions.

We have also considered the impact of the results in the context of the sensitivity checks discussed in our audit report (AQMAU_C1282_RP01). We can confirm that using the 2014 background monitoring results we agree with the applicants conclusions that the proposed facility is unlikely to result in an adverse impact at sensitive receptors.

Nevertheless, an improvement condition (IC 1) has been included for the Operator to submit a written report to the Agency on the commissioning of the Installation. The report shall summarise the environmental performance of the plant as installed against the design parameters set out in the Application. The report shall also include a review of the performance of the facility against the conditions of the permit and details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions. This includes a comparison of noise emissions at receptors included in Appendix 9 of the Application. This report is to be submitted within 4 months of the completion of commissioning,

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 Operator's proposals are BAT, and that there is no justification to reduce ELVs below the Chapter IV limits in these circumstances.

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

(i) Local factors

We have considered the following information:

Local wildlife and Nature Reserves close to the Installation.

Given the emission limits imposed, it is unlikely that these receptors will be affected.

(ii) National and European EQSs

The Installation is located in an Air Quality Management Area (AQMA) for Nitrogen Dioxide and planning permission is conditional on the achievement of a daily average nitrogen dioxide (NO_2) limit of no greater than 150 mg/Nm^3 at the conditions set out in the Industrial Emissions Directive Annex VI Part 3. The Environment Agency must ensure that any proposals minimise any NOx within an AQMA and we are satisfied that the technology proposed is capable of achieving this limit and that impacts arising from emissions of NOx are less than those originally permitted.

In the original Permit, the Environment Agency went beyond the IED (previously WID) requirements for monitoring and has required the use of continuous monitors for ammonia and nitrous oxide. This is to ensure that any increase in ammonia use at the site does not result in greater 'ammonia slip' from the abatement plant or to the formation of nitrous oxide. We are satisfied these arrangement remain relevant and the monitoring requirements have been retained

(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/recovery of energy from waste. Controls in the form of restrictions on the volume and type of waste that can be accepted at the Installation and permit conditions relating to energy efficiency effectively apply equivalent technical measures to limit CO_2 emissions.

(iv) Commissioning

A pre-operational condition has been included to ensure that commissioning occurs to the satisfaction of the Environment Agency and a post commissioning improvement condition has been included to report on the performance of the facility against the conditions of this permit and provide details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions.

6.7 Monitoring

6.7.1 Monitoring during normal operations

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

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

There are no monitoring arrangements for emissions to water or sewer although emissions to sewer shall be reviewed following completion of PO6.

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

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

The Operator has stated in 2.10.14 of the Supporting Document that they will provide back-up CEMS working in parallel to the operating CEMS. These will be switched into full operation immediately in the event that there is any failure in the regular monitoring equipment. The back-up CEMS measure the same parameters as the operating CEMS. In the unlikely event that the back-up CEMS also fail Condition 2.3.10 of the consolidated permit requires that the abnormal operating conditions apply.

6.7.3 Continuous emissions monitoring for dioxins and heavy metals

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

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

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

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

- The decision of the London Borough of Barking & Dagenham to grant planning permission on 05/11/2014.

- The report and decision notice of the local planning authority accompanying the grant of planning permission.

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

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

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

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

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

We must exercise our relevant functions for the purposes of ensuring that the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste and that any waste generated is treated in

accordance with Article 4 of the Waste Framework Directive. (See also section 4.3.9)

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

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

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

Article 23(1) requires the permit to specify:

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

These are all covered by permit conditions.

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

7.2 National primary legislation

7.2.1 **Environment Act 1995**

(i) Section 4 (Pursuit of Sustainable Development)

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

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

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

(ii) Section 7 (Pursuit of Conservation Objectives)

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

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

(iii) Section 81 (National Air Quality Strategy)

We have had regard to the National Air Quality Strategy and consider that our decision complies with the Strategy, and that no additional or different conditions are appropriate for this consolidated permit other than those already included in the determination.

7.2.2 **Human Rights Act 1998**

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

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

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

7.2.4 **Wildlife and Countryside Act 1981**

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

We assessed the Application and concluded that the Installation will not damage the special features of any SSSI because there are no SSSI's within 2km of the Installation.

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

Section 40 of this Act requires us to have regard, so far as is consistent with the proper exercise of our functions, to the purpose of conserving biodiversity.

We have done so and consider that no different or additional conditions in the Consolidated 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 because there are no European sites within 10km of the installation.

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant EU legislation

None

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 2.2 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(a) and Table S2.2 in Schedule 2 of the Consolidated permit.
45(1)(b)	The permit shall include the total waste incinerating or co-incinerating capacity of the plant.	Condition 2.3.3(a) and Table S2.2 in Schedule 2 of the Consolidated permit.
45(1)(c)	The permit shall include the limit values for emissions into air and water.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1(a) in Schedule 3 of the Consolidated permit.
45(1)(d)	The permit shall include the requirements for pH, temperature and flow of waste water discharges.	Not Applicable
45(1)(e)	The permit shall include the sampling and measurement procedures and frequencies to be used to comply with the conditions set for emissions monitoring.	Conditions 3.5.1 to 3.5.5 and Tables S3.1, S3.1(a), S3.3 and S3.4 in Schedule 3 of the Consolidated permit.
45(1)(f)	The permit shall include the maximum permissible period of unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices, during which the emissions into the air and the discharges of waste water may exceed the prescribed emission limit values.	Conditions 2.3.10 and 2.3.11.
45(2)(a)	The permit shall include a list of the quantities of the different categories of hazardous waste which may be treated.	Not Applicable
45(2)(b)	The permit shall include the minimum and maximum mass flows of those hazardous waste, their lowest and maximum calorific values	Not Applicable

IED Article	Requirement	Delivered by
	and the maximum contents of polychlorinated biphenyls, pentachlorophenol, chlorine, fluorine, sulphur, heavy metals and other polluting substances.	
46(1)	Waste gases shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Condition 2.3.1(a) and Table S1.2 of Schedule 1 of the Consolidated permit.
46(2)	Emission into air shall not exceed the emission limit values set out in parts 4 or determined in accordance with part 4 of Annex VI.	Conditions 3.1.1 and 3.1.2 and Tables S3.1 and S3.1a.
46(3)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(4)	Relates to conditions for water discharges from the cleaning of exhaust gases.	There are no such discharges as condition 3.1.1 prohibits this.
46(5)	Prevention of unauthorised and accidental release of any polluting substances into soil, surface water or groundwater. Adequate storage capacity for contaminated rainwater run-off from the site or for contaminated water from spillage or fire-fighting.	The application explains the measures to be in place for achieving the directive requirements
46(6)	Limits the maximum period of operation when an ELV is exceeded to 4 hours uninterrupted duration in any one instance, and with a maximum cumulative limit of 60 hours per year. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	Conditions 2.3.10 and 2.3.11
47	In the event of breakdown, reduce or close down operations as soon as practicable. Limits on dust (150 mg/m3), CO and TOC not to be exceeded during this period.	Condition 2.3.11
48(1)	Monitoring of emissions is carried out in accordance with Parts 6 and 7	Conditions 3.5.1 to 3.5.5. Reference

IED Article	Requirement	Delivered by
	of Annex VI.	conditions are defined in Schedule 6 of the Consolidated permit.
48(2)	Installation and functioning of the automated measurement systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	Condition 3.5.3, and tables S3.1, S3.1(a), and S3.4
48(3)	The competent authority shall determine the location of sampling or measurement points to be used for monitoring of emissions.	Conditions 3.5.3 and 3.5.4
48(4)	All monitoring results shall be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.	Conditions 4.1.1 and 4.1.2, and Tables S4.1 and S4.4
49	The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	Conditions 3.1.1 and 3.1.2 and 3.5.5
50(1)	Slag and bottom ash to have Total Organic Carbon (TOC) < 3% or loss on ignition (LOI) < 5%.	Conditions 3.5.1 and Table S3.5
50(2)	Flue gas to be raised to a temperature of 850ºC for two seconds, as measured at representative point of the combustion chamber.	Condition 2.3.7, Pre-operational condition PO3 and Improvement condition IC4 and Table S3.4
50(3)	At least one auxiliary burner which must not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil liquefied gas or natural gas.	Condition 2.3.8
50(4)(a)	Automatic shut to prevent waste feed if at start up until the specified temperature has been reached.	Condition 2.3.7
50(4)(b)	Automatic shut to prevent waste feed if the combustion temperature is not maintained.	Condition 2.3.7
50(4)(c)	Automatic shut to prevent waste feed if the CEMs show that ELVs are exceeded due to disturbances or failure of waste cleaning devices.	Condition 2.3.7

IED Article	Requirement	Delivered by
50(5)	Any heat generated from the process shall be recovered as far as practicable.	(a) The plant will generate electricity (b)Operator to review the available heat recovery options prior to commissioning (Condition PO2) and then every 2 years (Conditions 1.2. 1 to 1.2.3)
50(6)	Relates to the feeding of infectious clinical waste into the furnace.	No infectious clinical waste will be burnt
50(7)	Management of the Installation to be in the hands of a natural person who is competent to manage it.	Conditions 1.1.1 to 1.1.3 and 2.3.1 of the Consolidated permit.
51(1)	Different conditions than those laid down in Article 50(1), (2) and (3) and, as regards the temperature Article 50(4) may be authorised, provided the other requirements of this chapter are me.	No such conditions Have been allowed
51(2)	Changes in operating conditions do not cause more residues or residues with a higher content of organic polluting substances compared to those residues which could be expected under the conditions laid down in Articles 50(1), (2) and (3).	No such conditions Have been allowed
51(3)	Changes in operating conditions shall include emission limit values for CO and TOC set out in Part 3 of Annex VI.	No such conditions Have been allowed
52(1)	Take all necessary precautions concerning delivery and reception of Wastes, to prevent or minimise pollution.	Conditions 2.3.1, 2.3.3, 3.2, 3.3, 3.4 and 3.6.
52(2)	Determine the mass of each category of wastes, if possible according to the EWC, prior to accepting the waste.	Condition 2.3.3(a) and Table S2.2 in Schedule 3 of the Consolidated permit.
53(1)	Residues to be minimised in their amount and harmfulness, and recycled where appropriate.	Conditions 1.4.1, 1.4.2 and 3.5.1 with Table S3.5
53(2)	Prevent dispersal of dry residues and dust during transport and storage.	Conditions 1.4.1 2.3.1, 2.3.2 and 3.2.1.

IED Article	Requirement	Delivered by
53(3)	Test residues for their physical and chemical characteristics and polluting potential including heavy metal content (soluble fraction).	Condition 3.5.1 and Table S3.5and pre-operational condition PO4.
55(1)	Application, decision and permit to be publicly available.	All documents are accessible from the Environment Agency Public Register.
55(2)	An annual report on plant operation and monitoring for all plants burning more than 2 tonne/hour waste.	Conditions 4.2.2 and 4.2.3.

ANNEX 2: Pre-Operational Conditions

Based on the information on the Application, we consider that we do need to impose pre-operational conditions. These conditions are set out 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.

Table S1.4 Pre-operational measures	
Reference	Pre-operational measures
PO1	Prior to the commencement of commissioning, the Operator shall send a summary of the site Environment Management System (EMS) to the Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with the requirements set out in Section 1 of How to comply with your environmental permit – Getting the basics right. The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.
PO2	Prior to the commencement of commissioning, the Operator shall submit for approval a written report to the Environment Agency, which will contain a comprehensive review of the options available for utilising the heat generated by the waste incineration process in order to ensure that it is recovered as far as practicable. The review shall: • detail any identified proposals for improving the recovery and utilisation of waste heat and • provide a timetable for the implementation of the identified proposals • include a Cost Benefit Analysis of the operation of the installation as a high-efficiency cogeneration installation. The analysis shall be undertaken using the methodology contained in our Guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive dated 25/10/2012. The proposals shall be implemented in accordance with the written approval from the Environment Agency.
PO3	Prior to the commencement of commissioning, the Operator shall provide a written commissioning plan, including timelines for completion, for approval by the Environment Agency. The commissioning plan shall include the expected emissions to the environment during the different stages of commissioning, the expected durations of commissioning activities and the actions to be taken to protect the environment and report to the Environment Agency in the event that actual emissions exceed expected emissions. Commissioning shall be carried out in accordance with the commissioning plan as approved.
PO4	Prior to the commencement of commissioning, the operator shall submit a written plan to the Environment Agency detailing the ash sampling protocol to be used for Air Pollution Control (APC) residues and bottom ash, in conformance to Environment Agency Guidance.
PO5	Prior to the commencement of commissioning, the Operator shall submit a written report to the Environment Agency detailing the waste acceptance procedure to be used at the site. The waste acceptance procedure shall include the process and systems by which wastes unsuitable for incineration at the site will be controlled. The procedure shall be implemented in accordance with the written approval

Table S1.4 Pre-operational measures	
Reference	Pre-operational measures
	from the Agency.
PO6	Prior to the commencement of commissioning, the operator to submit for approval a written consent to discharge trade effluent to sewer together with details of the on-site arrangements to ensure compliance. These details shall include any on-site provisions for flow-balancing and treatment, control parameters, measurement and monitoring arrangements and maximum daily volumes of effluent together with peak volumetric flows.
PO7	At least three months before operation, the Operator shall submit a written report to the Environment Agency specifying arrangements for continuous and periodic monitoring of emissions to air to comply with Environment Agency guidance notes M1 and M2. The report shall include the following: • Plant and equipment details, including accreditation to MCERTS • Methods and standards for sampling and analysis • Details of monitoring locations, access and working platforms
PO8	Prior to the commencement of commissioning, the Operator shall submit the written protocol referenced in condition 3.2.4 for the monitoring of soil and groundwater for approval by the Environment Agency. The protocol shall demonstrate how the Operator will meet the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED. The procedure shall be implemented in accordance with the written approval from the Environment Agency.

ANNEX 3: Improvement Conditions

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

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

Reference	Improvement measure	Completion date
IC5	The Operator shall submit a written report to the Environment Agency describing the performance and optimisation of the Selective Non Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NO_x) emissions within the emission limit values described in this consolidated permit with the minimisation of nitrous oxide emissions. The report shall include an assessment of the level of NO_x and N_2O emissions that can be achieved under optimum operating conditions. The report shall also provide details of the optimisation (including dosing rates) for the control of acid gases and dioxins.	Within 4 months of the completion of commissioning.
IC6	The Operator shall submit a written summary report to the Agency to confirm by the results of calibration and verification testing that the performance of Continuous Emission Monitors for parameters as specified in Table S3.1 and Table S3.1(a) complies with the requirements of BS EN 14181, specifically the requirements of QAL1, QAL2 and QAL3.	Initial calibration report to be submitted to the Agency within 3 months of completion of commissioning. Full summary evidence compliance report to be submitted within 18 months of commissioning.

ANNEX 4: Consultation Reponses

A) Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website from 20th April 2015 to 20th May 2015. Copies of the Application were placed in the Environment Agency Public Register at:

Apollo Court
2 Bishops Square Business Park
St. Albans Road West
Hatfield
Herts
AL10 9EX

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

- London Borough of Barking & Dagenham (Environmental Protection)
- London Borough of Barking & Dagenham (Planning)
- London Fire Brigade - Barking & Dagenham
- Director of Public Health - London Borough of Barking & Dagenham
- NHS- Barking & Dagenham
- Foods Standards Agency
- Health & Safety Executive
- Public Health England
- Thames Water (Sewerage Undertaker)

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from The London Borough of Barking & Dagenham (Local planning Authority)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
The London Borough of Barking & Dagenham attached a planning condition regarding NO_2 emissions (condition no. 10) which is shown at Appendix 17 of the applicant's submission as the Borough falls within an Air Quality Management Area. Provided the applicant maintains their commitment to working within these NO_2 limits we would have no objection to the application.	A daily emission limit of 150mg/m^3 for oxides of Nitrogen as NO_2 has been included in the Permit. We are satisfied that the chosen technology is capable of operating within this limit.

Response Received from Public Health England	
Brief summary of issues raised:	Summary of action taken / how this has been covered
We recommend that any Environmental Permit issued for this site should contain conditions to ensure that potential emissions to air of nitrogen dioxide and particulate matter in particular do not impact upon public health, given that the site is in an Air Quality Management Area. Based solely on the information contained in the application, PHE has no significant concerns regarding risk to health of the local population from this proposed activity, providing that the applicant takes all appropriate measures to prevent or control pollution, in accordance with the relevant sector technical guidance or industry best practice.	A daily average nitrogen dioxide (NO_2) limit of no greater than 150 mg/Nm^3 at the conditions set out in the Industrial Emissions Directive Annex VI Part 3 has been set to ensure the proposals minimise any NOx within the Air Quality Management Area. We are satisfied that the technology proposed is capable of achieving this limit and that impacts arising from emissions of NOx are less than those originally permitted. Emissions of particulates have been screened out and modelled out as insignificant. For further information, refer to Section 5 of this document Prior to the commencement of commissioning, an Environmental Management System (EMS) shall be made available for inspection. The EMS shall be developed in line with the requirements set out in Section 1 of How to comply with your environmental permit. The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.

Response Received from The London Borough of Barking & Dagenham (Local planning Authority)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
The London Borough of Barking & Dagenham Environmental Protection team have no comment to make in addition to that provided by the local planning Authority	No additional action required.

No consultation responses were received from:

- London Fire Brigade - Barking & Dagenham
- NHS- Barking & Dagenham
- Foods Standards Agency
- Health & Safety Executive
- Public Health England
- Thames Water (Sewerage Undertaker)

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

No consultation responses were received from members of the Public or Community Organisations.

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3) <u>Representations from Local MP and Councillors</u>

No consultation responses were received from the Local MP or Councillors.