

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

Decision document recording our decision-making process

The Permit Number is: EPR/JP3336RM
The Applicant / Operator is: Go Green Fuels Limited
The Installation is located at: South Marston Demonstration Facility
 Unit A3 and A4 Marston Gate
 Stirling Road
 South Marston Park
 SN3 4DE

What this document is about

This is a decision document, which accompanies a permit.

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

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

Preliminary information and use of terms

We gave the application the reference number EPR/JP3336RM/A001. We refer to the application as "the **Application**" in this document in order to be consistent.

The number we have given to the permit is EPR/JP3336RM. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 30/03/2016.

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

Go Green Fuels Limited proposed facility is located at Unit A3 and A4 Marston Gate, Stirling Road, South Marston Park, Swindon SN3 4DE. 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.)

APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BREF	BAT Reference Note
CEM	Continuous emissions monitor
CHP	Combined heat and power
CROW	Countryside and rights of way Act 2000
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
EAL	Environmental assessment level
EIAD	Environmental Impact Assessment Directive (85/337/EEC)
ELV	Emission limit value
EMAS	EU Eco Management and Audit Scheme
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended
EQS	Environmental quality standard
EU-EQS	European Union Environmental Quality Standard
EWC	European waste catalogue
GWP	Global Warming Potential
HHRAP	Human Health Risk Assessment Protocol
HRA	Human Rights Act 1998
IED	Industrial Emissions Directive (2010/75/EU)
LCPD	Large Combustion Plant Directive (2001/80/EC) – now superseded by IED
LCV	Lower calorific value – also termed net calorific value
Opra	Operator Performance Risk Appraisal
PC	Process Contribution
PEC	Predicted Environmental Concentration
PHE	Public Health England
PPS	Public participation statement

PR	Public register
RDF	Refuse derived fuel
SAC	Special Area of Conservation
SGN	Sector guidance note
SSSI(s)	Site(s) of Special Scientific Interest
SWMA	Specified waste management activity
TGN	Technical guidance note
TOC	Total Organic Carbon
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

1 Our decision

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

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

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

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

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 30/03/16. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination, see below.

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

The application documents make reference to the production of “biomethane”. Biomethane is produced by the bacterial degradation of organic matter. We do not agree with use of this term, the purpose of this Installation is to gasify wood waste and refuse derived waste to produce a gas, a syngas, for export off-site for use as a fuel. Throughout this document we only refer to “syngas”.

2.2 Consultation on the Application

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

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

We made a copy of the Application and all other documents relevant to our determination (see below) available to view on our Public Register Environment Agency, Red Kite House, Howberry Park, Benson Lane, Wallingford OX10 8BD. 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":

- Swindon Borough Council
- Health and Safety Executive
- Local Fire Service
- Thames Water
- National Grid

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

Further details along with a summary of consultation comments and our response to the representations we received can be found in Annex 3. 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 22/04/2016. Additional information was also requested by email on 22/06/16. Copies of the information notice and response to the email were placed on our public register.

3 The legal framework

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

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

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

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

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

4 The Installation

4.1 Description of the Installation and related issues

4.1.1 The permitted activities

The Installation is subject to the EPR because it carries out an activity listed in Part 1 of Schedule 1 to the EPR. The Installation will gasify the waste to produce a syngas which will be exported off-site. The Applicant plans to clean the syngas to the extent that it will no longer be a waste and to ensure that when burned it can cause emissions no higher than those resulting from burning natural gas. Article 42(1) of IED excludes such plant from the requirements of chapter IV of IED. Therefore we consider that the most appropriate activity is:

- 1.2 Part A(1)(ja) activities involving the liquefaction or gasification of other carbonaceous material.

An installation may also comprise “directly associated activities”, which at this Installation includes the purification of syngas, compression of syngas (pending export off-site), the generation of electricity by a steam turbine (4 MWe) and flare operation (in an emergency).

Together, the listed and directly associated activities comprise the Installation

4.1.2 The Site

The Installation will be located at South Marston Park, Swindon. The immediate area around the installation is industrial with the nearest residential properties being approximately 370m away.

North Meadow & Clattinger Farm Special Areas of Conservation is the nearest habitat site at ~9.8km away. There are no Sites of Special Scientific Interest within 2km. The closest other ecological site is Stanton Park (Local Nature Reserve, LNR) 469 m away.

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

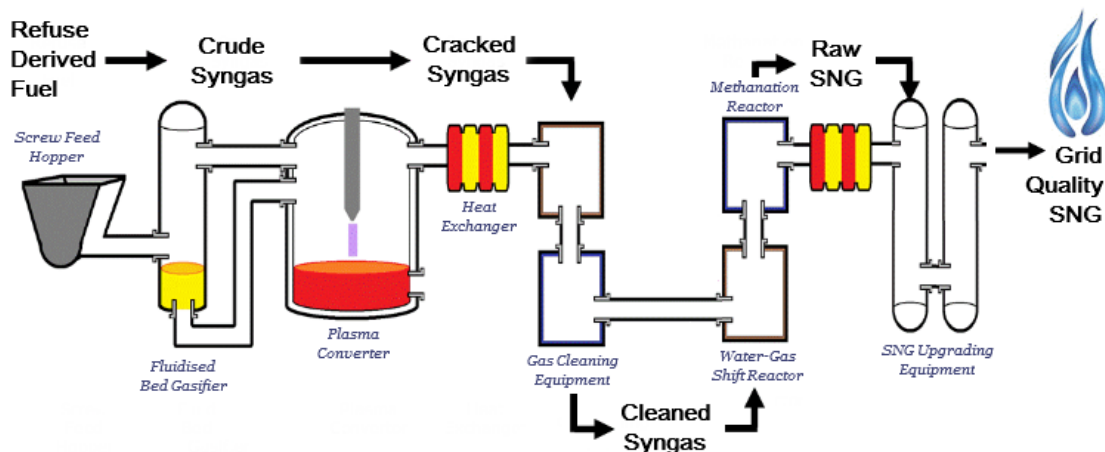
Further information on the site is addressed below at 4.3.

4.1.3 What the Installation does

The purpose of the Installation is to gasify waste to produce a gas, known as syngas, for export off-site for use as a fuel. The syngas will be purified to the extent that it will no longer be classed as a waste and can cause emissions no higher than those resulting from the burning of natural gas.

The overall facility can be viewed as comprising three distinct processes as is illustrated below.

1. Syngas production
2. Methanation & Upgrading
3. Preparation for export



Syngas Production: converts the RDF and wood waste into a syngas through the Gasplasma® process. Gasplasma® technology is a two-stage advanced conversion process, combining gasification and plasma arc conversion which includes cooling, cleaning and conditioning of the syngas. During the syngas cooling stage, steam is produced. This steam is used in the drying of RDF and in the Gasplasma® process.

The gasifier uses high purity oxygen and steam, to prevent introduction of nitrogen into the system. The syngas exiting the gasifier includes high levels of contaminants, notably condensable hydrocarbons, heavy metals, sulphur and halogens. The crude syngas is then passed through a plasma converter, which exposes the syngas to high temperatures and levels of excitation, reforming problematic species and allowing the constituent sulphur and halogens to be removed by conventional techniques, along with heavy metals.

After plasma treatment, the syngas is cooled in a heat recovery boiler and passed to a ceramic particulate filter dosed with sodium bicarbonate and activated carbon, removing volatile metals and reducing the acid gas content. A two-stage scrubber removes ammonia and residual acid gases. The gas is then compressed to 13bar, before a further carbon bed removes residual condensable hydrocarbons and heavy metals, and a zinc oxide guard bed provides final removal of sulphur compounds.

Methanation & upgrading: processes the cool clean syngas from the Gasplasma® process, and synthesises methane. This is achieved by polishing of the syngas to remove catalyst poisons, a water gas shift reaction to obtain the correct ratio of hydrogen to carbon monoxide, a methanation stage and a methane purification stage for removal of CO₂ to ensure that the compressed methane complies with the specifications for use in transport, as well as for grid export (subject to down-stream processing if required). The removed CO₂ is compressed and stored in tanks for transport off site and use as an industrial gas.

Preparation for Export. The final stage is to check the quality of the methane to ensure it meets grid and transport specification and then prepare the methane for both direct supply as transport fuel and for export to grid. For direct supply as transport fuel it is then compressed to 250barg and stored in a tube trailer. For export to grid, the gas is further upgraded using propane as required before being tested and metered onto the local gas grid.

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

Waste throughput, Tonnes/line	7,884 tonnes/annum	Up to 1 tonne/hour
Waste processed	RDF and wood waste	
Number of lines	1	
Technology	Gasplasma® Technology, a dual system fluid bed gasifier followed by Plasma Arc	
Fuel used for gasifier heating	Natural Gas	
Syngas clean up	Dry gas cleaning to remove fine particulate materials from the syngas stream, neutralises acid gases and removes heavy metal vapours. Dual wet gas cleaning to remove NH ₃ and then acid gases. Further acid gas removal system post methanation.	
Combustion unit	No syngas combustion except flare	
Electricity exported	Up to 2.7 MWe	

4.1.4 Key Issues in the Determination

The key issues arising during this determination were energy efficiency, the assessment of the control of emissions from waste handling, comparison of the syngas with natural gas and monitoring requirements for the syngas. 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 Installation will be located at located within the South Marston Business Park, Swindon at NGR SU 18028 88694. The immediate area around the installation is industrial warehousing with the nearest residential properties being approximately 350m to the north north-west, and beyond this a care home and lodge approximately 370m to the north-west. The Installation is located on a minor aquifer Minor Aquifer with High Leaching Potential but not within a source protection zone.

The nearest ecological receptors are Bydemill Brook approximately 450m to the north west, and South Marston Brook approximately 680m to the North East. North Meadow & Clattinger Farm (SAC) is 9795m.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

The following prevention measures are proposed:

- The majority of the processing equipment will be inside the building
- All external plant is located on a sealed / impermeable concrete hardstanding.
- Electronic monitoring including level gauges for all vessels;
- All external delivery areas will be contained within a sealed drainage and containment system that incorporates bund walls, appropriate falls and drains;
- All tanks will have impermeable bunds with a capacity of 110% of the largest volume, fill points provided with secondary containment and subject to regular visual inspection;
- Spill kits – materials suitable for absorbing and containing minor spillages will be readily available on site.
- Surface water run-off will be collected and discharged to sewer via an interceptor.

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

The Applicant has submitted a site condition report which 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 document Section 4.8 Decommissioning and Closure of the Operating Techniques and Monitoring Plan 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 permit, which we will not grant unless and until we are satisfied that these requirements have been met.

4.3 Operation of the Installation – general issues

4.3.1 Administrative issues

The Applicant is the sole Operator of the Installation.

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

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

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

4.3.2 Management

The Applicant has stated in the Application that they will implement an Environmental Management System (EMS) that will be certified under ISO14001 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 Permit conditions.

4.3.3 Site security

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

4.3.4 Accident management

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

The Applicant submitted a Fire Prevention Plan as part of the application. We asked the operator to provide clarification on the form of the wood waste and how it will be stored and further details on the quarantine area, the drainage arrangements, and the fire detection and suppression system within the Schedule 5.

The operator supplied information on 19/05/15 by providing a revised fire prevention plan document CRM 057 006 PE R 010 C Fire Prevention Plan FINAL CONSOLIDATED dated May 2016. We have reviewed and approved the Fire Prevention Plan. We consider that it complies with the requirements of our guidance and have included the response within Operating Techniques table S1.2. The fire detection and suppression system must be installed and commissioned prior to combustible waste being stored or treated at the site as required by a pre-operational condition (PO2).

4.3.5 Off-site conditions

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

4.3.6 Operating techniques

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

Description	Parts Included	Justification
The Application	Document Operating Techniques and Monitoring Plan January 2016	Duly Made 30/03/2016
Response to Schedule 5 Notice dated 22/04/2016	Question 1,2,3,4, and 5 CRM 057 006 PE R 010 C Fire Prevention Plan FINAL CONSOLIDATED	Received 09/05/16 Received 19/05/2016
Additional information requested by email 22/06/16	Question 1 relating to throughput and annual waste processed. Question 3, specification of levels of H ₂ S and Arsenic in the clean syngas	Received 23/06/16

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

We have specified the permitted waste types, descriptions and where appropriate quantities which can be accepted at the installation in Table S2.2.

We are satisfied that the Applicant can accept this waste contained in Table S2.2 of the Permit because it will be well suited to the gasification process.

We have limited the total capacity of the Installation to 7,884 tonnes of waste per annum. This is based on the installation operating approximately 7,884 hours per year at a nominal capacity of 1 tonnes per hour.

We consider this annual capacity is consistent with the design, scale and nature of waste materials to be processed at the facility.

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

4.3.7 Energy efficiency

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

- (i) 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.
- (ii) Whether energy is generated efficiently from the activity.
- (iii) The process 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.

(i) 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:

- Effective maintenance will be employed
- The parasitic energy demand of the gasification and gas conversion stage (methanation) will be of approximately 0.1 and 0.7 MWe

(ii) Efficient generation of energy

The project has been designed to process 1,000 kg/h of dried RDF for feeding into the gasifier, equivalent to 4.7 MWth of energy input. Through the gasification and methanation processes this will yield 2.9 MWth on a gross CV basis or 200 kg/h of synthetic natural gas, giving a process efficiency of 61%.

In addition 0.7 MWh of heat is recovered from cooling the syngas (heat recovery boiler) is used in the drying of RDF and in the Gasplasma® process. The Sankey diagram demonstrates a high level of energy efficiency in the process.

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

Compliance with Article 14(5) of the Energy Efficiency Directive is not a relevant consideration because the installation's total net thermal input is 4.7 MW which is below the threshold specified in the directive.

(iv) Permit conditions concerning energy efficiency

Permit condition 1.2.1 will ensure that energy is used efficiently and that energy is recovered with a high level of efficiency.

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:

- Syngas produced
- Substitute Natural Gas exported
- Electrical energy generated
- Flare operation

Together with the total waste treated, this will enable the Environment Agency to monitor energy recovery efficiency at the Installation and take action if at any stage the energy recovery efficiency is less than proposed.

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

The Operator is required to report energy usage and energy generated under condition 4.2 and Schedule 5. The following parameters are required to be reported:

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.

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 stream the Installation is molten slag from the plasma converter.

Solid waste from gasifier is fed into plasma converter. Any ash and dust particles that drop out of the gas stream, are incorporated into a molten slag pool which builds up in the base of the converter. This molten material is continuously removed from the plasma converter via an overflow weir and cooled for use as a vitrified and stable material. This material has been granted end of waste status and is trademarked under the name Plasmarok® for use in the construction industry. In the Gasplasma process the amount of vitrified material produced from the ash content of the RDF fuel is typically between 8 and 15wt%, if we assume 12% ash, then the plant will generate around 946 tonnes per year of vitrified product.

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. . An improvement condition (IC4) is included requiring the Operator to report confirmation of that vitrified product is suitable for use in outlets.

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, 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.

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in 'Environmental Risk Assessment' referenced CRM 057 PE R 005 ERA of the Application. The assessment comprises:

- An H1 screening assessment of emissions to air from the operation of the fluidised bed gasifier and plasma converter
- A study of the impact of emissions on nearby sensitive habitat/conservation sites.

There are no point source emissions to air as no syngas is combusted. All of the organic material is converted to syngas. Any material that cannot be gasified is melted and flows out as molten slag. Long residence times within the reactor ensure there is sufficient time to crack any tars and minimize particulate carryover systems.

Syngas can either be diverted to an enclosed emergency flare where it is oxidised prior to release to atmosphere, via emission point A3, or it can be directed to the methanation process train. No assessment has been undertaken of this release. This is because A3 is solely for emergency purposes only (emergency gas flare). Any use of the flare will be limited to short durations. Pre-operational condition PO7 requires the operator to provide for approval the procedures for the management of out of specification syngas and flare operation.

We have required the applicant to monitor and report the number of operational hours to which the flare is used under Schedule 4, table S4.3 of the permit.

Our review of the Applicant's assessment leads us to agree with the Applicant's conclusions.

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:

5.3.2 Assessment of Health Effects from the Installation

We have assessed the health effects from the operation of this installation. We have applied the relevant requirements of the National and European legislation in imposing the permit conditions. We are satisfied that compliance with these conditions will ensure protection of the environment and human health.

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

5.4.1 Sites Considered

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

- North Meadow Clattinger Farm (SAC), 9795m

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
 - Sheepslaught Plantation,
 - Stanton Park Lake,
 - Stanton Park
 - St Julian's Community Woodland
- WWT Reserve
 - River Cole
 - Great Wood - Stanton Fitzwarren,
 - Kingsdown Old Railway
- Ancient Woodland
 - Great Wood

Applicant's Ecological Assessment

The consultant has identified several ecological receptors including Local Nature Reserves (LNR) and Sites of Importance for Nature Conservation) within 2km of the plant and two sites designates for European Importance within 10km.

DESIGNATED SITE	Distance from Site
Special Areas of Conservation North Meadow & Clattinger Farm (SAC)	9795m
Stanton Park (LNR)	469m
Local Wildlife Sites	
Sheepslaught Plantation	1551m
Stanton Park Lake	1066m
Stanton Park	469m
St Julian's Community Woodland	1295m
WWT Reserve	
River Cole	702m
Great Wood - Stanton Fitzwarren	589m
Kingsdown Old Railway Lines	535m

DESIGNATED SITE	Distance from Site
Ancient Woodland - England Woodland	
GREAT WOOD	1044m
GREAT WOOD	816m
GREAT WOOD	1036m
GREAT WOOD	606m
GREAT WOOD	844m

5.4.2 Habitats Assessment

There is one European habitat site within 10km of the Installation, Meadow & Clattinger Farm (SAC) ~9.8 km away. We have checked their selections and confirm that they are representative. There are no point source emissions to air other than the flare which is only used in an emergency no detailed assessment of the effect of the releases from the installation on SACs, SPAs and Ramsar sites is required.

5.4.3 Assessment of other conservation sites

The Applicant carried out an assessment of impacts at 13 local wildlife sites within 2km of the Installation. As explained in section 5.2 there are no point source emissions to air therefore we are satisfied that impacts will not be significant at any of these sites.

6. Application of Best Available Techniques

6.1 Scope of Consideration

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

- The first issue we address is the fundamental choice of gasification technology. There are a number of alternatives, and the Applicant has explained why it has chosen one particular kind for this Installation.
- We consider the options for the syngas clean up system and consider the end of waste status of the syngas;
- We also consider the energy efficiency 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.

6.1.1 Consideration of the thermal treatment option

The prime function of the gasification plant is the production of a gas (syngas capable of export or injection into the gas network) by thermal treatment of waste. We asked the applicant to justify the gasification technology selected in a schedule 5. The Applicant responded that the selection was based on consideration of a syngas with low tar.

The following gasification systems were considered:

- updraft gasifiers was discounted as produces syngas with a high level of tar.
- downdraft gasifiers do not scale beyond around 2MWth input, has entrained flow systems requiring high level of feed preparation
- direct plasma gasifiers have a very high parasitic load
- bubbling and fluidised bed gasifiers are cheaper

The following tar removal systems were considered:

- Thermal cracking of tars by partial combustion of syngas (used in entrained flow coal gasification systems). This approach was rejected for a waste derived syngas because it has a lower energy density and thermal cracking uses energy that could be used in fuel production to heat the syngas leading to lower overall process efficiencies.

- Water scrubbing of tars at the output of the gasifier such as that used by Air Products Tees Valley gasification project. This was rejected because it wastes the sensible heat in the syngas and requires large quantities of water which is then contaminated by the tars.
- Catalytic conversion of tars at low temperatures is used in the Andritz plant in Skive. This technology appears attractive but the applicant has been unable to identify a provider of appropriate catalyst technology and there are concerns over the robustness of the catalysts to handle the impurities found in a waste derived syngas.
- Oil based scrubbing of the syngas to selectively remove tars for recycling back to the gasifier is used by Dahlman. This was rejected because concerns that the process would struggle to deal with the variability of tars in a waste derived syngas.
- Plasma conversion of tars to syngas. This ensures high cold syngas and carbon conversion efficiencies and is known to destroy organic sulphur species which are an acknowledged issue with indirect gasifiers used in other BioSNG developments in Europe.

Overall, the results from the Swindon pilot plant show that the combination of a fluidised bed gasifier and plasma converter produce a syngas from a variety of waste feedstock that is extremely low in tars. This led to the adoption of that approach of using dual system advanced Gasplasma® thermal process.

Based on the information supplied by the Applicant we are satisfied that the chosen option to generate syngas from the waste is BAT.

6.2 Syngas Clean-up and end of waste

The purpose of the syngas clean-up is to produce a gas that will be cleaned so that it will no longer be a waste and can cause emissions no higher than those resulting from the burning of natural gas.

IED article 42(1) states:

This chapter shall not apply to gasification or pyrolysis plants, if the gases resulting from this thermal treatment of waste are purified to such extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas.

The Applicant's proposed clean up system consists of the following measures:

- After exiting the gasifier the crude syngas is passed to plasma converter and heated to over 1100°C to crack the tar and char materials into their basic composition of hydrogen (H₂), carbon monoxide (CO), carbon dioxide (CO₂), and water (H₂O).

- Molten slag which accumulates in the base of the converter is continually removed and cooled for use as vitrified material, secondary aggregate.
- A Heat recovery boiler designed to reduce syngas temperatures from circa 1100°C to 160°C and generate saturated steam at 10 bar(g)
- A dry gas cleaning system, operating at 150 to 180°C, to remove fine particulate materials from the syngas stream, neutralises acid gases and removes heavy metal vapours.
- Activated carbon filter - providing a final polish of the gas.
- A dual Wet Gas Cleaning System to remove firstly NH₃ which also acts to cool the syngas by direct contact with scrubbing liquor in a condenser scrubber. The gases are then passed through a second, alkaline scrubber to remove acid gases - in particular SO₂ and hydrogen sulphide (H₂S), The H₂S, is chemically oxidised to produce a stable effluent.
- Polishing stage to remove catalyst poisons.
- A water gas shift reaction to obtain the correct ratio of hydrogen to carbon monoxide.
- A methanation & purification stage for removal of CO₂ to ensure that the compressed syngas complies with the specifications for use in transport, as well as for grid export.

The Applicant has proposed using natural gas for start up procedures, which is a very low sulphur fuel and has confirmed in the application that control of the wood waste and RDF feed to meet strict specification.

It should be noted that this facility is a commercial demonstration facility which follows a smaller scale pilot plant trials using the advanced Gasplasma® thermal process rated at 0.25 tonnes per hour. To date, no testing has been carried out as the scale of the pilot plants is too small to obtain meaningful results. This demonstration facility will be used to obtain a full suite of analysis of the gas and other process variables which will be used to develop the full scale commercial facility.

The Operator provided a specification for their syngas as shown in the table below:

Parameter	Combined Specification	Achieved by compressed syngas	Fate and impact
Hydrogen (H ₂)	<0.3 mol%	Yes	Converted to water during combustion, no identifiable additional impact from increased levels of hydrogen.
Oxygen (O ₂)	<0.2 mol%	Yes	Low levels of Oxygen will have little effect on combustion.
Carbon Monoxide (CO)	No Limits Stated	Yes	Will be converted to CO ₂ during combustion.

Parameter	Combined Specification	Achieved by compressed syngas	Fate and impact
Carbon Dioxide(CO ₂)	No Limits Stated	NA	Vented during gas cleaning process
Ethene	No Limits Stated	NA	Thermally cracked during plasma gasification
Ethane (C ₂ H ₆)	No Limits Stated	NA	Thermally cracked during plasma gasification
Sulphur	<50 mg/m ³	Yes	Removed during gas scrubbing and shift reaction gas polishing
Hydrogen Sulphide (H ₂ S) and other reduced sulphur compounds	<5mg/ m ³	Yes	Removed during gas scrubbing and shift reaction gas polishing
Acid Gases	No Limits Stated	NA	None present in synthesis gas
Rare gases (Ar, He, Ne, Xe)	No Limits Stated	NA	None present in synthesis gas
Halogenated Hydrocarbons	1.5 mg/m ³	Yes	Thermally cracked during plasma gasification
Hydrogen Chloride	1.5 mg/m ³	Yes	Captured by gas cleaning process
Hydrogen Fluoride	5 mg/m ³	Yes	Captured by gas cleaning process
Arsenic	0.1 mg/m ³	Yes	Captured by gas cleaning process
Cd + Ti	Below Limit of detection (<LOD)	NA	Captured by gas cleaning process
Hg	<LOD	NA	Captured by gas cleaning process
Sb + As + Pb +Cr+ Co +Cu + Mn+ Ni + V	<LOD	NA	Captured by gas cleaning process
Zylenes	100 mg/m ³	Yes	Thermally cracked during plasma gasification
Ammonia	<20 mg/m ³	Yes	Thermally cracked during plasma gasification
Siloxanes	0.1 mg/m ³	Yes	Removed in dry gas cleaning system
Gross Calorific Value	36.9 to 42.3MJ/ m ³	Yes	Customer specification is marginally below GS(M)R ¹ specification however this is the specification which will be adhered to. Propane will be added to the compressed methane injected to the grid to meet the target value.

¹Gas Safety (Management) Regulations 1996, Schedule 3, Part I

They conclude that:

- Plasma conversion step has 100% removal efficiency for tar removal.
- Metals retained in char are condensed and retained in scrubber liquors.
- Particulate matter, including the by-products from the reagent reactions, is trapped on the ceramic candle filter elements and periodically removed using a carbon dioxide reverse pulse system.
- Water and alkaline scrubbing described are recognised sector BAT with 98% removal of NH₃, HCl, H₂S and HF

The levels of total sulphur, hydrogen sulphide, aromatic hydrocarbons and halogenated hydrocarbons are in line with the levels for natural gas set out in our briefing note (Briefing on classifying syngas as a waste). We asked the applicant to confirm the limit for H₂S is 5mg/m³ and not 5mg/kg. We also asked the applicant to clarify the limit for Arsenic as this is untypically high. The applicant confirmed that the limit will be around 0.03mg/m³.

The specification provided refers to '<Limit of Detection' (LoD) as the limit for some heavy metals. As the limit of detection can vary we have defined the specific LoD a limits for heavy metal parameters in syngas.

In addition natural gas analysis for another similar permit application showed total heavy metals at ~ 0.03 mg/m³. Therefore we have set the limit in the permit at 0.03 mg/m³. The applicant has confirmed that they can meet this limit.

Comparison to natural gas.

Total S, total aromatic hydrocarbons, total chlorinated hydrocarbons and hydrogen sulphide are equivalent to that in natural gas.

	SynGas (adjusted to CV of 37 MJ/kg)	Natural Gas specification
Total Sulphur	≤ 50 mg/m ³	50 mg/m ³
Hydrogen Sulphide (H ₂ S)	≤ 5 mg/m ³	5 mg/m ³
Total Halogenated Hydrocarbons	1.5 mg/m ³	1.5 mg/m ³
Xylenes (all isomers)	≤ 54.2 mg/m ³	100 mg/m ³

We have also set an improvement condition (IC5) for the Operator to report on syngas monitoring and also to carry out natural gas analysis to confirm the information provided in the Application.

End of waste requires that the syngas to be of a quality which does not cause worse environmental effects than natural gas. From IED article 42, chapter IV will not apply if the gas is no longer a waste AND can cause emissions no

higher than natural gas. The IED test is therefore tighter than the end of waste test.

The reasoning behind this is that if the compositions are comparable then the syngas could then not cause emissions higher than from combustion of natural gas.

Certainty of use

End of waste also requires that there is an end use for the proposed material. The application contained a description of two end uses: a transport fuel or for export to the grid. Where the gas is exported to the grid, the gas is enriched using propane before being tested and metered onto the local gas grid. We have included a pre-operational condition which will require the operator to provide confirmation of the end users prior to final commissioning – these must be approved in writing by the Environment Agency.

Summary

Based on the information submitted by the applicant we are satisfied that the syngas has the potential to meet the test that its combustion will cause emissions no higher than natural gas. If it turns out that the syngas is more polluting than natural gas, the plant will not be able to operate under this permit due to condition 2.3.7.

We have set improvement conditions for the applicant to submit a report on syngas analysis, in order to confirm the application data with operational data. The applicant is also required to carry out further natural gas analysis to provide further assurance on the decision.

Based on this we have permitted the plant as a 1.2 activity. If the applicant cannot meet the limits set in the permit or if future analysis shows that the syngas is no longer comparable to natural gas then the operator would have to cease operation of the plant until the permit is varied, to accommodate additional gas clean up techniques, or to amend the activity where Chapter 4 of the IED applies i.e. S5.1 Incineration of Waste.

Pre-operational condition PO3 requires the Operator to submit a commissioning plan to include a proposal for syngas monitoring during commissioning. IC3 then requires a report on the syngas monitoring carried out during operation of the Installation.

We have set monitoring requirements to ensure that syngas is monitored against this specification. This is covered in section 6.7 of this decision document.

The Applicant stated that the flare will only be used during start-up, shut down or for emergency reasons. Condition 2.3.7 will prevent waste feed to the gasifier unit where the syngas is found to be out of specification. This condition will also prevent waste feed if the flare is operating because operation of the flare will be indicative of syngas being out of specification. A brief description of start-up shut-down, and emergency use of the flare were provided. PO6 requires detailed procedures to be submitted for approval.

6.3 BAT and emissions control

The prime function of syngas gas treatment is to produce a clean syngas which can cause emissions no higher than those resulting from natural gas combustion. The control measures below look at the main emissions from natural gas combustion - oxides of nitrogen and carbon monoxide.

With the exception of a small release of CO₂ from emissions point A2, there are no emissions to air. During the methane purification stage all CO₂ is removed from the tail gas, compressed and stored in tanks for transport off site and use as an industrial gas. A small stream will be released at sufficient pressure to allow it to be used as a sealing and purge gas in the Gasplasma® and SNG process.

6.3.1 Oxides of Nitrogen

No combustion of the syngas will take place on site. An auxiliary gas boiler will be used during start up. All of the syngas will be exported from site. Emissions will be minimised by using low NO_x burners. We are satisfied that the proposed measures are BAT.

6.3.2 Carbon monoxide

The prevention and minimisation of emissions of carbon monoxide is through the optimisation of combustion controls.

6.4 BAT and global warming potential

This section summarises the assessment of greenhouse gas impacts which has been made in the determination of this Permit. Emissions of carbon dioxide (CO₂) 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, CO₂ is clearly a pollutant for IED purposes.

No waste is combusted on site, therefore only source of greenhouse gas emissions from the installation is CO₂ emissions from the burning of support fuels (natural gas) 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 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 CO₂ emissions from the Installation are:

On the debit side

- CO₂ emissions from burning auxiliary or supplementary fuels;
- CO₂ emissions associated with electrical energy used;

On the credit side

- CO₂ saved from the export of gas to the public supply by displacement of burning of virgin fuels;

Taking all these factors into account, the Applicant's assessment shows that GWP is minimal. The Environment Agency agrees with this assessment and that the chosen option is BAT for the installation.

6.5 Other Emissions to the Environment

6.5.1 Emissions to water

There will be no emissions to water from the Installation.

6.5.2 Emissions to sewer

All process effluent will be contained and tankered away off site. However, the Operator intends to apply to Thames Water for a Sewerage Discharge Consent at emission point S1.

Due to the early developmental stage of the facility, the exact profile of the process emissions has not been determined. The application contained an impact assessment (H1) for emissions to sewer for the following pollutants Mercury, Cadmium, Arsenic, Lead, Chromium III, Nickel and Zinc. Cadmium & its compounds, Chromium III and Mercury Compounds failed test 1 but all passed test 2 allowing these pollutants to be screened out as "insignificant". We are satisfied that emissions are unlikely to give rise to significant pollution.

Based upon the information in the application we are satisfied that appropriate measures will be in place to prevent and /or minimise emissions to sewer. We have included a pre-operation condition (PO4) to prohibit the discharge to sewer until the operator can show that a trade effluent consent is in place.

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.

- Storage tanks will be within the main building or on concrete hard standing. They will have secondary containment have impermeable bunds with a capacity of 110% of the largest volume;
- Fill points provided with secondary containment;
- Reception building drainage is collected in tank via a catch-pit. is connected to sediment traps and oil interceptor which are subject
- All external plant is located on a sealed / impermeable concrete hardstanding.
- Electronic monitoring including level gauges for all vessels;
- All external delivery areas will be contained within a sealed drainage and containment system that incorporates bund walls, appropriate falls and drains;
- Tanks and drainage system will be inspected daily
- Spill kits – materials suitable for absorbing and containing minor spillages will be readily available on site.
- Surface water run-off will be collected and discharged to sewer via an interceptor.

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

All potentially odorous activities will be carried out within the main reception building. RDF will be stored as wrapped bales when it arrives on-site and only opened at point of use. The facility will use the 'first-in', 'first-out' waste handling practices, reducing as far as possible the residency time of materials on site.

The building will have roller shutter doors that will remain closed other than to allow vehicle access. The air from the reception building will be kept under negative pressure to mitigate the potential for air egress. Negative pressure will be through an induced draft fan and will give 3 air changes per hour. The air extraction system will be vented via emissions point A1.

The thermal gasification process and the methanation process are operated under negative pressure to ensure no gas can escape to outside of the building.

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

6.5.5 Noise and vibration

The 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 standard specified in BS4142:2014 "Methods for rating and assessing industrial and commercial sound" can be used to estimate the likelihood of an adverse impact, or the likelihood of a significant adverse impact. BS4142:2014 compares the sound level that is coming from the site to the background sound level when the site isn't operating. It then adds a variable penalty for sounds that are tonal, and an additional variable penalty for impulsive sounds (or a single +3dB penalty for a characteristic that is neither tonal nor impulsive). A level difference of greater than around 5dB is likely to indicate an adverse impact, and a level difference of greater than around 10dB is likely to indicate a significant adverse impact depending on the context.

The noise assessment (using BS4142:2014) establishes the baseline noise climates at the site, and considers noise source information relating to each of the main components of the plant (e.g. reception, compressors etc) to assess likely effects on people living close by. The survey considers the three closest residential receptors (and proposed development).

The report concludes that during the operational phase, noise impacts are considered to have a negligible effect on existing residential receptors using appropriate design, mitigation measures, and intervening distances to the nearest residential development. The assessment showed that the predicted rating levels were between 8dB and 35 dB below the background during the day and between 2 and 19 dB below the background during the night.

Based upon the information in the application we are satisfied that 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.

6.6 Setting ELVs and other Permit conditions

6.6.1 Translating BAT into Permit conditions

IED 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. There are no point source emissions to air.

(i) Global Warming

CO₂ is an inevitable product where waste is combusted. No waste is combusted on site, it is therefore inappropriate to set an emission limit value for CO₂. 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 considered setting equivalent parameters or technical measures for CO₂. 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 syngas that can be imposed that do not run counter to the primary purpose of the plant, which is the gasification of waste and the generation of syngas. 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 CO₂ emissions.

(ii) Commissioning

Pre-operational condition PO5 & PO6 have been set for a commissioning programme to be agreed. IC2 requires a report on commissioning to be submitted.

6.7 Monitoring

6.7.1 Syngas process monitoring

We have set a requirement to monitor the syngas in table S3.3 of the permit. Permit conditions 3.5.5 and 3.5.6 set the monitoring frequency of the monitoring. Sampling points are to be agreed through PO6.

Section 6.2 of this decision document includes the specification that the Applicant provided for their syngas. Monitoring has been set for the key components to ensure that emissions are no higher than natural gas combustion. The table below shows the monitoring that has been set in the permit.

Process monitoring requirements – syngas quality	
Parameter	Monitoring frequency
Total Sulphur	As specified in condition 3.5.5
Hydrogen Sulphide	As specified in condition 3.5.5
Total halogenated hydrocarbons	As specified in condition 3.5.5
Heavy metals Hg, Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	As specified in condition 3.5.5
Total aromatic hydrocarbons (expressed as xylene)	As specified in condition 3.5.5
Calorific Value	As specified in condition 3.5.5

Condition 3.5.5 will require daily sampling to start with for these components. Condition 3.5.5 allows the frequency to be relaxed if samples are shown to meet the limits. If samples fail then the required monitoring frequency will increase.

Condition 3.5.5 (d) allows quarterly sampling frequencies (maximum) whereby the sequence of daily, weekly and monthly monitoring have demonstrated full compliance.

In the event of a failure during quarterly sampling, the operator is required to revert back to 3.5.5 (c) – weekly, rather than 3.5.5 (d) - monthly. This is due to the fact that the point of use for the syngas will not be within the installation (as it will be exported), and thus increased controls are considered necessary in any such event.

Hydrogen sulphide is included because this installation will be exporting syngas as product, rather than combusting within the permitted installation. It was therefore considered that additional controls (monitoring) for H₂S are required.

Condition 3.5.6 ensures that if a sample fails another is taken within a week. Condition 2.3.7 will prevent waste feed if two consecutive samples fail the limits.

6.8 Reporting

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

7 Other legal requirements

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

7.1 The EPR 2010 and related Directives

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

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

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

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

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

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

The local planning authority (Swindon Borough Council did not require an EIA. The development is permitted by a lawful development certificate issued on 19/02/16.

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

7.1.2 Schedule 9 to the EPR 2010 – Waste Framework Directive

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

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

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

Article 23(1) requires the permit to specify:

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

These are all covered by permit conditions. The permit does not allow the processing of hazardous waste so Article 18(2) is not relevant.

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

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

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

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

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

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

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

This Application has been consulted upon in line with this statement. The Environment Agency has deemed that this site is not a Site of High Public Interest, which has been reflected by no public representations received following our advert on the application.

7.2 National primary legislation

7.2.1 **Environment Act 1995**

(i) Section 4 (Pursuit of Sustainable Development)

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

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

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

(ii) Section 7 (Pursuit of Conservation Objectives)

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

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

(iii) Section 81 (National Air Quality Strategy)

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

7.2.2 Human Rights Act 1998

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

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

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

7.2.4 Wildlife and Countryside Act 1981

Under section 28G of the Wildlife and Countryside Act 1981 the Environment Agency has a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest. Under section 28I the Environment Agency has a duty to consult Natural England in relation to any permit that is likely to damage SSSIs. There are no SSSIs within 2KM of the site that would be affected by this installation.

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

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

7.3 National secondary legislation

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

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

We sent a summary of our conclusions on an Appendix 11 to Natural England that the operation of the Installation would not have a likely significant effect on the interest features of protected sites.

The habitat assessment is summarised in greater detail in section 5.4 of this document. A copy of the full Appendix 11 Assessment can be found on the public register.

7.3.2 **Water Framework Directive Regulations 2003**

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

7.3.3 **The Persistent Organic Pollutants Regulations 2007**

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

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

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

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 3. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive.

ANNEX 1: Pre-Operational Conditions

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

Reference	Pre-operational measures
PO1	Prior to the commencement of commissioning, the Operator shall send a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with the requirements set out in Environment Agency web guide on developing a management system for environmental permits (found on www.gov.uk). 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	No combustible waste shall be stored or treated in the reception building until: <ul style="list-style-type: none"> • the fire detection and suppression system specified in section 4.4.2 of the approved Fire Prevention Plan has been installed and commissioned; • a commissioning plan has been submitted to the Environment Agency that includes, but need not be limited to, confirmation that the above measures have been completed; and the Environment Agency has agreed in writing that combustible waste acceptance may commence.
PO3	At least three months before final commissioning, the operator shall submit proof of agreement for the export and sale of syngas, including evidence that no further processing to the syngas is required prior to use (or any other appropriate documentation demonstrating certainty of use of syngas) for approval in writing by the Environment Agency.
PO4	No waste water shall be discharged to sewer until a discharge consent from Thames Water has been submitted and the Environment Agency has agreed in writing that discharge to sewer may acceptance may commence.

Reference	Pre-operational measures
PO5	<p>At least 2 months before final commissioning; the Operator shall provide a written commissioning plan including timelines for completion, for approval by the Environment Agency. The commissioning plan shall include:</p> <ul style="list-style-type: none"> • Specific operational parameters for the activities listed in Table S1.1 required to define “final commissioning”. • a written plan for sampling and analysis of the syngas against the parameters set out in table S3.3 of the permit, • the expected emissions to the environment during the different stages of commissioning and final 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. • details of emergency scenarios under which the flare will be used, and confirmation that this will meet the operational requirements of guidance LFTGN05. <p>Commissioning shall be carried out in accordance with the commissioning plan as approved.</p>
PO6	<p>At least 1 month before final commissioning the operator shall submit a Syngas Monitoring Methodology for approval in writing by the Environment Agency - detailing how representative sampling and analysis of syngas will occur to demonstrate that it meets the limits specified in table S3.3. The methodology shall include, but not be limited to;</p> <ul style="list-style-type: none"> • Sample point location and evidence of homogenous sample collection. • Details of sampling methods, including duration, for representative sampling across different operating loads and waste feedstock. • Sample analysis methods, limits of detection and availability of laboratory accreditation for methods. • Procedures for implementing the requirements of conditions 3.5.5 and 3.5.6, including details of sampling, courier, analysis and reporting responsibilities and timescales. <p>The methodology shall be implemented in accordance with the Environment Agency’s written approval.</p>
PO7	<p>Prior to the commencement of final commissioning the operator shall submit procedures for the management of out of specification syngas to the Environment Agency for approval in writing. Procedures shall include details of syngas specification, how syngas recirculation processes operate and identify processes for the management of syngas where any limit in Schedule 3 Table 3.3 has been exceeded and/or the requirements of conditions 3.5.5 or 3.5.6 are being met.</p>

ANNEX 2: 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 are 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	Requirement	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 gasified
IC2	The Operator shall submit a written report to the Environment Agency on the commissioning of the installation. The report shall summarise the environmental and operational performance of the plant as installed against the design parameters set out in the Application. The report shall also include a review of the performance of the facility against the conditions of this permit and details of procedures developed during commissioning for achieving and demonstrating compliance with permit conditions.	Within 4 months of the completion of commissioning.
IC3	<p>The Operator shall carry out checks to verify that the syngas composition is lower than the limits specified in Table 3.3 across a range of operating scenarios and waste feedstock mixes, and that it meets the End of Waste criteria.</p> <p>The Operator shall also carry out analysis of at least 3 samples of natural gas for the parameters specified in table S3.3.</p> <p>A written report shall be submitted to the Environment Agency containing the results of syngas testing and natural gas analysis, and shall include but not be limited to:</p> <ul style="list-style-type: none"> • A comparison of data between syngas and natural gas for the parameters specified in table S3.3 • Details of the waste types that were gasified to generate the syngas which was sampled and analysed during this verification • Details of process parameters which could be used as surrogate monitoring to provide assurance that syngas quality as specified in table S3.3 will be achieved • Details of any other monitoring / analysis undertaken for quality control for the supply of compressed syngas • A statement of action (including timescales for implementation) to be taken should syngas levels be shown to have higher pollutant levels than detected within the natural gas analysis. 	Within 2 months of the completion of commissioning
IC4	The operator shall submit a report on the recovery of ash from process, vitrified product "Plasmarok" material. The report shall include analysis of the ash as specified in Section 5.4 of the Application and confirmation of its suitability for available recovery outlets.	3 months following commissioning

Table S1.3 Improvement programme requirements		
Reference	Requirement	Date
IC5	The operator shall submit a report on the performance of syngas clean up techniques to demonstrate the removal of pollutants as detailed in the application. The report shall include analysis of representative samples of ash, syngas and scrubber residues to demonstrate the removal efficiency of acid gases, dioxins, heavy metals and ammonia abatement.	3 months following commissioning

ANNEX 3: Consultation Responses

A) Advertising and Consultation on the Application

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

The Application was advertised on the Environment Agency website from 01/02/2016 to 29/04/16. The Application was made available to view at the Environment Public Register at Environment Agency, Red Kite House, Howberry Park, Benson Lane, Wallingford OX10 8BD.

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

- Swindon Borough Council (Environmental Health)
- Local Fire Service;
- Health and Safety Executive
- Thames Water
- National Grid

1) Consultation Responses from Statutory and Non-Statutory Bodies

No consultation responses were received.

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

No responses were received.

ANNEX 4: IED article 42(1) further information (Introduction)

IED article 42(1) states:

This chapter shall not apply to gasification or pyrolysis plants, if the gases resulting from this thermal treatment of waste are purified to such an extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas.

As stated within section 6.1 and section 6.2, this facility is a commercial demonstration facility which follows a smaller scale pilot plant trials using the advanced Gasplasma® thermal process rated at 0.25 tonnes per hour producing a syngas that is extremely low in tars. To date, no testing has been carried out as the scale of the pilot plants is too small to obtain meaningful results. This demonstration facility will be used to obtain a full suite of analysis of the gas and other process variables which will be used to develop the full scale commercial facility that will produce a clean syngas that will be will no longer be waste is compressed directly used as a transport fuel or fed to the national grid.

Fate and impact

End of waste requires that the syngas to be of a quality which does not cause worse environmental effects than natural gas. From IED article 42, chapter IV will not apply if the gas is no longer a waste AND can cause emissions no higher than natural gas. The IED test is therefore tighter than the end of waste test.

Gas cleaning and conditioning

The Applicant's proposed clean up system consists of the following measures:

- Plasma converter that cracks the tar and char materials into their basic composition of hydrogen (H₂), carbon monoxide (CO), carbon dioxide (CO₂), and water (H₂O).
- A dry gas cleaning system, operating at 150 to 180°C, to remove fine particulate materials from the syngas stream, neutralises acid gases and removes heavy metal vapours.
- Activated carbon filter - providing a final polish of the gas.
- A dual Wet Gas Cleaning System to remove firstly NH₃ which also acts to cool the syngas by direct contact with scrubbing liquor in a condenser scrubber. The gases are then passed through a second, alkaline scrubber to remove acid gases - in particular SO₂ and hydrogen sulphide (H₂S), The H₂S, is chemically oxidised to produce a stable effluent.
- Polishing stage to remove catalyst poisons.
- A water gas shift reaction to obtain the correct ratio of hydrogen to carbon monoxide.

- A methanation & purification stage for removal of CO₂ to ensure that the compressed biomethane (“CBM”) complies with the specifications for use in transport, as well as for grid export.

Annex F of the application contains compressed syngas specification, as reproduced below.

APPENDIX F – COMPRESSED SYNGAS SPECIFICATION

Parameter	Combined Specification	Achieved by compressed syngas	Fate and impact
Hydrogen (H ₂)	<0.3 mol%	Yes	Converted to water during combustion, no identifiable additional impact from increased levels of hydrogen.
Oxygen (O ₂)	<0.2 mol%	Yes	Low levels of Oxygen will have little effect on combustion.
Carbon Monoxide (CO)	No Limits Stated	Yes	Will be converted to CO ₂ during combustion.
Carbon Dioxide(CO ₂)	No Limits Stated	NA	Vented during gas cleaning process
Ethene	No Limits Stated	NA	Thermally cracked during plasma gasification
Ethane (C ₂ H ₆)	No Limits Stated	NA	Thermally cracked during plasma gasification
Sulphur	<50 mg/m ³	Yes	Removed during gas scrubbing and shift reaction gas polishing
Hydrogen Sulphide (H ₂ S) and other reduced sulphur compounds	<5mg/kg	Yes	Removed during gas scrubbing and shift reaction gas polishing
Acid Gases	No Limits Stated	NA	None present in synthesis gas
Rare gases (Ar, He, Ne, Xe)	No Limits Stated	NA	None present in synthesis gas
Halogenated Hydrocarbons	1.5 mg/m ³	Yes	Thermally cracked during plasma gasification
Hydrogen Chloride	1.5 mg/m ³	Yes	Captured by gas cleaning process
Hydrogen Fluoride	5 mg/m ³	Yes	Captured by gas cleaning process
Arsenic	0.1 mg/m ³	Yes	Captured by gas cleaning process
Cd + Ti	Below Limit of detection (<LOD)	NA	Captured by gas cleaning process
Hg	<LOD	NA	Captured by gas cleaning process
Sb + As + Pb +Cr+ Co +Cu + Mn+ Ni + V	<LOD	NA	Captured by gas cleaning process
Zylenes	100 mg/m ³	Yes	Thermally cracked during

Parameter	Combined Specification	Achieved by compressed syngas	Fate and impact
			plasma gasification
Ammonia	<20 mg/m ³	Yes	Thermally cracked during plasma gasification
Siloxanes	0.1 mg/m ³	Yes	Removed in dry gas cleaning system
Gross Calorific Value	36.9 to 42.3MJ/m ³	Yes	Customer specification is marginally below GS(M)R specification however this is the specification which will be adhered to. Propane will be added to the compressed biomethane injected to the grid to meet the target value.

The specification provided above refers to ‘<Limit of Detection’ as the limit for some heavy metals. As the limit of detection can vary we have defined the limit as 0.03 mg/m³ for heavy metals Hg, Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total) and set this in Table 3.3 of the Permit.

Certainty of use

End of waste also requires that there is an end use for the proposed material. The plant will convert Refuse Derived Fuel (RDF) and non-hazardous waste wood into a syngas which is then upgraded to a methane for use as a transport fuel and for export to grid.

Summary

Based on the information submitted by the applicant we are satisfied that the syngas has the potential to meet the test that its combustion will cause emissions no higher than natural gas.

We have set improvement conditions for the applicant to submit a report on syngas analysis, in order to confirm the application data with operational data. The applicant is also required to carry out further natural gas analysis to provide further assurance on the decision.

Based on this we have permitted the plant as a 1.2 A(1) (ja) activity. If the applicant cannot meet the limits set in the permit or if future analysis shows that the syngas is no longer comparable to natural gas then the operator would have to cease operation of the plant until the permit is varied, to accommodate additional gas clean up techniques, or to amend the activity where Chapter 4 of the IED applies (i.e. S5.1 Incineration of waste).

ⁱ Gas Safety (Management) Regulations 1996, Schedule 3, Part I