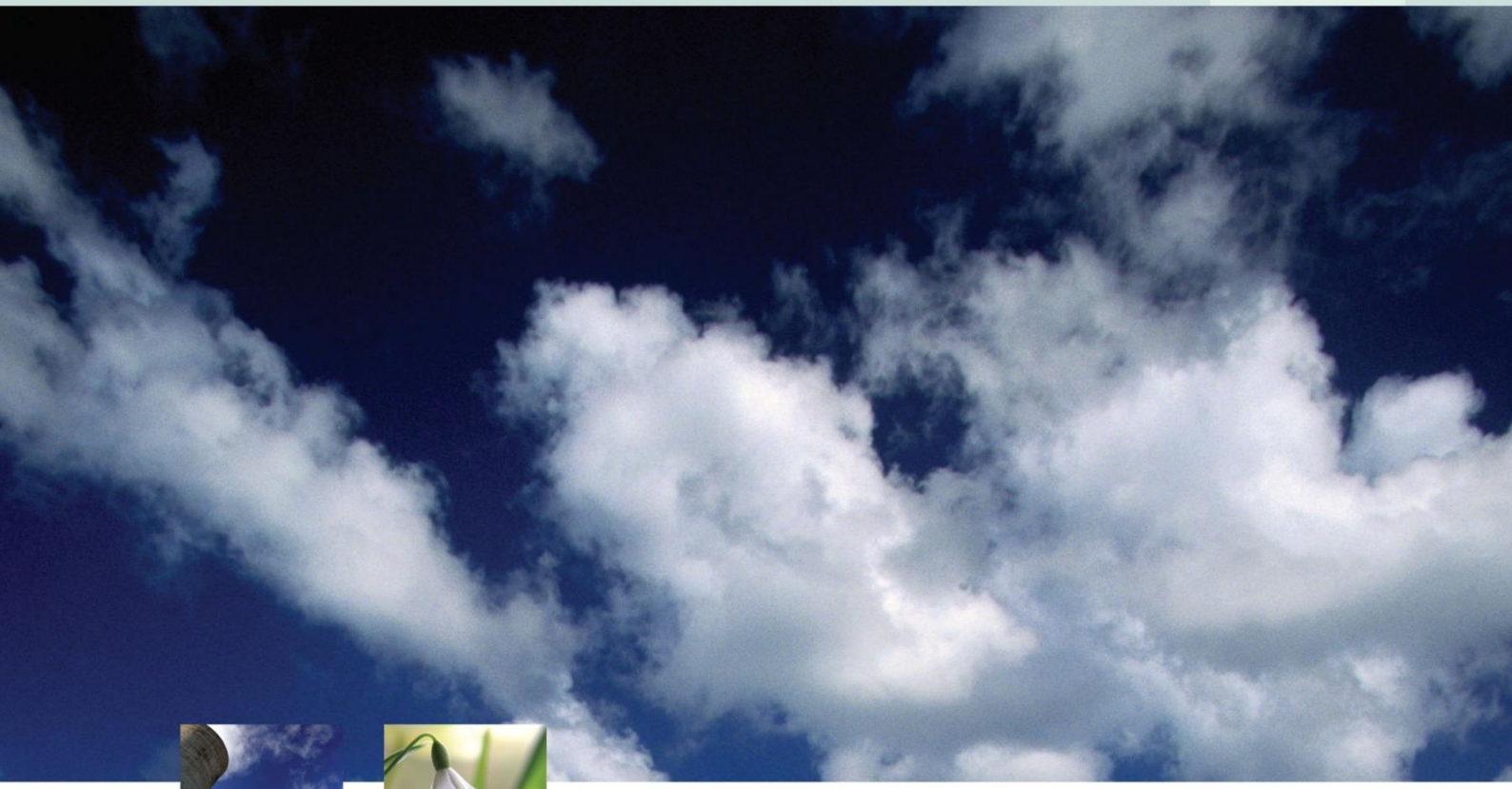

# EPR BESPOKE INSTALLATION PERMIT VARIATION

## G P Biotec Ltd
## Anaerobic Digestion Plant
## Great Porthamel

Prepared by:
Sol Environment Ltd

Date:
January 2022

Project or Issue Number:
SOL_21_P001_GPB

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| Issue | Description of Status | Date | Reviewer Initials | Authors Initials |
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| 1 | First Issue to Client for Review | December 2021 | AS | CG |
| 2 | Issue to NRW | January 2022 | SB | CG |

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## Glossary of Terms

| Term | Definition |
|---|---|
| ATEX | ATEX is the name commonly given to the two European Directives for controlling explosive atmospheres: Directive 99/92/EC (also known as 'ATEX 137' or the 'ATEX Workplace Directive') and Directive 94/9/EC (also known as 'ATEX 95' or 'the ATEX Equipment Directive') |
| BAT | Best Available Technique |
| BAT-AEL | Best Available Technique – Associated Emission Level |
| BREF | BAT Reference Document |
| CCTV | Closed Circuit Television |
| CHP | Combined Heat and Power Plant (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process. |
| $CO_2$ | Carbon dioxide |
| DAA | Directly Associated Activity |
| DSEAR | Dangerous Substances and Explosive Atmospheres Regulations 2002 |
| EMS | Environmental Management System |
| EWC | European Waste Catalogue |
| GEU | Grid Entry Unit |
| IC | Improvement Condition |
| ISO14001 | ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes etc.) negatively affect the environment (i.e., cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above. |
| kW | Kilowatt |
| LpA dB | A-weighted Sound Pressure Level in Decibels |
| LPG | Liquid Petroleum Gas |
| $m^3/hr$ | Meters cubed per hour |
| MWe | Megawatt Electric |
| MWth | Megawatt Thermal |
| nmVOCs | Non methane Volatile Organic Compounds |
| NRW | Natural Resources Wales |
| PLC | A Programmable Logic Controller, PLC or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery. |
| PSA | Pressure Swing Adsorption |
| Renewable Energy | Renewable energy is generally defined as energy that comes from resources which are continually replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat.<br>Renewable energy is also defined under the Renewable Energy Directive as comprising energy from the biomass fraction of waste. |
| RGN | Regulatory Guidance Note |
| ROV | Remotely Operated Valve |
| SCADA | SCADA (supervisory control and data acquisition) is a type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes. |

| | |
|---|---|
| SGN | Sector Guidance Note |
| TGN | Technical Guidance Note |
| µg/m$^3$ micrograms per cubic metre | A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m$^3$ means that one cubic meter of air contains one microgram (millionth of a gram) of pollutant. |
| WAMITAB | WAMITAB is an Education and Skills Funding Agency approved End-Point Assessment Organisation |

# NON-TECHNICAL SUMMARY

This document has been prepared on behalf of G P Biotec Ltd ('the applicant' hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environment Permitting Variation Forms Part C2 and Form Part C3 issued by Natural Resources Wales (NRW).

The G P Biotec Installation ('the Site') is located at Great Porthamel, Talgarth, Brecon, Powys, LD3 0DL.

The existing Anaerobic Digestion plant processes liquid and slurry waste, biodegradable solid wastes, and energy crops to create digestate and biogas. The biogas is currently used by the two combined heat and power plant (CHPs) to generate renewable energy in the form of heat to the process and electricity for export to the National Grid.

G P Biotec Ltd are proposing to add a biogas upgrading plant to produce renewable gas (biomethane) from a waste product and thereby further increase the sustainability of the site. The biogas upgrading plant has been designed to accept biogas from the existing anaerobic digestion plant on site and will export the biomethane to the National Gas Grid.

Condensate removed from the biogas at the biogas upgrading facility will be captured in sealed drainage and routed back to the anaerobic digesters as per the current drainage arrangements on site.

This variation application seeks to make a change to the environmental permit to add the new biogas upgrading plant and a new standby biogas boiler with a rated thermal input of 928 kWth and increase the permitted boundary.

The main built elements of the biogas upgrading facility comprise:

- Biogas chilling equipment;
- Activated carbon filtration equipment;
- Compressor unit;
- Biogas upgrading unit (utilising membrane technology);
- Propane storage;
- Grid Entry Unit (GEU); and
- Pipelines to transport biogas in from the existing Anaerobic Digestion process and to transport biomethane out to the National Gas Grid);

We have considered the relevance of '*Section 1.2 A(1)(a) – Refining of gas where this is likely to involve the use of 1000 more tonnes of gas in any 12-month period*', but do not consider this relevant. RGN 2 Note 1.2.1 states "'*Gas' in this Section means only mineral gases, obtained by mining or similar activities*". Biogas upgrading does not meet with this description, so therefore is not considered to apply.

The biogas upgrading plant will become a DAA to the existing Section 5.4 Part A(1)(b)(i) installation '*Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving; i) biological treatment.*'

As the new biogas boiler's rated thermal input (928 kWth) is below 1MWth it will not therefore constitute a new Medium Combustion Plant.

### Emissions to Air

Two new point source emissions to air (A7 and A8) will be added by this variation application:

- A7 will occur from a 928 kWth biogas fired standby boiler which will be used to provide heat and hot water to the facility in the event of CHP engine breakdown or maintenance.
- A8 will occur from the biogas upgrading plant stack (post carbon filtration) and will consist of carbon dioxide separated in the upgrading process and trace contaminants (nmVOCs and hydrogen sulphide) from the raw biogas together with a small amount of methane slip.

The new biogas boiler will only operate as standby plant (approximately 500 – 700 hours per annum) to supplement heat to the Anaerobic Digestion plant (i.e., when one of the main CHP engines is turned off) and as such the emissions have not been modelled as part of this permit variation due to the plant's small scale, intermittent usage, and negligible effect on the overall results.

The activated carbon filters used to filter the biogas in advance of upgrading have a very high efficiency and the raw biogas contains very low levels of contaminants[1] with hydrogen sulphide levels below the LOD even in the raw biogas (0.01% v/v).

Therefore, the impacts to air associated with the new biogas upgrading plant are not significant.

### Emissions to Controlled Water

There are no process emissions to controlled water arising from the Installation.

The new biogas upgrading plant will be housed on sealed concrete foundations with sealed drainage infrastructure. Condensate discharges are collected and routed to the existing Installation drainage network and are harvested for use within the anaerobic digesters. Clean uncontaminated surface water will drain to ground so there will be no discharges to surface water or sewer.

The new biogas boiler will be housed within the existing shed to the east of Digester Tank 1. This area of the installation drains surface water to the west of the site and through silt interceptor pits to the River Llynfi / Ennig.

### Emissions to Land

There are no emissions to land arising from the Installation. Clean, uncontaminated surface water from the new biogas upgrading plant area will drain to ground.

[1] Demonstrated through analysis undertaken by G P Biotec in October 2021

# 1 INTRODUCTION

This document has been prepared on behalf of G P Biotec Ltd ('the applicant' hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environment Permitting Variation Forms Part C2 and Form Part C3 issued by Natural Resources Wales (NRW).

The existing G P Biotec Installation ('the Site') is located at Great Porthamel, Talgarth, Brecon, Powys, LD3 0DL and this variation application relates to the proposed addition of a biogas upgrading facility as a Directly Associated Activity.

The existing Anaerobic Digestion plant processes liquid and slurry waste, biodegradable solid wastes, and energy crops and this creates digestate and biogas. The biogas is currently utilized for power generation through two existing gas reciprocating combined heat and power (CHPs) engines. The heat generated by the CHP engines is used to provide recovered / renewable heat for the purposes of process heating. All electricity generated by the plant is exported to the National Grid.

G P Biotec Ltd are proposing to install a biogas upgrading plant to their facility to enable the production and export of upgraded biomethane to the National Grid Distribution network.

This variation application seeks to make a change to the environmental permit to add the new biogas upgrading plant and thus allow a proportion of the biogas to be upgraded and exported to the Nation Grid Distribution System. All gas produced by the plant will meet the requirements of the National Grid gas injection 'entry' standards as defined by the Gas Safety (Management) Regulations and associated Quality Protocol. These upgrades are being carried out by the Operator, as the combination of gas CHP and gas injection provides a higher plant thermal / resource efficiency as solely gas generation and CHP operation.

Condensate removed from the biogas at the biogas upgrading facility will be captured and harvested within a sealed drainage system and routed back to the anaerobic digesters as per the current drainage arrangements on site.

The main built elements of the biogas upgrading facility comprise:

- Biogas chilling equipment;
- Activated carbon filtration equipment;
- Compressor unit;
- Biogas upgrading unit (utilizing membrane technology);
- Propane storage;
- Grid Entry Unit (GEU);
- Pipelines to transport biogas in from the existing Anaerobic Digestion process and to transport biomethane out to the National Gas Grid);

In the context of this variation application '*Section 1.2 A(1)(a) – Refining of gas where this is likely to involve the use of 1000 more tonnes of gas in any 12-month period'*, is not considered relevant[2].

The biogas upgrading plant will therefore become a DAA to the existing Section 5.4 Part A(1)(b)(i) installation 'Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving:

i) biological treatment.'

The biogas upgrading plant has been designed to accept biogas from the anaerobic digestion plant on site.

This permit variation also seeks to add a new standby biogas boiler to the permitted activities with a rated thermal input of 928 kWth. This below is below 1MWth and will not therefore constitute a new Medium Combustion Plant.

The remainder of this application support document is structured accordingly:

- Section 2: Provides a detailed planning and permitting history of the site and associated activities;
- Section 3: Provides specific nature of the proposed changes associated with the Bespoke Application;
- Section 4: Provides specific nature and detailed description of the emissions to air and water associated with the DAA to the installation;
- Section 5: Provides details of all environmental monitoring associated with the DAA to the Installation;
- Section 6: Provides details of the energy efficiency measures on site; and
- Section 7: Provides an Environmental Impact and Assessment of the DAA to the Installation.

All technical appendices associated with the DAA to the Installation are included and comprise the following:

- Annex A: Figures;
- Annex B: Technical Data;
- Annex C: Environmental Risk Assessment;
- Annex D: Noise Assessment;
- Annex E: Environmental Management System Summary;
- Annex F: Site Condition Report;
- Annex G: Accident Management Plan; and
- Annex H: WAMITAB

2 RGN 2 Note 1.2.1 states "'*Gas' in this Section means only mineral gases, obtained by mining or similar activities"*. This application relates to biomethane.

The site location, site layout and boundary of the installation are provided overleaf in Figure 1.1 and 1.2 and 1.3.

Additional annexes include Application Forms A, C2, C3 and F and an OPRA Assessment.

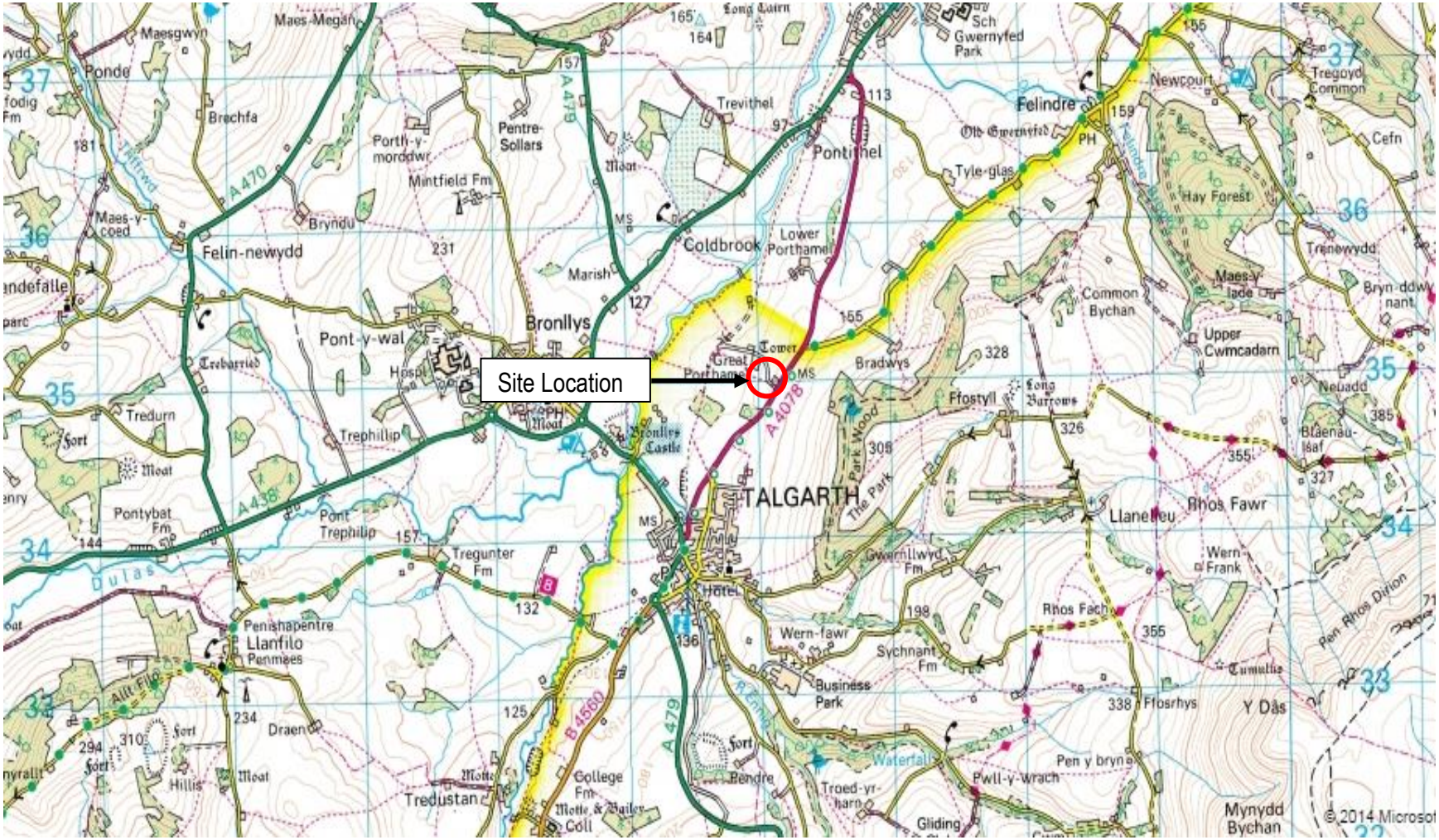


**Figure 1.1:** Site Location (*OS License No: 100062750*)

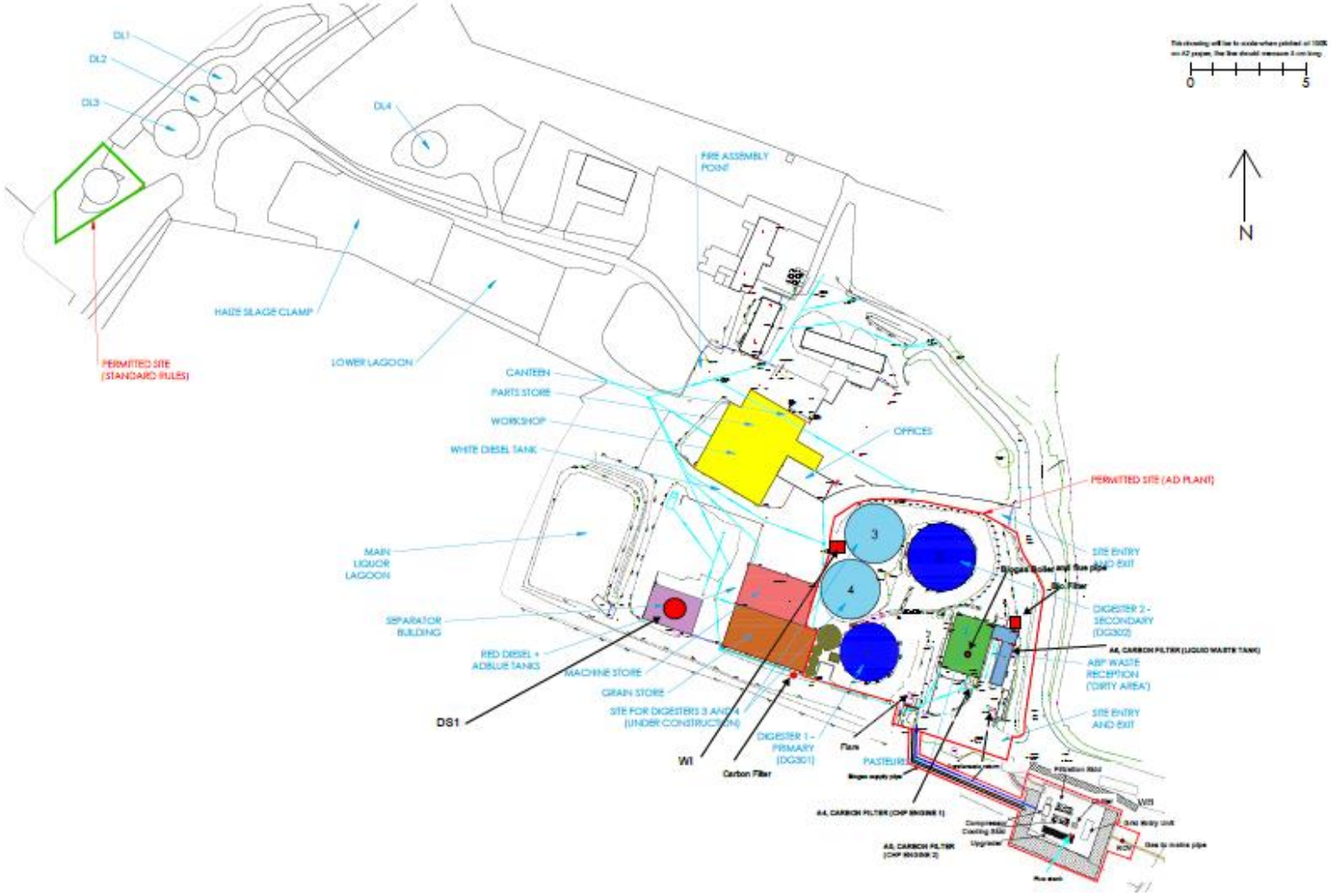


**Figure 1.2:** Installation Site Layout and New Boundary

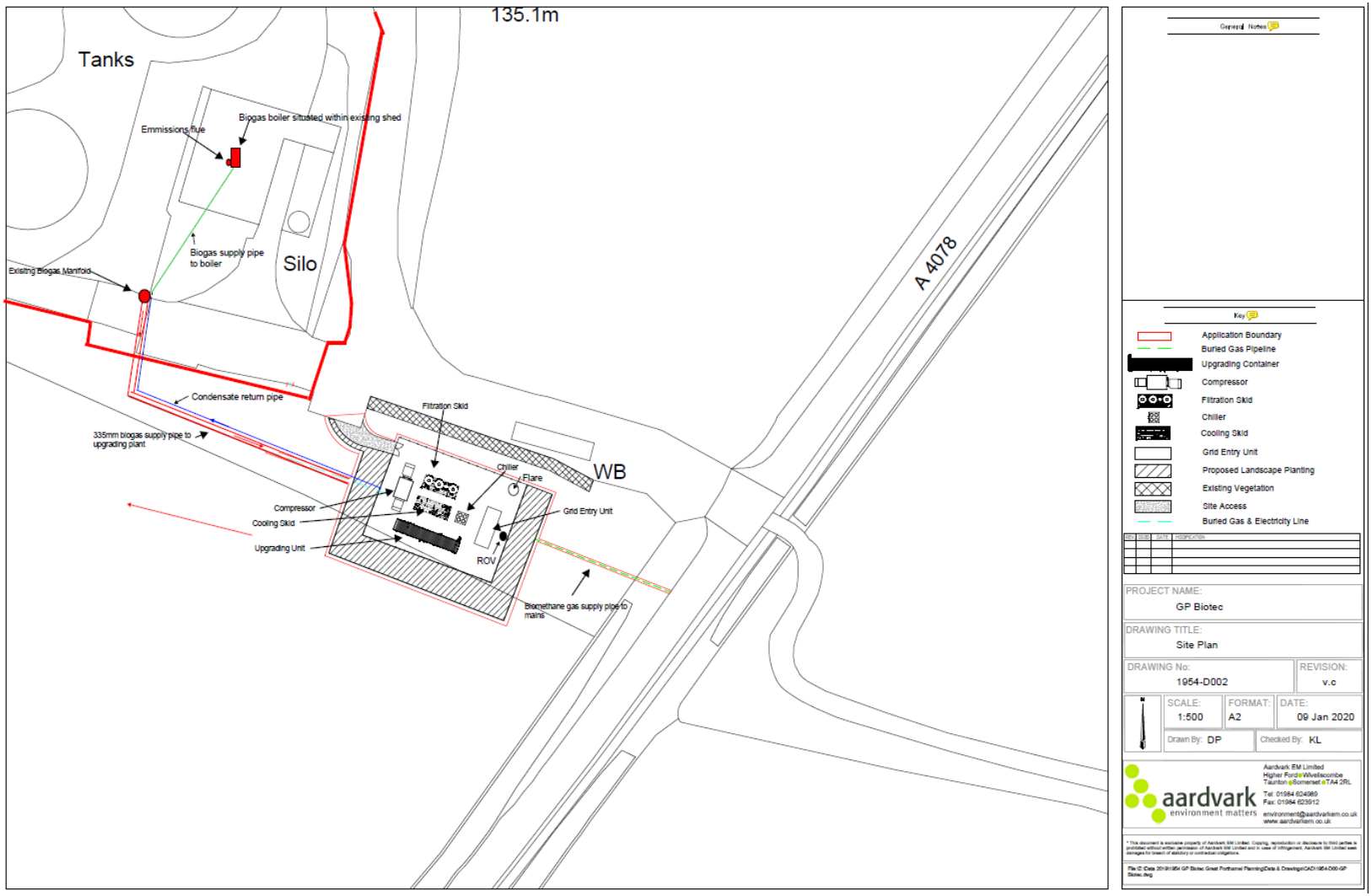


**Figure 1.3**: Biogas Upgrading Plant Area Layout

# 2 PERMITTING & PLANNING HISTORY

The sites permitting and planning history is provided in Table 2.1(a) and Table 2.1(b). The changes brought about by this variation were approved (20/18444/FUL) on 21st May 2021.

All details pertaining to all known planning permissions are provided in Table 2.1 below.

**Table 2.1(a): Permitting History**

| Reference | Description | Status | Date Granted |
|---|---|---|---|
| EPR/AB3233DW/A001 | Application for a New Bespoke Installation Permit | Determined | 12/03/2012 |
| EPR/ AB3233DW /V002 | Regulator led variation to amend infrastructure requirements | Permit Varied | 25/07/2013 |
| EPR/ AB3233DW /V003 | Variation and consolidation to include a listed activity following the implementation of the Industrial Emissions Directive and update to a modern condition format. | Permit Varied | 06/07/2015 |
| EPR/ AB3233DW /V004 | Variation and consolidation to increase the amount of animal waste that can be accepted to site. | Permit Varied | 12/02/2016 |
| EPR/ AB3233DW /V005 | Variation to add EWC Code 02 02 99. | Permit Varied | 25/09/2017 |
| EPR/ AB3233DW /V006 | Variation and consolidation to increase the site capacity from 55,000 TPA to 75,000 TPA and various other minor site changes. | Permit Varied | 30/01/2020 |
| EPR/ AB3233DW /V007 | Regulated led variation following the publication of the revised BAT Reference Document for Waste Treatment. | Permit Varied | 09/02/2021 |

**Table 2.1(b): Planning History**

| Reference | Description | Status | Date Granted |
|---|---|---|---|
| 07/01356/FUL | GP Services Proposed AD application submitted | Granted | 26/09/07 |
| 07/01356/FUL | LPA Decision | Refused | 08/05/09 |
| APP/P9502/A/09/2106895 | Appeal Lodged | - | June 2009 |
| APP/P9502/A/09/2106895 | Appeal Decision | Approved | 13/01/09 |
| CO/2615/2010 | S288 application lodged by BBNPPA | - | February 2010 |
| CO/2615/2010 | S288 Hearing in High Court | Permission Granted | 17/11/10 |
| 20/18444/FUL | Installation of a biogas upgrading facility, ancillary infrastructure and equipment, access and | Approved | 21/05/2021 |

| | | | |
|---|---|---|---|
| | landscaping | | |
| 20/18728/SO | Request for Screening Opinion under Part 2, Regulation 6 of The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 relating to Planning Application 20/18444/FUL for installation of a biogas upgrading facility, infrastructure and equipment at Great Porthamel, Talgarth | Environmental Statement Not Required | 04/08/2020 |
| 21/20246/DISCON | Discharge condition 6 (Letter dated 28 July 2021-Materials) and condition 7 (Drawing Ref: 1255/10 Landscape Proposals) in relation to planning application 20/18444/FUL. | Awaiting decision | - |

# 3 PROPOSED ACTIVITIES

## 3.1 Type of Permit

G P Biotec Ltd is making this variation application to enable the installation of the following plant and equipment to their existing Bespoke Installation Permit:

- Biogas chilling equipment;
- Activated carbon filtration equipment;
- Compressor unit;
- Biogas upgrading unit (utilizing membrane technology);
- Propane storage;
- Grid Entry Unit (GEU);
- Pipelines to transport biogas in from the existing Anaerobic Digestion process and to transport biomethane out to the National Gas Grid); and
- A new standby biogas boiler

The plant installation will also include new telemetry and a remotely operated valve (ROV), to control the feed rate of the biomethane into the gas grid. The ROV and all control assets are designed, supplied, owned and operated by the gas network utility company. As such, the scope of the permitted operations include all supplies to the valve / ROV but do not include the assets owned and operated by the gas utility company.

*Biogas upgrading plant*

The biogas upgrading plant will accept approximately 450 – 600 $m^3$/hr biogas for upgrading to biomethane and will export approximately 270 – 400 $m^3$/hr biomethane to the National Gas Grid.

We have considered the relevance of '*Section 1.2 A(1)(a) – Refining of gas where this is likely to involve the use of 1000 more tonnes of gas in any 12-month period*', as per Neil Herbert at NRW's request but do not consider this relevant. RGN 2 Note 1.2.1 states "'*Gas' in this Section means only mineral gases, obtained by mining or similar activities"*. The biogas upgrading plant will only utilize biogas.

The proposed biogas upgrading plant meets the description of a Directly Associated Activity (DAA) in accordance with RGN2 Limb (ii) by:

- Being directly associated with the stationary technical unit (the anaerobic digestion plant) as it serves the stationary technical unit by taking the biogas created by it;
- Having a technical connection with the listed activities carried out by the stationary technical unit by accepting the biogas created by the stationary technical unit i.e., it is an integral output activity concerned with the treatment of waste or other emissions (in this case biogas) from the stationary technical unit; and
- Being capable of influencing emissions, as the biogas upgrading plant produces condensate and also has an emission point to air (utilising carbon filtration to remove contaminants prior to release)

Accordingly, the biogas upgrading plant is considered to be a DAA to the existing Section 5.4 Part A(1)(b)(i) installation '*Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving: i) biological treatment.'*

The biogas upgrading plant has been designed to accept biogas from the anaerobic digestion plant on site. It will be obliged to meet the specification provided in Table 3.2.

*Standby biogas boiler*

A new standby biogas boiler will also be installed with a thermal rated input of 928 kWth. This is below the threshold to be considered Medium Combustion Plant but has been added to the existing A4 DAA for completeness.

The applicant is making a variation application to their existing Environmental Permit to carry out the following listed activities (new activities/changes to existing activities in red text) as shown in Table 3.1:

| Table 3.1 Permitted Activities | | | |
|---|---|---|---|
| Activity Reference | Activity listed in Schedule 1 of the EP Regulations | Description of specified activity | Limits of specified activity and waste types |
| A1 | Section 5.4 Part A(1)(b)(i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving one or more of the following activities: Biological Treatment | Anaerobic Digestion (with a capacity exceeding 100 tonnes per day) of permitted waste.<br><br>R3: Recycling/reclamation of organic substances<br>R13: Storage of wastes pending the operations numbered R1 to R12<br>D: Physico-chemical treatment which results in final compounds or mixtures where are discarded by means of any of the operations numbered D1 to D12 | All storage tanks and chambers will be sealed.<br><br>The digester and waste tanks shall be located on an impermeable surface with sealed drainage with engineered bund(s) with the capacity to contain 110% of the largest volume tank and 25% of the combined volume of all the tanks in the bund in case of spillage. The containment area shall be regularly inspected.<br><br>Foul water will be discharged via a sealed drainage system to a holding tank and used in the digestion process.<br><br>Anaerobic digestion of wastes including pasteurisation and chemical addition.<br><br>Wastes as specified in table S2.2.<br><br>Pre-treatment of waste including shredding, sorting, compaction, bailing, mixing and maceration<br><br>Gas cleaning by biological or chemical scrubbing and upgrading to biomethane.<br><br>Gas storage and drying.<br><br>Treatment of digestate including screening to remove plastic residues, centrifuge or pressing, addition of thickening agents (polymers) or drying.<br><br>The maximum throughput of animal waste [Note 1] shall be 30 tonnes per day. |

| Directly Associated Activity | | | |
|---|---|---|---|
| | | | The total quantity of waste accepted at the site shall be less than 75,000 tonnes a year.<br><br>Use of pressure valves to protect the integrity of the plant. Such systems should not be used routinely to vent unburnt biogas.<br><br>All food waste to be stored indoors and treated on an impermeable surface with sealed drainage, surrounded by a bund with a capacity of at least 110% of the largest vessel and 25% of the total tankage volume. Digestate shall be stored within covered containers or covered lagoons and should be of a design and capacity fit for purpose.<br><br>All biogas condensate shall be discharged into a sealed drainage system.<br><br>From receipt of permitted waste through to its digestion and recovery of by-products from the installation. |
| A2 | Biogas storage and supply system | Storage of biogas arising from the Anaerobic Digestion Plant | From receipt of gas into the holders to supply to the listed activity |
| A3 | Emergency flare operation | Use of an auxiliary flare required only for periods of breakdown or maintenance of the CHP engines.<br>D10: Incineration on land | From receipt of biogas to the release of combustion products from the flare stack. |
| A4 | Combustion plant operation | R1: Burning of waste as a fuel<br><br>Combustion of biogas in two combined heat and power (CHP) engines. The thermal input of each is 2.76 MWth (CHP1) and 3.36 MWth (CHP2). Combustion of biogas in a standby boiler the thermal input of which is 0.928 MWth | From receipt of biogas produced on site to combustion via a CHP engine with the release of combustion gases. |

| | | | |
|---|---|---|---|
| A5 | **Biogas upgrading plant operation** | R3: Recycling / reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)<br>Upgrading of biogas to biomethane (including the removal of moisture and other substances such as carbon dioxide, hydrogen sulphide, and non-methane volatile organic compounds) in a biomethane to grid plant for injection into the National Gas Grid. | From receipt of biogas produced at the on-site anaerobic digestion process, biogas cleaning and upgrading to biomethane |

Note 1: Animal Waste is defined in Schedule 6 of the Permit

The new biogas upgrading plant and new standby boiler are considered to be technically linked to the main activity and are included within the installation boundary of the site. The area housing the new biogas upgrading plant sits partially outside the current installation boundary and therefore the boundary is being extended as part of this variation application.

The technical guidance notes used in the preparation of this application document are:

- Control and monitor emissions for your environmental permit, published February 2016, last updated November 2018;
- Risk assessments for your environmental permit, last updated March 2021
- Air emissions risk assessment for your environmental permit, published February 2016, last updated August 2016; and
- Assess the impact of air emissions on global warming, published February 2016.
- How to comply with your environmental permit; October 2014
- Sector Guidance Note (SGN) S5.06, Guidance for the Recovery and Disposal of Hazardous Waste and Non-Hazardous Waste, October 2018;
- Technical Guidance Note (TGN) How to comply with your environmental permit. Additional guidance for: Anaerobic Digestion (LIT 8737), November 2013 (noted this will be superseded by the below); and
- EU Waste Treatment BREF BAT Conclusions, August 2018.

## 3.2 Details of the Installation

### 3.2.1 Installation Boundary

All activities will take place within the Installation boundary outlined in Section 1 Figure 1.2. The Installation boundary has been extended slightly to accommodate the full area to be developed for the biogas upgrading plant.

A Site Condition Report which provides a baseline conceptual model from the site has been completed and included within *Annex F*.

The Site Condition Report does not identify that the existing site presents either a significant contamination risk, nor does it identify any aspect of the new biogas upgrading plant or biogas boiler that presents a potential contamination risk to the environment.

All aspects of the new DAA have been designed in accordance with the Environment Agency's Pollution Prevention Guidance and NRW's Horizontal Guidance Notes.

### 3.2.2 Site Infrastructure and Design

The site to be developed for the biogas upgrading plant lies to the south of the weighbridge and site entrance and currently comprises bare ground. The footprint of the site will be extended to provide space for the upgrading container, carbon filter skid, cooling skid, chiller, Grid Entry Unit, and remotely operated valve (ROV) together with pipelines for biogas in (to the biogas upgrading plant), biomethane out (to grid) and buried electricity line.

A 12 tonne, underground, propane storage tank will also be installed on the site and located in the top yard. The new biogas boiler will be located within the existing installation in the existing shed to the east of primary digester 1.

*Site Drainage*

The new biogas boiler will be housed in the existing shed to the east of digester 1. This area drains surface water to the west of the site and through silt interceptor pits to the River Llynfi / Ennig.

The new biogas upgrading plant will be housed on concrete bases surrounded by compacted hardcore and will benefit from sealed drainage for process water. A new drainage pipeline will be routed for this process water drainage to connect it to the existing Installation drainage network which returns drainage to the anaerobic digesters. Clean uncontaminated surface water will drain to ground so there will be no discharges to surface water or sewer.

- Biogas pipeline – The pipeline containing biogas will run in a sealed subterranean trench between the existing installation and the biogas upgrading plant area. There is no risk of spillage to ground from the biogas pipe. Planned preventative maintenance measures will be implemented to ensure the duct is inspected at a frequency consistent with the site risk assessment (or at least annually).

- Biogas upgrading plant, propane, and odorant storage area – All process effluent (condensate) arising from the biogas upgrading plant will be routed to anaerobic digesters via the sealed drainage system as is currently the case for condensate arising in other areas of the site. Clean uncontaminated surface water will drain to ground.

- Biomethane pipeline – the pipeline containing biomethane will run in a sealed subterranean trench between the biogas upgrading plant and the grid entry point, via the GEU. Additional pipeline will also run from the GEU to the existing flare on site to transport out of specification biomethane.

- Biogas boiler – Surface water from this area of the installation drains to the west of the site and through silt interceptor pits to the River Llynfi / Ennig.

A detailed Site Drainage Plan is included in Annex A.

*Tanks and Bunds*

All tanks have been installed with secondary containment and designed to comply with the following standards and guidance requirements:

- Environment Agency Pollution Prevention for Business;
- HSE Bulk LPG Storage Tank: Safety of your LPG Storage Tank;
- CIRIA C598: Chemical Storage Tank Systems – Good Practice; and
- CIRIA 736: Design of Containment Systems for the Prevention of Pollution.

All storage and processing tanks associated with the Installation are detailed within Table 3.3 in Section 3.3.1 'Raw Materials'. The underground storage tank for the propane will be installed on contract with a propane supplier.

*Design and Layout*

The proposed biogas upgrading plant comprises the following features:

- Gas compression and chilling;
- Carbon filtration;
- Biogas upgrading plant using membrane technology and including stack (7.2 m above ground);
- Gas blending with propane and metering;
- GEU;
- Pipework for raw biogas in and biomethane out; and
- Propane storage tanks.

The carbon filters will be housed in a filtration skid. There will also be a cooling skid and biogas upgrading container. The GEU will be located in its own kiosk and the compressor will be located outside.

The boiler comprises the following:

- Viesssman Vitorond 200 biogas boiler with a rated thermal input of 928 kWth
- Riello RS100/M biogas burner assembly
- Riello RB300 biogas booster
- Vitorond 200 supply/return boiler header
- Boiler flue (6.7m above shed floor level)
- How water motive water pump
- Pipework for biogas
- Pipework for hot water feed/return
- Ancillaries such as safety shut off valve, safety relief valve and flash trap, manual isolation valves etc.

The new biogas boiler will be housed in the existing shed to the east of the primary digester 1.

The layout of the site is provided in Figures 1.2 (whole site) and 1.3 (new biogas upgrading area).

*Roadways and External Areas*

The existing site access roadway system has been designed to give safe access to all aspects of the site including the new standby biogas boiler. A short new section of track will be added at the site entrance to access the biogas upgrading plant area.

All vehicular access and personnel access areas are included within the installation boundary.

## 3.3 Description of the Process

A summary description of the key stages of the new activities are described below.

- Biogas Upgrading Plant: All biogas formed within the existing digesters will collect in the integrated gas store at the top of the tanks and is subsequently transported to:
    - Existing combustion plant (CHPs);
    - A new biogas upgrading plant where it is upgraded to biomethane for export to the national grid; and
    - A new biogas boiler where it is used as a fuel for this standby combustion plant.

  The biogas upgrading plant will remove moisture and contaminants from the biogas, compress it and use membrane technology to separate methane from carbon dioxide resulting in the production of biomethane which will be injected into the National Gas Grid and carbon dioxide which will be vented to atmosphere.

- Biogas boiler: the new biogas boiler will be used as standby combustion plant to provide heat for the anaerobic digestion process in the event one of the engines is offline.

A process schematic is provided in Figure 3.1.

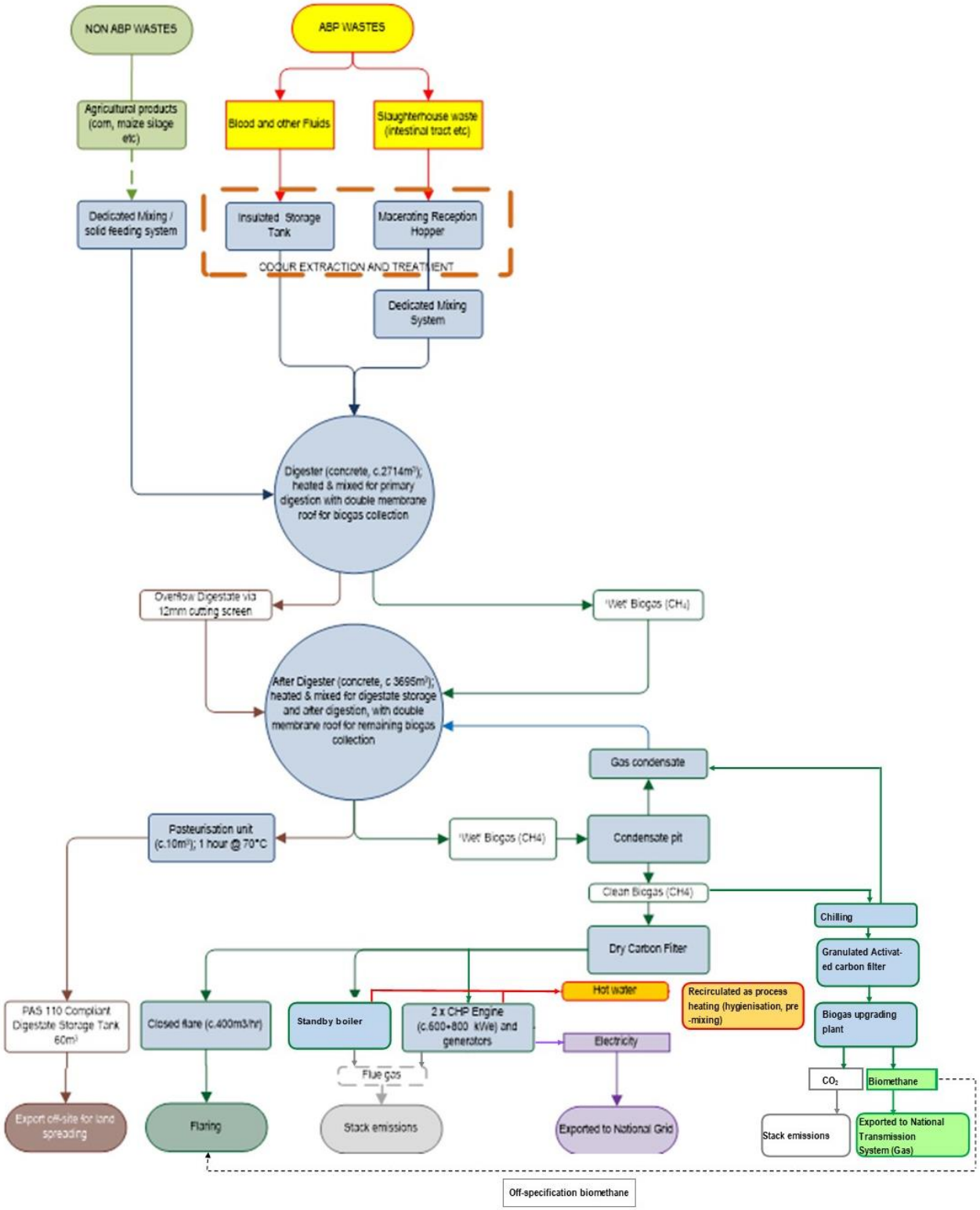


**Figure 3.1**: Simplified Process Schematic

### 3.3.1 Raw Materials

*Biogas*

The amount of biogas generated by the Anaerobic Digestion plant is between 850 and 1050 $m^3$/hr.

The raw biogas composition is shown in Table 3.2 below.

Table 3.2: Raw Biogas composition

| Parameter | Unit | LOD | Value |
|---|---|---|---|
| Hydrogen | % (v/v) | 0.05 | <0.05 |
| Oxygen | % (v/v) | 0.3 | 2.9 |
| Nitrogen | % (v/v) | 1.0 | 10 |
| Carbon monoxide | % (v/v) | 0.01 | <0.01 |
| Carbon dioxide | % (v/v) | 0.01 | 28 |
| Methane | % (v/v) | 0.01 | 58 |
| Ethane | % (v/v) | 0.001 | <0.001 |
| Hydrogen sulphide | % (v/v) | 0.01 | <0.01 |
| Ethene | % (v/v) | 0.001 | 0.002 |
| C3 Hydrocarbons as Propane | % (v/v) | 0.001 | <0.001 |
| C4 Hydrocarbons as n-Butane | % (v/v) | 0.001 | 0.001 |
| C5 Hydrocarbons as n-Pentane | % (v/v) | 0.001 | <0.001 |
| C6+ Hydrocarbons as n-Hexane | % (v/v) | 0.001 | 0.008 |
| Total | % (v/v) | N/A | 100 |

The detailed list of European Waste Catalogue (EWC) codes of wastes that are already included in the permit for acceptance by the installation remains unchanged by the addition of the biogas upgrading plant and the waste throughput of the installation will not change. It is however anticipated that an additional 5,000 – 10,000 tonnes of sileage / whole crop will be digested to achieve the biogas target levels.

*Raw Materials*

The quantity of biogas to be exported to grid via the new biomethane to grid plant, the extra quantities of crops and GAC, plus new storage and use of propane and odorant blend used as a result of the changes to the regulated facility are shown in Table 3.3.

| Table 3.3: Raw Materials and Storage Tank Inventory | | | | |
|---|---|---|---|---|
| Material | Tank Inventory | Description | Location | Fate |
| Sileage / whole crop | 5,000 – 10,000 tonnes | Existing feeding hopper | Anaerobic Digestion 'clean' Process Area External | Digested in the anaerobic digestion process. PAS110 Digestate used as soil conditioner and fertilizer for Great Porthamel Farm |
| Biogas | 3 x Primary Digestion Tanks with Integrated Gas Store 24 x 6m 1 x Secondary Digestion Tank with Integrated Gas Store 28m x 6m | Cast-in-situ concrete tank Fully insulated Double membrane gas stores 5,605 $m^3$ capacity (total for all tanks) Working volume ~ primary tanks 3 x 2714$m^3$, secondary tanks 1 x 3500 $m^3$ To digest organic material and convert to biogas. | Anaerobic Digestion Process Area External – within secondary containment | Biogas is transferred to Biogas Upgrade Plant, CHPs or Standby Biogas Boiler |
| Liquid Propane Gas | Propane Store 12 tonnes | LPG tank (underground) Supplier Specification | Top Yard External – within secondary containment | Entry to gas grid |
| Activated Carbon | 3 x stainless steel tanks each containing 1100 l of activated carbon | Activated Carbon stainless steel tanks | Biogas upgrading plant | Waste, recycled |
| Odorant | 40 kg odorant in GA50 Stainless Steel Schmidt Container | Neat Blend Mercaptan in stainless steel container, bunded | GEU – bunded container | Entry to gas grid |

## 3.4 Proposed Process

Raw biogas from the anaerobic digestion plant will be sent to both the existing combustion plant (CHPs) and the new biogas upgrading plant. Where either of the CHPs are offline (e.g., for maintenance) biogas will be sent to the new standby biogas boiler. The biogas upgrading plant will remove contaminants using carbon filtration and then upgrade the biogas using membrane technology to produce biomethane for injection into the National Gas Grid, and carbon dioxide (vented through a stack to atmosphere).

The new boiler is a 0.928 MWth, Viessman Vitorond 200 biogas (with Riello burner assembly) and will include provision of a new Riello RB300 biogas booster.

The existing flare will remain on site for emergency use and will be utilized for burning off-specification biomethane also e.g., during start-up / shut down.

### 3.4.1 Biogas Upgrading Plant

The raw biogas produced by the anaerobic digestion process is treated to reduce the hydrogen sulphide concentrations by injecting small quantities of $O_2$ into the biogas storage region of the digesters, and where further treatment is needed, dosing the digesters with Ferric Sulphate.

A proportion (approximately 450 – 600 $m^3$/hr) of the biogas produced by the anaerobic digestion process is then transferred to the biogas upgrading plant where it is upgraded prior to export to the National Gas Grid.

*Pre-treatment*

The raw biogas is chilled to further reduce the condensate. Chilling the biogas causes water to condense. The resultant condensate will be pumped back to the anaerobic digestion plant while the dried gas flows on to the biogas upgrading plant.

As hydrogen sulphide increases the operating costs in the upgrade plant it is necessary to remove as much of it as possible prior to upgrading. Carbon filtration will be used to remove impurities, such as hydrogen sulphide (down to 10ppm) from the raw biogas ahead of upgrading.

The raw biogas then undergoes compression to 16 bar pressure.

*Biogas upgrader*

The biogas is then pumped through a multistage set of selectively permeable membranes housed in an ISO container. The membrane system will allow $CO_2$ to pass through the membranes and separate it from the methane. The methane is separated out in three-stage interconnected membrane modules. The methane is held back on the pressure side of the membrane, while carbon dioxide and steam permeate through. This results in a gaseous product (biomethane) which is very rich in methane.

Fluctuations in raw biogas quality are compensated for by the control system.

*Control Systems*

The whole process is controlled by central switching and control equipment for automatic operation of the system. These can be operated in either manual or automatic mode.

*Grid Entry Unit*

This section of the plant is designed to introduce the required amount of propane to the biomethane and to analyse the final gas produced before allowing injection into the National Gas Grid.

This part of the plant includes:

- An LPG enrichment unit;
- A reject line to gas flare;
- Gas analysers; and
- The pipe to the entry point.

The biomethane will be analyzed via the GEU equipment to check that it reaches the required calorific value, and if necessary, will be supplemented with small quantities of propane to increase its calorific value to match that of the gas already in the National Gas Grid. Once the GEU determines that the gas meets the required specification demanded by the Grid, an odorant is added to the gas and injection to the National Gas Grid network is allowed via a ROV controlled by the gas network utility company.

Propane will be delivered to the site and stored within dedicated above ground tanks. The propane will be added to the biomethane to raise the energy content so that the energy requirements for UK standard gas is met. The addition of the propane will be carried out by an LPG enrichment unit. A propaniser will be used to control the addition of propane to ensure that the biomethane has a high enough Wobbe Index for use on the Gas Grid.

This grid connection is controlled by the National Grid and should it be unavailable at any time the gas is diverted to the emergency flare.

The reject line to gas flare is only used in instances where the gas produced does not meet the required standard for grid entry (having cycled round the biogas upgrading plant a second time prior to reject to flare).

If the biogas upgrading plant is offline for maintenance, then raw biogas will be consumed by the existing CHP plant, or where necessary the flare.

*Gas Quality Testing*

Gas analysers and sensors will be installed on site which will look at the composition of the gas to ensure that the number of contaminants (anything apart from methane) is within an acceptable range for Grid entry. The biogas detection unit will also analyse combustion properties of the gas, including its calorific value and Wobbe Index.

The monitoring includes but is not limited to:

- Oxygen;
- Carbon dioxide;
- Methane;
- Hydrogen sulphide;
- Temperature;
- Dewpoint;
- Calorific value;
- Wobbe Index;
- Soot Index,
- Hydrogen; and
- Nitrogen.

Further checks will be carried out for the presence and percentile composition of other short-chain hydrocarbons (i.e., propane, $C_2H_8$). An Impedance Hydrometer will be used to check the water dew point of the gas.

The biomethane will be fully compliant to the requirements of the Gas Safety (Management) Regulations 1996 and will meet the requirements in Table 3.5 below and will also meet the additional requirements stipulated in the WRAP bio-methane quality protocol[3].

[3] The WRAP biomethane protocol requires total Sulphur to <30mg/Nm$^3$ as well as: ammonia 20mg/Nm$^3$, hydrogen chloride 1.5mg/Nm$^3$, hydrogen fluoride 5mg/Nm$^3$, total halogenated hydrocarbons 1.5mg/Nm$^3$, xylenes 100mg/Nm$^3$ and Arsenic <0.1mg/Nm$^3$.

| Table 3.4: Biomethane Requirements | |
|---|---|
| **Property** | **Range or Limit** |
| Hydrogen Sulphide | Not more than 5 mg/$m^3$ |
| Total Sulphur | Not more than 30 mg/ $m^3$ (see footnote 2) |
| Hydrogen | Not more than 0.1% (molar) |
| Oxygen | Up to 1% as per HSE decision towards injection criteria |
| Hydrocarbon Dewpoint | Shall be at such levels that they do not interfere with the integrity or operation of pipes, or any has appliance (within the meaning of regulation 2(1) of the 1994 Regulation) which a consumer could reasonably be expected to operate |
| Water Dew Point | Shall be at such levels that they do not interfere with the integrity or operation of pipes, or any has appliance (within the meaning of regulation 2(1) of the 1994 Regulation) which a consumer could reasonably be expected to operate |
| Wobbe Number | In the range 47.20 to 51.41 MJ/$m^3$ |
| Impurities | Shall be at such levels that they do not interfere with the integrity or operation of pipes, or any has appliance (within the meaning of regulation 2(1) of the 1994 Regulation) which a consumer could reasonably be expected to operate |
| Incomplete Combustion Factor | ≤ 0.48 |
| Soot Index | ≤ 0.60 |

*Gas Injection Point*

An odouriser (Neat Blend Mercaptan) will be blended with the biomethane to ensure that the biomethane meets the National Gas Grid Injection Standards. There will be a ROV to enable the grid operator to shut down biomethane offtake in the event of operation issues. Any off-specification biomethane will be sent to the existing site flare.

Gas is transported in a dedicated buried biomethane pipe connected to the existing Medium Pressure (MP) System in the Wales and West Utility Distribution Network located to the east of the upgrading plant area.

### 3.4.2 Control Systems

The whole process is controlled by central switching and control equipment for automatic operation of the system.

All of the process plant will be operated remotely from the main control room. All the individual local equipment panels are equipped with touch screen interfaces which show the process control parameters, alarms, and plant status.

The control system will monitor all relevant process data (flows in/out, operating temperatures and pressures etc.). Biomethane flowing to the grid must always be compliant with the requirements of the Gas Safety (Management) Regulations 1996. A class exemption in respect of oxygen content has been granted by the Health and Safety Executive which allows an oxygen concentration up to 1.0% by volume.

Remote access to the system will be provided to allow process analysis from any plant staff or technical knowledge not present onsite when required, and for the updating of the software by the provider when appropriate.

### 3.4.3 Odour Control

The principal risk for offensive offsite odour originating from the new biomethane to grid plant arises from trace emissions of nmVOCs, hydrogen sulphide, and methane slip and the possibility of fugitive emissions of biogas, odorant or biomethane. The activated carbon filters will reduce the hydrogen sulphide, and nmVOCs to trace amounts. As a result, odour is not expected to be detectable in the biogas upgrader exhaust off-gas.

The inherent design of the new biogas and biomethane pipework and the odorant container will be such that the opportunity for fugitive emissions will be virtually eliminated. Further to this, the maintenance regime that will be in place for the new pipework and odorant container will ensure that the potential for such fugitive emissions will be kept low.

In addition, such plant items will be subject to control measures set out by the existing Odour Management Plan (OMP) for the site which will be updated to include the new biogas upgrading plant and will include a review of control measures appropriate for the emissions from the plant. These will be updated as necessary to address the addition of the biomethane to grid plant and will include consideration of fugitive emissions from biomethane from plant items and fugitive emissions of odorant from the odorant container.

Specific details of the activated carbon filters have been provided in Annex B.

## 3.5 Energy Efficiency

All heat and power required by the existing plant on site is generated by the existing, on-site CHPs.

The new biogas upgrading plant has an energy demand of 350 - 380kW which in addition to the existing plant parasitic load of 150kW increases the overall demand of the site to approximately 500kWe. Given that the existing CHPs can generate 1.2Mwe, there is adequate capacity to run both the existing plant and new upgrading plant without requiring grid support.

All plant and equipment have been chosen both on ability to perform and on its energy efficiency. G P Biotec Ltd have an operation and maintenance programme in place to undertaken routine inspections and checks. Plant will be monitored to ensure that no plant is operating ineffectively leading to the loss of energy. Regular maintenance will take place on site and any inefficient plant will be replaced.

The existing permit (EPR/AB3233DW/V007) has an improvement condition to provide an energy efficiency plan and energy balance record by 17th February 2022 and this will therefore be provided under separate cover.

## 3.6 Management System

The GP Biotec Ltd site is operated in accordance with the company's Environmental Management System (EMS). The company's EMS meets the requirements of ISO14001:2015.

The EMS has been designed to ensure:

- The identification of all foreseeable environmental impacts and risk that permitted activities pose to the environment.
- Prevention or minimisation of any identified risks to a practical minimum.
- Legal Compliance assurance.
- Identification of risks of pollution including those arising from operations, maintenance, accidents, incidents, non-conformances, and complaints, and how these will be minimised.
- Activities at the site are managed in accordance with the management system, which is subject to continuous review, audit, and improvement. Specific detailed management system reviews take place if there is a significant change to the activities, following an accident or if a non-compliance is found.
- Furthermore, the whole management system is subject to annual external audit by competent third parties.
- The key aspects of the EMS for the site includes:
    - Preventative maintenance;
    - Operator requirements;
    - Training and Competence;
    - Emergency response and incident management; and
    - Monitoring, measurement, and reporting.

The environmental management system and procedures will be updated to ensure that the environmental risk and impact of the normal running of the new biogas upgrading plant and standby boiler is documented and minimised.

The existing permit (EPR/AB3233DW/V007) has an improvement condition (IC1) to update the EMS in line with BAT 1 of the Waste Treatment BREF Document by 17th February 2022 and this will be dealt with under separate cover to this application.

*Environmental Management Procedures*

GP Biotec have developed a suite of environmental management procedures for the site. The procedures provide the environmental controls for all aspects of the site. The Management System Summary is included in Annex E.

*Site Maintenance*

All maintenance activities on site will be carried out in accordance with the manufacturers' recommendations and will be integrated within the company's EMS.

The key aspects of the maintenance management programme will include:

- A programme of Planned Preventative Maintenance (PPM) is undertaken to ensure ongoing management and replacement of key plant and equipment rather than waiting for the equipment to fail and the maintenance of any critical environmental equipment.
- The inspection and maintenance schedules that the manufacturer recommends are adhered to, including any period of recommended shut-down.
- Predictive maintenance is carried out to prevent any catastrophic breakdown.
- Real time data collection and plant condition monitoring.

The detailed management system operated by the site will include procedures for ensuring that adequate maintenance of the new plant is undertaken at the site.

The maintenance programme will ensure that all equipment or infrastructure that is deemed essential in the prevention of pollution to the environment (e.g., hard-standing, bunds, abatement plant etc.) or the prevention of local nuisance impacts (e.g., odour abatement etc.) is maintained and kept in good operating condition.

All maintenance activities for each part of the new key plant components (biogas upgrading plant, GEU, standby biogas boiler, propane storage tanks) will be carried out under contract by suitably qualified and competent third-party organisations.

Planned Preventive Maintenance is undertaken to include all site infrastructure, process plant, equipment, and side wide services with daily, weekly, monthly, quarterly, six monthly, and annual checks carried out. Checklists will be developed based on advice from the plant technology providers, manufacturers recommended inspections and experience gained through running the plant and these will be updated to include the new plant.

## 3.7 Operator Competence

The new biogas upgrading plant and biogas boiler will be fully automated to the point that all process activities will be linked to the existing PLC controls and SCADA. The biogas upgrading plant has on-line monitoring which can be administered remotely to ensure the process is optimised and operating correctly.

Notwithstanding the above, the site is always staffed during operating hours by the operations team. The primary role of day staff is to ensure and oversee waste receipts, monitor, and optimize plant processes and management.

Additional activities include general site housekeeping and administration activities. Additional staff attending the site will be visiting engineers from the equipment manufacturers who are adequately trained to perform their duties at site. GP Biotec Ltd maintain written operation instructions for all plant and monitoring equipment present on site and these will be updated to include the new biogas upgrading facility and biogas boiler.

The Site Manager at the site is deemed competent through qualification and holds the necessary WAMITAB CoTC Level 4 qualification as required by the WAMITAB / NRW Operator Competency Scheme

for anaerobic digestion including the use of resultant biogas (*Annex H*). There is no government-approved technical competence scheme for biogas upgrading plant in isolation.

All personnel working at the facility will be trained in the necessary sections of the EMS and any associated Procedures. All staff working for and on the behalf of the site will be suitably trained and competent (e.g., professional maintenance engineers, electricians, equipment operators etc.).

The EMS will be updated to include a procedure to ensure that operators of the biomethane to grid plant will be subject to training in line with site operating procedures and industry standards to ensure that appropriate technical management is in place. Staff who will work with the new biomethane to grid plant will receive specific training in its operation and the environmental impact of the process, as well as health and safety and this will be delivered by the technical provider.

The operators will have a detailed understanding of the operational procedures for the plant for both normal and abnormal operation. As part of the training, operators will receive specific instructions relating to those aspects of plant operation that have the potential for a negative impact on the environment. This training will be provided by the equipment manufacturers or in-house staff as appropriate.

A review of training needs for the operators and management, to meet the requirements of the regulated facility will be undertaken on the issuing of the permit variation. An appropriate training package will be developed and delivered within a suitable timeframe.

No operations (pre-conditional or otherwise) that involve the acceptance, handling or processing of any wastes will take place without a technically competent person being employed by the Operator.

*Operational Times*
The site will continue to be operated on a continuous 24/7 basis and when unstaffed, the site will be subject to remote monitoring.

The biogas upgrading plant will operate continuously 24/7 and the new biogas boiler will operate as standby only, for approximately 500 - 700 hours per annum.

## 3.8 Site Security

The site security measures have stayed the same as per the existing permitting requirements.

In summary the Site Security measures comprise;

- A perimeter fence which is inspected periodically to ensure that the site security has not been compromised.
- CCTV monitoring of the external and internal areas of the Installation.
- External on-line monitoring and administration of the process from a remote location.

## 3.9 Accidents and Emergencies

*Accident Management Plan*

The Applicant has an Accident Management Plan based around the specific risks associated with the site operations and this has been updated to include the new activities forming the subject of this variation.

Additional specific emergency response procedures have been developed by the operator in conjunction with the biogas upgrading plant and propane storage.

The key aspects of the Sites Accident Management Plan are:

- Reviewed by the Site Management annually and as soon as practicable after an accident.
- Considers hazards presented by:
  - Emergency shut-down procedures;
  - Actions in case of fire/explosion;
  - Actions in case of fire/emergencies;
  - Contaminated firewater;
  - Failure of any equipment;
  - Failure of abatement plant;
  - Spillages and uncontrolled release;
  - Plant or equipment failure (e.g., over-pressure of vessels and pipework, blocked drains);
  - Vandalism; and
  - Flooding/extreme weather.
- Identifies events or failures that could damage the environment.
- Assesses the likelihood and the potential environmental consequences from accidents at the site.
- Proposes action to minimise the potential causes and consequences of accidents.

In the event of an accident, NRW will be immediately informed and necessary measures to limit the environmental impact of the accident will be carried out, as well as measures to prevent further possible accidents.

All handing of the odorant and propane will be subject to stringent procedures and operatives are trained in the necessary measures to ensure safe handling and prevent fugitive releases. A DSEAR Assessment, ATEX zoning and use of ATEX rated plant and equipment in ATEX zones, operating and maintenance procedures and emergency plans are used to minimise risk of fire and explosion. These will be updated as necessary to include the new biomethane to grid plant, additional ATEX zones and ATEX rated equipment.

The sites Accident Management Plan has been included in *Annex G.*

*Incident Reporting*

The reporting of incidents and non-conformities forms a key component of the company's Environmental Management System. Identified non-conformities under the system include, but are not limited to the following:

- Uncontrolled leaks and spillages of any materials with the potential to cause pollution to the environment (hydraulic fluid/oils, unabated dust emission to atmosphere);

- Non-compliance to any permitted condition or consent limit (emissions excursions, missing of reporting deadlines, breach of any permitted consent limits);
- Internal Audit findings (legal non-compliances, EMS procedural breaches, system non-compliances);
- External and Internal Complaints; and
- Whenever a plant malfunction, breakdown or failure, or any near miss occurs.

The company's EMS undergoes periodic external audit and review to ensure that both compliance and continuous improvement is achieved. The EMS requires that all identified incidents and non-conformities will be investigated and closed out.

All plant and equipment will be PLC controlled, monitored, and alarmed using a 'SCADA' system, thus ensuring that continuous plant diagnostics can be facilitated.

The Company's EMS system is certified to ISO 14001:2015.

# 4 EMISSIONS AND THEIR ABATEMENT

## 4.1 Emissions to Air

Two new point source emissions to air (A7 and A8) will be added by this Variation Application.

- A7 - Standby Biogas Boiler Flue: A 928 kWth biogas fired standby boiler which will be used to provide heat and hot water to the facility in the event of CHP engine breakdown or maintenance. This boiler is below 1MWth and will therefore not constitute a new Medium Combustion Plant. The stack will be vertical and unimpeded by cowls or caps.
- A8 – Biogas Upgrading Plant Flue: Stack from the biogas upgrading plant stack (post carbon filtration) consisting of separated carbon dioxide and trace contaminants from the raw biogas together with a small amount of methane slip.

Contaminants identified in the raw biogas through Marches biogas analysis dated 21st October 2021 are nmVOCs. Ammonia was not recorded. Hydrogen sulphide was not measured above the limit of detection. The activated carbon filters used in the pre-treatment of the biogas prior to upgrading, have a very high efficiency (hydrogen sulphide to less than 10ppm).

Membrane biogas upgrading offers a high level of efficiency of methane retention which reduces methane slip (a maximum of up to 1% of the methane content of the raw biogas).

All other existing emissions points will remain unaltered.

The locations of the proposed emissions to air are shown on the Figure below.

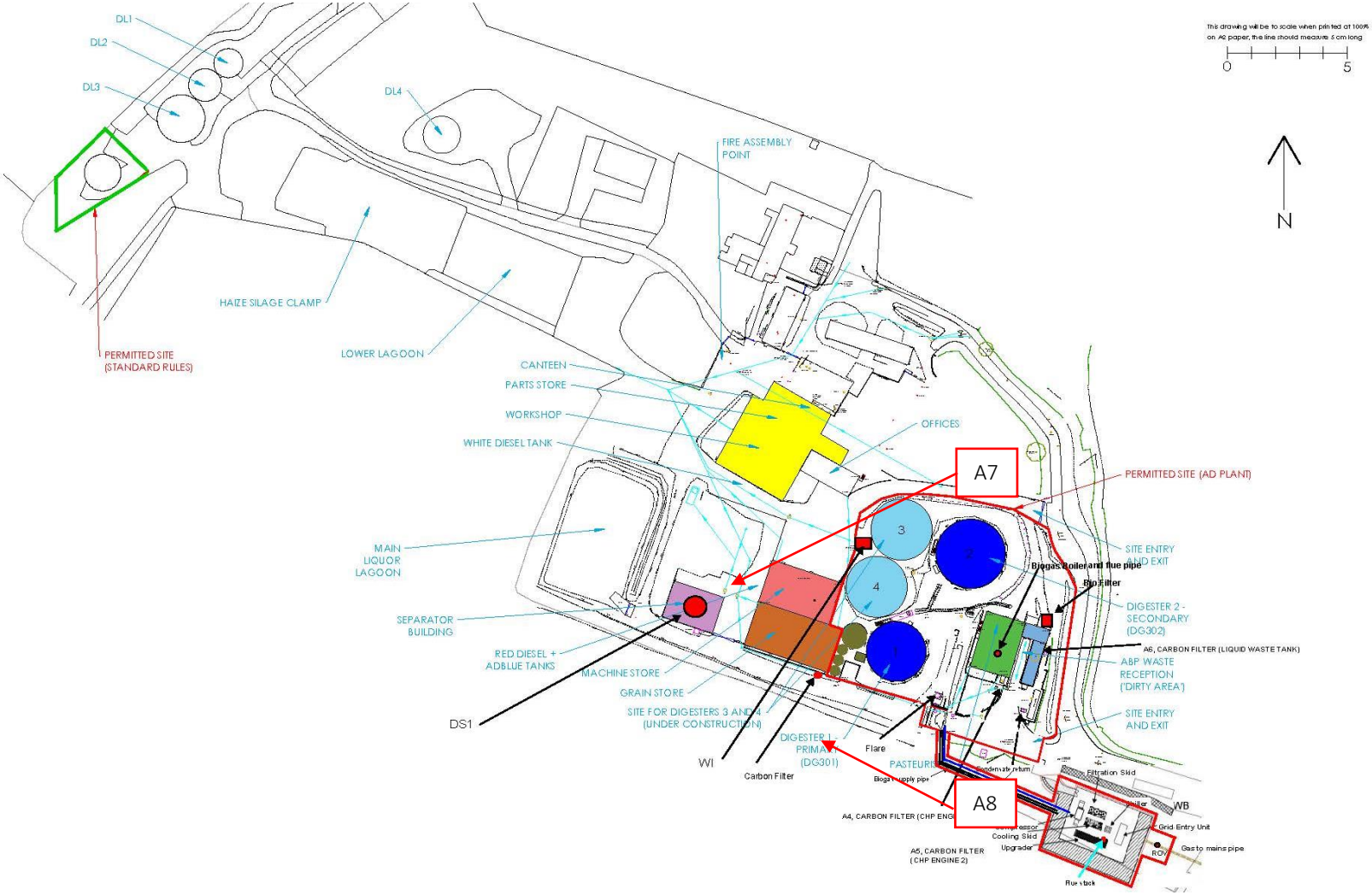


**Figure 4.1:** Emission Locations

It is not expected that there will be a significant impact to air from the new biogas upgrading plant or biogas boiler and further information is provided in section 7.

The table below summarises the BAT justification for emissions to air.

**Table 4.1 BAT Justification for Emissions to Air**

| BAT | Justification |
|---|---|
| Monitor channelled emissions to air in accordance with EN Standards | The biogas upgrading plant is not itself a biological treatment process, but it is a directly associated activity treating biogas from the wider site. It is considered that the Waste Treatment BREF BAT-AELs are relevant future benchmarks for the biogas upgrading stack (of which ammonia, odour and hydrogen sulphide are relevant to emissions from biological treatment and BAT 8 clarifies that operators may monitor ammonia and hydrogen sulphide or odour). The operator will monitor ammonia and hydrogen sulphide every six months in line with their other, existing, channelled emissions points.<br>Channelled emissions to air from the new boiler will not be monitored as the plant is below the threshold (1MWth) for Medium Combustion Plant controls. |
| Reduce emissions to air of dust, organic compounds, and odorous compounds (including H2S and NH3) by using one or more:<br>- adsorption<br>- biofilter<br>- fabric filter<br>- thermal oxidation<br>- wet scrubbing | Activated carbon filters will be used to remove odorous compounds including hydrogen sulphide and nmVOCs from the raw biogas prior to being upgraded in the biogas upgrading plant. |
| Use flaring only for safety reasons or non-routine operating conditions ensuring correct plant design and plant management | No changes to the flare are proposed as part of this variation. An improvement condition (IC4) already exists on the permit to assess the gas recovery system capacity and ensure correct plant design. |
| Reduce emissions to air when flaring is unavoidable using correct design of flaring devices and monitoring and recording as part of flare management | No changes to the flare are proposed as part of this variation. Continuous monitoring of the quantity of gas sent to flare is a permit requirement |

## 4.2 Emissions to Controlled Water

There are no process emissions to controlled water from the site.

Surface water from the ABP reception area is collected and transferred into the anaerobic digestion process. All uncontaminated surface water run-off from the site is tested prior to release and then discharged via pipeline to the River Llynfi via existing discharge points W1 and W2.

Surface water draining to ground in the biogas upgrading facility area, will be restricted to clean, uncontaminated surface water only.

Process water arising from the operation of the proposed biogas upgrading plant (condensate) will drain to sealed drainage which will be harvested by the anaerobic digestion plant.

## 4.3 Emissions to Sewer

There are no process emissions to sewer from the site. There are no connections to any public or private foul water systems at the site and the proposed variation will not have any impact on emissions to sewerage.

## 4.4 Emissions to Land

There are no emissions to land arising from the installation and the proposed variation will not introduce any. Surface water draining to ground in the biogas upgrading facility area, will be restricted to clean, uncontaminated surface water only.

## 4.5 Odour

Odour management and mitigation is a key issue for the Installation and has formed part of the primary design parameters of the site plant. The Installation has been designed with a hierarchy of odour control and abatement measures to ensure that the potential for odour impacts is minimised and this includes the new biogas upgrading plant. The process has been designed to ensure that there will be no significant fugitive or point source releases of odour from the plant under normal operating conditions.

The potential sources of odour from the proposed new biogas upgrading plant are limited to the Biogas upgrader off gas (methane slip, hydrogen sulphide).

Carbon filters will be used upstream of the biogas upgrading and will remove odorous compounds.

The off gas from the biogas upgrader is not expected to contain odorous compounds such as hydrogen sulphide at an appreciable level as these are at low concentrations in the raw biogas and the carbon filters have a very high efficiency and will retain all contaminants (it is not regenerative).

A release of odour may only occur if the filters become overloaded under abnormal conditions. There will be controls in place e.g., hydrogen sulphide alarms, to ensure this does not occur.

The Odour Management Plan has been reviewed in line with Best Available Techniques and olfactometry measurement will be carried out following a substantiated odour complaint.

Daily odour monitoring will also be carried out as part of the Daily Checks Procedure.

No further control of odour emissions is therefore required.

There will be no sources of odour from the proposed new biogas boiler.

The table below summarises the BAT justification for odour emissions and management.

| Table 4.2: BAT Justification for Odour Management and Monitoring | |
|---|---|
| **BAT** | **Justification** |
| Periodically monitor odour emissions where nuisance is expected and/or has been substantiated | Daily 'odour intensity' sniff test monitoring is undertaken at the installation. The permit includes an existing improvement condition (IC3) to update the OMP to include monitoring in line with BAT 10 where a substantiated odour issue occurs. |
| Set up and implement an Odour Management Plan where nuisance is expected and/or has been substantiated, including:<br>- Protocol containing actions and timelines<br>- Protocol for conducting odour monitoring<br>- Protocol for response to odour incidents/complaints<br>- Odour prevention and reduction programme | The site has an Odour Management Plan in place that will be updated to include the new biogas upgrading plant. |
| Minimise residence times (open systems only) | n/a to the new biogas upgrading plant or boiler |
| Use chemical treatment | $H_2S$ generated in the digesters is reduced by injecting a small quantity of $O_2$ into the gas storage. If levels are particularly high and $O_2$ addition is not sufficient, ferric sulphate is injected to the digester. Remaining contaminants in the biogas entering the biogas upgrader are abated using activated carbon filters. |
| Optimising aerobic treatment | n/a to the new biogas upgrading plant or boiler |

During normal operation of the biogas upgrading plant, the likelihood of odour impacts is judged to be insignificant given that:

- The above measures have all been incorporated in the biogas upgrading plant design for the prevention / mitigation of odour emissions; and
- The distance between the site and non-site sensitive receptors.

More detail relating to the sites odour prevention measures are provided in detail within the site Odour Management Plan and this will be updated to include the new biogas upgrader plant (including storage of the odorant).

## 4.6 Noise

The design of the new biogas upgrading plant and boiler at the facility has taken into account the potential impacts on the environmental and neighboring receptors in regard to noise. The plant has been designed to ensure compliance with BS 4142 and in accordance with the *'Noise and vibration management: environmental permits'* guidance.

Sources of noise as a result of the changes proposed in this permit variation are limited to noise from the new chiller, blower, and compressor for the biogas upgrading plant. The upgrading facility is an entirely enclosed process which mitigates impact from noise. The facility is not located close to any sensitive receptors (beyond the residential dwellings of the operator). The maintenance regime that will be in place for the new biomethane to grid plant and boiler will ensure that the potential for noise emissions will be kept low.

A quantitative noise impact assessment of the proposed plant has been undertaken using predictive acoustic modelling software and the results used to calculate the noise emissions associated with the new plant arrangements.

The results of the assessment conclude that the introduction of the new biogas upgrading plant are negligible and will not be audible at the receptor properties.

*Noise Abatement Measures*

To minimise noise emissions from the facility, the following mitigation measures have been incorporated as appropriate into its design and layout:

- Noise-emitting plant has been enclosed within appropriately designed housings; and
- Equipment has been screened.

By employing the above mitigation measures, it is concluded that the proposed biogas upgrading plant will have both a low daytime and nighttime noise impact and is unlikely to give rise to noise complaints.

The assessment also identifies that no significant effect to the cumulative specific sound level nor change in ambient sound level will be engendered as a result of the proposed biogas upgrading plant in its proposed and assessed form, at the closest noise-sensitive receptors.

The assessment summarizes that the plant has a negligible impact and accords with the indicative Best Available Techniques.

The noise modelling carried out for the proposed development is provided in Annex D.

Table 4.3 below shows the BAT justification for noise prevention on site.

| Table 4.3: BAT Justification for Noise | |
|---|---|
| Indicative BAT | Justification |
| Set up, implement, and regularly review a Noise and Vibration Management Plan where nuisance is expected and/or has been substantiated to include:<br>- Protocol with actions and timelines<br>- Noise and vibration monitoring plan/protocol<br>- Noise and vibration complaint response plan/protocol<br>- Noise and vibration reduction programme | The permit requires emissions from the activities to be free from noise and vibration at levels likely to cause pollution outside the site and if the activities are giving rise to noise pollution outside the site, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration will be required. The addition of the new biogas upgrading plant and boiler are not anticipated to generate noise levels above acceptable limits. |
| Appropriate location of equipment and buildings | The location of the site, topography of the land and the fact that there are no nearby sensitive receptors (beyond the residential dwellings of the operator) in close proximity to the site mean that noise is not considered to be a significant potential source of pollution to the environment. |
| Operational measures | All machinery is turned off when not in use; operation of plant and machinery takes place during permitted hours only; routine inspection and maintenance of plant and equipment. |
| Low-noise equipment | The sound sources associated with the new biogas upgrading plant are the chiller (58$L_{pA}$ dB at 10m), the blower (75$L_{pA}$ dB at 1m) and the compressor (75$L_{pA}$ dB at 1m) |
| Noise and vibration control equipment | The new biogas upgrading plant and new boiler will be enclosed within containers/building. |
| Noise attenuation | This technique is not used. |

## 4.7 Energy Use

The energy required by the existing plant on site is generated by the existing, on-site CHPs.

The new biogas upgrading plant has an energy demand of 350 - 380 kW. The existing CHPs will have adequate capacity to run both the existing plant and new upgrading plant.

The existing permit (EPR/AB3233DW/V007) has an improvement condition to provide an energy efficiency plan and energy balance record by 17th February 2022 and this will therefore be provided under separate cover.

## 4.8 Fugitive Emissions

*Air*

The biogas upgrading plant and biogas boiler have been designed to ensure that there will be no fugitive emissions from the site. The proposed activity will not result in any fugitive releases of process emissions, dust, or odour under normal operating conditions.

There will be the potential for fugitive emissions to air from the new plant items, as a result of minor slippage of:

- Biogas from the new section of biogas pipework and the new biogas upgrader;
- Propane from the new propane tanks or pipework;
- Biomethane from the new biomethane pipework; and
- Odorant from the storage container.

The inherent design of the pipework and the new biogas upgrader is such that the opportunity for fugitive emissions will be virtually eliminated. Further to this, the maintenance regime that will be in place for the new pipework and biogas upgrader will ensure that the potential for such fugitive emissions will be kept low. Routine maintenance will include checking that the supply systems and the new biogas upgrader are gas tight.

Any fugitive emissions that are detected will be recorded as part of the maintenance record. This will ensure that an inventory of fugitive emissions will be maintained, and appropriate remedial action implemented. The control of biogas, biomethane and propane is particularly important because of the explosion risk they present. If the biogas upgrader needs to be shut down, the biogas will be diverted to the flare to maintain safe operating pressure within the biogas network.

Should any abnormal incident occur regarding the biogas supply such that there is insufficient biogas to maintain operation of the biogas upgrader, the unit will automatically shut down.

The propane tanks will be supplied by a UK supply leader and maintained as part of the planned preventative maintenance programme. Gas tight seals and gas detection systems will be used to mitigate risk of leaks.

The odorant is inherently highly odorous and even a minor fugitive release has the potential to cause widespread odour. Accordingly, it will be stored and handled in very small quantities, in sealed containers, at the new biomethane to grid plant. Its injection into the biomethane will be automatically controlled by a fully enclosed system inside the GEU which is purpose-designed and subject to a comprehensive inspection and maintenance regime to prevent fugitive releases.

All handing of the odorant will be subject to stringent procedures which will be noted in the Odour Management Plan (OMP) for the installation (to be reviewed and updated) and operatives are trained in the necessary measures to prevent fugitive releases.

*Surface Water / Sewer / Groundwater / Land*

The principal potential sources of fugitive emissions to surface water, sewer and groundwater are the storage and handling of chemicals and maintenance sundries associated with the new biomethane to grid plant. Appropriate containment measures will be in place, including procedural controls and the provision of spill kits. Potential sources of fugitive emissions for the biogas upgrader include leaks of:

- Effluent from the drying chillers;
- Effluent from the condensate separators;
- Oil from the compressor; and
- Effluent from the coalescer.

The inherent design of the plant will be such that the opportunity for fugitive emissions will be virtually eliminated, plus the likelihood of occurrence of leaks will be minimised by the maintenance regime that will be in place. The concrete hardstanding and sealed drainage system prevent any fugitive emissions from reaching the environment. The compressor will be located in a compressor bund housing. The capacity of the housing will be greater than 110% of the capacity of the compressor.

Drainage systems external to the biomethane to grid plant area are subject to the standard management arrangements of G P Biotec Ltd, which include control measures to ensure harmful substances cannot be discharged to surface water, groundwater, or land. Spill kits are in place on the site, and operatives receive regular training in their use.

There will be no discharges (fugitive or otherwise) to ground water.

A summary of the potential fugitive emissions and the appropriate mitigation and control measures is provided within the table below.

**Table 4.4: Control of Fugitive Emissions**

| Media | Aspect | Mitigation / design measure | Potential |
|---|---|---|---|
| Fugitive emissions to air | Incidents and Accidents | Key potential incidents and accidents are outlined below:<br>• Leakage of tanks –maintained as part of the planned preventative maintenance programme, gas tight seals and gas detection systems used to mitigate risk of leaks, use of sealed containers, injection of odorant into the biomethane will be automatically controlled by a fully enclosed system, handing of the odorant will be subject to stringent procedures which will be noted in the Odour Management Plan (OMP); and<br>• Leakage of pipework – | All the identified potential accident scenarios will be addressed in the Accident Management Plan.<br><br>All scenarios considered unlikely to create significant fugitive emissions. |

| | | | |
|---|---|---|---|
| | | maintenance regime that will be in place will ensure that the potential for such fugitive emissions will be kept low | |
| Fugitive emissions to water | Contaminated runoff | The new biogas boiler is housed within a building.<br><br>The new biogas upgrading plant is a contained system. The plant itself will benefit from connection to sealed drainage and will be mounted on concrete. Rainwater run off from surrounding areas will not come into contact with any wastes or potentially polluting substances and will therefore drain to ground. | No potential for fugitive emissions. |
| | Contamination leakage through hardstanding | All plant will be constructed on sealed concrete floor slabs/purpose-built skids with a minimum thickness of 200mm (but typically greater in high load areas).<br><br>All contaminated materials will be stored within sealed tanks. | No potential for fugitive emissions. |
| | Leakage of storage tanks | New chemicals for the new plant are limited to propane (gaseous) and odorant (liquid) and very small volumes of oil for the compressor.<br><br>All storage tanks are constructed of stainless steel with suitable bunding to 110% volume and will be easy to inspect. The compressor will be located within compressor bund housing which will have a capacity of greater than 110% of the capacity of the compressor.<br><br>All storage tanks will be located on a bunded area constructed of re-enforced concrete >200mm thickness. Odorant will be stored in a double skinned tank within an odorant bund.<br><br>Propane will be stored in a purpose-built steel tank with suitable secondary containment provided by specialist | No potential for fugitive emissions. |

| | | | |
|---|---|---|---|
| | | supplier.<br><br>All leaks of odorant would be collected within the secondary containment and immediately cleaned up. Propane would evaporate. | |
| | Leakage of pipework | All pipework will be mounted aboveground or within ducts to facilitate inspection.<br><br>All pipework will be periodically inspected to ensure its integrity | No potential for fugitive emissions. |
| Fugitive emissions to sewer | Effluent Discharge | Effluent will be routed to the anaerobic digestion plant. | No potential for fugitive emissions |
| Fugitive emissions to land | Contamination leakage through floor slabs/skid base | All processing plant will be located on concrete with a minimum thickness of 200mm (but typically greater in high load areas).<br><br>All contaminated materials are stored within sealed tanks. New chemicals for the new plant are limited to propane (gaseous) and odorant (liquid).<br><br>Biogas and biomethane are also gaseous. | No potential for fugitive emissions |

Table 4.5 shows the BAT justification for preventing fugitive emissions from the proposed development.

| Table 4.5: BAT Justification for Fugitive Emissions | |
|---|---|
| Indicative BAT | Justification |
| Air | |
| Techniques to prevent or where not practicable reduce diffuse emissions to air, in particular of dust, organic compounds and odour. Use one or a combination of the following: | |
| Minimise potential diffuse emission sources | The biogas upgrading activities form a sealed system and transfer of biogas, biomethane and raw materials is undertaken using sealed pipework. |
| Select and use high integrity equipment | The biogas upgrading plant will be designed to incorporate high integrity components to minimise releases. Contaminants will be removed from the incoming biogas via activated carbon filters which have high efficiencies and limit fugitive emissions. |

| Table 4.5: BAT Justification for Fugitive Emissions | |
|---|---|
| Indicative BAT | Justification |
| Corrosion prevention | Hydrogen sulphide will be removed using activated carbon filters as part of pre-treatment upstream of the biogas upgrading activity. Appropriate construction materials to protect from corrosion will be used for pipework and plant and the biogas upgrading plant will be subject to regular inspection and maintenance. |
| Containment, collection and treatment of diffuse emissions | No solid or liquid waste accepted as part of the biogas upgrading operation or biogas boiler combustion. Transfer of biogas is undertaken using sealed pipework. The biogas upgrading plant and new boiler are contained systems other than their point source emissions. |
| Dampening (with water / fog) | n/a to the new biogas upgrading plant or boiler |
| Maintenance | Site checks including integrity of containment, bunds, drains, waste and digestate storage and machinery are undertaken and recorded. The maintenance programme will be updated to include the new biogas upgrading and boiler plant in line with manufacturers recommendations. |
| Cleaning of waste treatment and storage areas | n/a to the new biogas upgrading plant or boiler |
| Leak detection and repair (LDAR) programme for organic compounds | As BAT 14 requires 'one or a combination of' techniques a – h, BAT is still considered met through other techniques employed. |
| **Surface Water / Sewer / Groundwater / Land** | |
| Optimize water consumption, reduce wastewater generation and prevent or where not practicable reduce emissions to soil and water. Use one or a combination of the following: | |
| Water management | The operator has committed to adopt water saving plans and establish water efficiency objectives. |
| Water recirculation | Water streams are recirculated within the AD plant. |
| Impermeable surface | The surface of the new biogas upgrading area and boiler will be located on an impermeable concrete base that adheres to an approved standard. An improvement condition exists within the current permit (IC5) to provide information on the engineering standard for the existing hardstanding. |
| Reduce likelihood and impact of tank/vessel overflows and failures | Raw materials stored in tanks for the biomethane to grid plant are gaseous in nature / would evaporate if leaked, with the exception of odorant which will be stored in a double skinned tank within an odorant bund inside the kiosk.<br><br>The compressor will be located within compressor |

| Table 4.5: BAT Justification for Fugitive Emissions | |
|---|---|
| Indicative BAT | Justification |
| | bund housing which will have a capacity of greater than 110% of the capacity of the compressor. |
| Roofing of waste storage and treatment areas | n/a to new biogas upgrading plant and boiler. |
| Segregation of water streams (being mindful of existing plant constraints) | Uncontaminated water streams i.e., rainwater is collected in a bunded area on the main anaerobic digestion part of site and discharged only after visual checks and routine checks have confirmed the suitability of release. Surface water in the new biogas upgrading plant area will drain to ground as the new plant is enclosed.<br>Wastewater streams require treatment and are recirculated into the anaerobic digestion plant (including process water from the new biogas upgrading plant) hence are separated from uncontaminated waste water. |
| Adequate drainage infrastructure | The new plant drainage will be connected to existing sealed drainage infrastructure and recirculated to the anaerobic digesters. |
| Design and maintenance provisions to allow risk-based leak detection and repair. Minimise use of underground components. | New tanks situated above ground in suitable containment and within bunds. New biogas upgrading plant and boiler installed on impermeable surface with sealed drainage. Regular monitoring for potential leakages is risk based and when necessary, equipment is repaired. |
| Appropriate buffer storage capacity (being mindful of existing plant constraints) | Storage capacity is provided for wastewater generated during other than normal operating conditions. |

## 4.9 Waste Summary

The proposed new biogas upgrading plant and boiler will not inherently produce significant quantities of waste.

*Types and Amounts of Waste*

The site does not routinely create any wastes beyond typical site general wastes and low levels of maintenance related wastes.

Incidental wastes, general wastes, maintenance consumables etc. will be recycled and reused where possible.

The main waste stream associated with the new plant items is considered to comprise spent activated carbon. Maintenance consumables will be catered for by the existing waste management arrangements at the facility. Spent membranes from the biogas upgrader will be removed from site and disposed of off-site.

The membranes typically need to be replaced every 5 – 10 years. Compressor oil filters and oil will be disposed of by a suitable waste contractor.

The site is committed to identity and implement waste prevention opportunities during the operation of the facility. The use of raw materials will be regularly monitored and reported against key performance measures in accordance with BAT requirements.

*Waste Storage*

The design of the installation has taken into account the potential impacts on the environment and neighboring receptors.

All waste will be stored in situ (i.e., within the plant that generates it) until such time as maintenance activities require its removal and replacement.

The table below provides estimated quantities of wastes generated by the proposed new activities:

**Table 4.6: Product / Waste Summary**

| Waste | Approx. Quant (tonnes/yr) | Source & Storage | R / D Code | Environmental Fate |
|---|---|---|---|---|
| Activated Carbon | 3 tonnes | In activated carbon filter unit, which will be removed from site for regeneration off-site during maintenance | R3 (recycling / reclamation of organic substances which are not used as solvents) | Regenerated for reuse |
| Waste membranes | Replacement every 5 – 10 years | In biogas upgrader. Membranes will be removed from site for disposal during maintenance | tbc | Regenerated for reuse |
| Compressor oil filters/ oil | 300 litres every 8000 hours running | In compressor block, which will be removed from site for disposal during maintenance | tbc | Disposal |
| Coolant | 6 – 10 litres | Coolant will be removed from site for disposal during maintenance | tbc | Disposal |

Table 4.7 summarises the BAT justification for the proposed storage of waste on site.

**Table 4.7: BAT Justification for Storage on Site**

| Indicative BAT | Justification |
|---|---|
| Subsurface structures | Propane will be stored in an underground tank with secondary containment, supplied and installed by specialist supplier. |

| Table 4.7: BAT Justification for Storage on Site | |
|---|---|
| **Indicative BAT** | **Justification** |
| Appropriate surfacing and containment or drainage facilities for all operational areas, taking into consideration collection capacities, surface thicknesses, strength/reinforcement; falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures;<br>• have an inspection and maintenance programme for impervious surfaces and containment facilities;<br>• unless the risk is negligible, have improvement plans in place where operational areas have not been equipped with:<br>– an impervious surface<br>– spill containment kerbs<br>– sealed construction joints<br>– connection to a sealed drainage system | • The new biogas upgrading plant and boiler will be constructed on sealed impermeable concrete.<br>• The surfacing is designed to ensure that it is of the appropriate strength, reinforcement and thickness to ensure appropriate foundation for processing equipment.<br>• The installation has an extensive maintenance programme in place which will include provision for the inspection of all new plant and structures.<br>• Routine inspections are undertaken on a daily basis by site personnel as part of the daily site checks. |
| Above-ground tanks | • Above ground bulk storage tanks containing liquids will be appropriately constructed to ensure they are impermeable.<br>• Above ground bulk storage tanks containing explosive gases will be appropriately constructed to ensure they are safe. Gas tight seals and gas detection systems will be used to mitigate risk of leaks. Propane storage and handling will comply with Dangerous Substances and Explosive Atmospheres Regulations 2002.<br>• All tanks and facilities will be installed with secondary containment and be designed to comply with the following standards and guidance requirements;<br>• Environment Agency: Oil Storage Regulations for Businesses (applicable to Wales also)<br>• Environment Agency: Storing Oil at Your Home or Business (applicable to Wales also)<br>• CIRIA C958: Chemical Storage Tank Systems – Good Practice;<br>• CIRIA C736: Design of Containment Systems for the Prevention of Pollution: Secondary, Tertiary, |

| Table 4.7: BAT Justification for Storage on Site | |
|---|---|
| Indicative BAT | Justification |
| | and other measures for industrial and commercial premises. |
| Storage areas (IBCs, drums, bags etc.)<br><br>Storage areas should be located away from watercourses and sensitive boundaries, (e.g., those with public access) and should be protected against vandalism.<br><br>Storage areas should have appropriate signs and notices and be clearly marked-out, and all containers and packages should be clearly labelled.<br><br>Where spillage of any stored substance could be harmful to the environment, the area should be appropriately kerbed or bunded.<br><br>The maximum storage capacity of storage areas should be stated and not exceeded, and the maximum storage period for containers should be specified and adhered to.<br><br>Appropriate storage facilities should be provided for substances with special requirements (e.g., flammable, sensitive to heat or light) and formal arrangements should be in hand to keep separate packages containing incompatible substances (both “pure” and waste).<br><br>Containers should be stored with lids, caps and valves secured and in place - and this also applies to emptied containers.<br><br>All stocks of containers, drums and small packages should be regularly inspected (at least weekly).<br><br>Procedures should be in place to deal with damaged or leaking containers. | All waste materials will be kept within the plant which generates them until such time as maintenance requires their removal.<br><br>Any storage of liquids will be within appropriately constructed containment (plant in which they are generated) and in a bunded location.<br><br>All plant and bunding are subject to a daily inspection as part of the site inspection procedure. |

# 5 ENVIRONMENTAL MONITORING

## 5.1 Emissions to Air

As the new biogas boiler plant is not within scope of the Medium Combustion Plant Directive, it is not proposed to routinely undertake periodic monitoring of the gas burner (A7).

The biomethane to grid plant will not itself be a biological treatment process but it will treat biogas from the wider site anaerobic digestion plant and as a result of this variation, will become a Directly Associated Activity to the anaerobic digestion plant.

On that basis, it is considered that the Waste Treatment BREF BAT-AELs are relevant benchmarks for the biogas upgrading stack. BAT 34 of the Waste Treatment BREF provides the following AELs:

- Ammonia BAT-AEL of 0.3 – 20 mg/Nm$^3$ for biological treatments of waste; and
- Odour BAT-AELs of 200 – 1000 OUE/Nm$^3$ for biological treatments of waste.

The BREF also has a requirement (BAT 8) to monitor hydrogen sulphide in channeled emissions to air from biological treatment processes. BAT 8 also provides additional clarification that operators may monitor ammonia and hydrogen sulphide *or* odour.

It is therefore proposed, that in accordance with the Waste Treatment BREF BAT Conclusions, ammonia and hydrogen sulphide monitoring from the biogas upgrading stack (A8) is undertaken on a 6 monthly basis.

The sample location will be designed to comply with the requirements of TGN M1.

## 5.2 Emissions to Controlled Water

There are no emissions to controlled water resulting from this permit variation, therefore no monitoring is required.

## 5.3 Emissions to Sewer

There are no emissions to sewer resulting from this permit variation, therefore no monitoring is required.

## 5.4 Emissions to Land

There are no process emissions to land arising from this permit variation, therefore, no monitoring is required. Clean, uncontaminated surface water will drain to land in the new biogas upgrading plant area.

## 5.5 Monitoring Frequency

Monitoring of emissions from A8 will be undertaken every six months.

In addition, the biogas upgrading process will be equipped with comprehensive continuous monitoring facilities which have been designed to ensure optimum efficiency, compliance with the requirements of Quality Protocol and minimise environmental impacts.

Gas analysers and sensors will monitor:

- Oxygen;

- Carbon dioxide;
- Methane;
- Hydrogen sulphide;
- Temperature;
- Dewpoint;
- Calorific value;
- Wobbe Index;
- Soot Index;
- Hydrogen;
- Nitrogen.

The process management system will use the generated data to adjust the operation of the biogas upgrader.

Online monitoring linked to an alarm will also be used to identify when a carbon filter needs changing.

Records will be kept of all monitoring carried out at site. The reporting results will be submitted to Natural Resources Wales as part of annual reporting (in accordance with Table S4.1) and will be retained for at least 6 years from the date the records were made.

Please refer to Table 5.1 for more information.

**Table 5.1: Emission Points and Monitoring**

| Emission Point | Source | Parameter | Monitoring Frequency | Methodology |
|---|---|---|---|---|
| A7 | Biogas boiler | - | - | - |
| A8 | Biogas upgrader stack | • Ammonia<br>• Hydrogen sulphide | • 6 monthly | In accordance with EN ISO 21877<br>In accordance with US EPA Method 11 (impinger method) and CEN TS 13649 (Charcoal tube), US EPA Method 15 |

# 6 BAT JUSTIFICATION

## 6.1 High Level BAT Considerations

### 6.1.1 Energy Recovery and Distribution

The primary objective for the installation of a gas upgrading plant at G P Biotec Ltd is to improve the energy efficiency of the site as a whole, in conjunction with the delivery of the operational imperative that the optimum temperature of the digesters must always be achieved. The principal options for the recovery of the energy in the biogas are either combustion-based or require the treatment of biogas to produce biomethane for export to the gas grid and subsequent use elsewhere.

Biomethane export to the grid achieves maximum energy efficiency in the end use of the biogas. Since 2010 only boilers that are 88% or more efficient can be installed in homes and most that are currently purchased have a thermal efficiency in the region of 90%. By way of comparison, the existing CHP engines have a thermal efficiency of approximately 40%.

Export of biogas to the grid therefore offers greater efficiency in relation to both heat and power when compared with the existing CHP engines and is considered to be the optimum solution for the recovery of the renewable energy content of biogas.

Biomethane export to the grid is therefore considered to be BAT in terms of recovery of the energy potential of the biogas, hence the decision to add a new biomethane to grid plant rather than additional CHP engines.

### 6.1.2 Biogas Upgrader Technology

The following technologies were considered as viable candidates for the biogas upgrader for the new biomethane to grid plant:

- Chemical scrubbing;
- Membrane separation; and
- Water scrubbing.

During this process, the following criteria were considered:

- Methane recovery efficiency;
- Resource use;
- Waste production;
- Emissions arising (including odour and noise);
- Integration with existing site;
- Maintainability; and
- Complexity.

An assessment of the three technologies has been carried out making references *'How to comply with your environmental permit. Additional guidance for Anaerobic Digestion, November 2013 [4]'*.

Methane Recovery Efficiency

Chemical scrubbing has the highest methane recovery efficiency (>99%[4]), followed by membrane separation (98.5% to 99.5%) and water scrubbing (>97%[4]). Pressure Swing Adsorption achieves methane recovery of > 96% but there are very few PSA biogas upgrading plants in the UK and due to their complexity, they have been discounted.

Resource Use

Chemical scrubbing has the greatest heat demand as this technology requires heat to regenerate the amine that is used. G P Biotec Ltd does not have a sufficient surplus of waste heat to address this requirement and would therefore need to use an additional source of energy for this purpose. High maintenance costs are also associated with chemical scrubbing together with the requirement to store chemicals for the process.

Membrane separation has a lower power requirement compared with water scrubbing. This is because, although membrane separation takes place at a higher gas pressure, the need to pump water, which is a requirement for water scrubbing, is not present.

Membrane separation does not require a supply of potable water to operate, whereas water scrubbing requires approximately 5 $m^3$/d.

Both technologies use GAC although, when saturated, this can be regenerated off site. Water scrubbing also uses lava rock medium in the biofilter, whilst membrane separation also uses polymer membranes which need to be changed if they become fouled.

Waste Production

Both technologies produce saturated GAC, but this can be regenerated off site.

Emissions Arising

Membrane separation gives rise to carbon dioxide and trace concentrations of nmVOCs, hydrogen sulphide and methane containing emissions to air from the membrane gas upgrader. The raw biogas does not contain hydrogen sulphide at concentrations above the LOD (0.01 % v/v) and the activated carbon filters will remove trace hydrogen sulphide and nmVOCs. Membrane separation has a lower methane slip than water scrubbing and pressure swing adsorption[5].

The membrane separation technology has a very low methane slip (up to 1% of the methane content of the input biogas volumes). Membrane separation also gives rise to aqueous emissions from the drying chiller which may contain traces of contaminants.

Water scrubbing gives rise to hydrogen sulphide containing emissions to air from the biofilter of the water scrubbing unit. It also gives rise to nmVOCs containing aqueous emissions from the chilling unit, hydrogen

[4] Environment Agency (2013). How to comply with your environmental permit. Additional guidance for Anaerobic Digestion.

[5] J. Lgerak et al (2020). Biogas upgrading: membrane separation takes over – the success story of Poundbury continues. *18th European Biosolids and Organic Resources Conference and Exhibition*.

sulphide and carbon dioxide containing blow down from the stripper column of the water scrubbing unit and aqueous emissions from the thermal swing adsorber.

For membrane separation, the trace nmVOCs and hydrogen sulphide containing emissions to air from the upgrading plant stack may give rise to odour (noting raw biogas is filtered in activated carbon filters to remove these ahead of upgrading), whilst for water scrubbing, the hydrogen sulphide containing emissions to air from the biofilter of the water scrubbing unit may give rise to odour.

Both membrane separation and water scrubbing require gas compression, but as a higher gas pressure is required for the former there might be a greater likelihood of higher noise emissions.

Integration with Existing Site

Water scrubbing would require access to towers at height thereby increasing health and safety risks for maintenance activities and risks media contamination issues when media is changed. Membrane separation is built on a skid / in a container which results in a small footprint and an easily transportable system at ground level.

Maintainability

Both membrane separation and water scrubbing provide good plant availability (typically greater than 90%). Such availabilities should support the intention to operate the new biomethane to grid plant continuously.

Membrane separation technology is robust, stable and requires little maintenance.

Complexity

Membrane separation is more complex than water scrubbing as it uses several stages of polymer membranes to separate carbon dioxide from methane, however, membrane separation has a similar level of complexity to technologies that are currently in use at the site.

Overview

Based on the information provided above, membrane separation is considered to be BAT for the new biogas upgrader. The main considerations supporting this conclusion are its potentially higher methane recovery efficiency, its lower energy requirement and the absence of need for a potable water supply (water conservation).

## 6.2 BAT Assessment

All plant and equipment has been designed in accordance with BAT and will comply with the relevant standard and guidance requirements.

The following BAT demonstration is based on the EU BAT Conclusions on Waste Treatment published August 2018.

The proposed plant involves the upgrading of biogas to biomethane to be injected into the national grid. The use of biomethane in this manner has a number of advantages:

- Biomethane injection is supported under the Renewable Heat Incentive (RHI) and Green Gas Support Scheme;
- Biomethane is a much more flexible fuel than biogas;
- Biomethane has a higher energy density than biogas;
- Biomethane is one of the most prominent routes of providing an economical, secure energy supply whilst reaching the EU legislation's reduction in carbon emissions targets;
- By directly injecting the biomethane into the gird, the efficiency of the energy course is greatly increased;
- By diverting the waste from landfill. Methane is prevented from being released into the atmosphere;
- Ensures energy that is captured in the biogas is used efficiently; and
- Is cheaper for the plant operator to install a gas to grid connection than an electricity connection.

A full review of the BAT conclusions specified in the Waste Treatment BREF insofar as they apply to the addition of the biogas upgrading activity, is provided below. The biogas upgrading plant will not itself be a biological treatment process, but it will treat biogas from the wider site anaerobic digestion plant and will become a Directly Associated Activity to the anaerobic digestion plant. On that basis, it is considered that the BAT requirements regarding biological treatment of waste are the most relevant.

Consideration of the biogas boiler is not relevant under this BREF due to the process of combustion being outside of the scope of the BREF. The biogas boiler is below 1MWth and is therefore not in scope of the Medium Combustion Plant Directive either. The biogas boiler stack will be vertical and unimpeded by cowls or caps.

| Table 6.1: Guidance Review – BREF Waste Treatment | | |
|---|---|---|
| BAT Reference | BAT Conclusion | Justification |
| *GENERAL BAT CONCLUSIONS* | | |
| *Overall Environmental Performance* | | |
| BAT 1 | In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates the features provided within the BREF document. | G P Biotec Ltd have an ISO14001:2015 Environmental Management System in place that incorporates the relevant features outlined within the BREF document with the exception of those parts for which an Improvement Condition (IC1) already exists in the permit (to be provided under separate cover).<br>Where relevant the EMS will be updated to incorporate the new plant which are the subject of this permit variation. |
| BAT 2 | In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques provided within the BREF document. | BAT 2 is not relevant to the biogas upgrading plant and biogas boiler which will not receive raw waste but rather biogas produced from the directly associated anaerobic digestion plant.<br>G P Biotec Ltd implements the following on site in relation to the anaerobic digestion plant:<br>• Waste Pre-acceptance procedures;<br>• Waste Acceptance procedures;<br>• A waste tracking system and inventory;<br>• An output quality management system;<br>• Waste segregation;<br>• Ensures waste compatibility during waste inspection; and<br>• The sorting of incoming waste (solids separate from liquids).<br>The addition of the new plant which are the subject of this permit variation will not change this. |

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| BAT 3 | In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of wastewater and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the features provided within the BREF document. | There are no wastewater discharges to sewer or watercourse from the installation. The process water (condensate) from the biogas upgrading plant will be collected in the site sealed drainage and returned to the anaerobic digestion plant.<br><br>The site will have 2 new emission points to atmosphere, one from the biogas upgrading plant carbon dioxide stack (post carbon filtration) and one from the biogas boiler stack.<br><br>The characteristics of the raw biogas to be utilized by the biogas upgrading plant and biogas boiler can be found in Table 3.2. Monitoring data is not available for the off-gas from the biogas upgrading stack but will be collected during commissioning and is not expected to contain contaminants at any appreciable level due to the low concentrations in raw biogas and very high efficiency of the carbon filters. Monitoring data from the biogas boiler stack is not considered relevant under this BREF due to the process of combustion being outside of the scope of the BREF. The biogas boiler is below 1MWth and is therefore not in scope of the Medium Combustion Plant Directive either.<br>The existing improvement condition (IC3) will be dealt with under separate cover. |
| BAT 4 | In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques provided within the BREF document. | BAT 4 is not relevant to the biogas upgrading plant and biogas boiler which will not incorporate storage of waste.<br>The following is carried out on site for the directly associated anaerobic digestion process, to reduce the environmental risk associated with the storage of incoming waste and off-spec produced pellets:<br>• Adequate storage capacity; and<br>• Safe storage operation. |

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| | | No hazardous waste is accepted on site.<br>The addition of the new plant which are the subject of this permit variation will not change this. |
| BAT 5 | In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures. | BAT 5 is not relevant to the biogas upgrading plant and biogas boiler which will not incorporate handling and transfer of waste.<br>All handling and transfer of waste is carried out by competent staff and documented via the sites acceptance procedures and management system.<br>Any spillages on site will be detected via the sites site walkover procedure and managed accordingly. ABP and non ABP wastes are segregated and only mixed within the closed anaerobic digestion system. A Hazard Analysis and Critical Control Points plan is in use which means critical control points are examined and assessed against their corresponding critical control limit. The addition of the new plant which are the subject of this permit variation will not change this. |
| ***Monitoring*** | | |
| BAT 6 | For relevant emissions to water as identified by the inventory of wastewater streams (see BAT 3), BAT is to monitor key process parameters (e.g., waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g., at the inlet and/or outlet of the pretreatment, at the inlet to the final treatment, at the point where the emission leaves the installation). | N/A – there are no wastewater discharges to sewers or watercourse from the installation.<br>The new biogas boiler and the new biogas upgrading plant area are both constructed on sealed concrete hard standing and will benefit from sealed drainage. A new process water drainage pipeline will be routed from the biogas upgrading plant to connect to the existing Installation drainage network which returns drainage to the anaerobic digesters. There will be no discharges to surface water (save for clean uncontaminated surface water) or sewer. Clean uncontaminated surface water from the biogas upgrading plant area will drain to ground. |
| BAT 7 | BAT is to monitor emissions to water with at least the frequency given in the guidance, and in accordance with EN standards. If EN standards | N/A – there are no process emissions to controlled waters or sewer. The addition of the new plant which are the subject of this permit variation will |

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| | are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. | not change this. |
| BAT 8 | BAT is to monitor channelled emissions to air with at least the frequency given in the guidance, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. | There will be two new point source emissions to air: from the biogas boiler (which is not relevant to the Waste Treatment BREF BAT) and from the biogas upgrading plant stack. This stack will need to be monitored once every six months in line with BAT 8 for $H_2S$ and $NH_3$. There should be no requirement set for odour concentration monitoring as no odour nuisances are expected. |
| BAT 9 | BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given in the BREF guidance note. | N/A – Regeneration of solvents, decontamination of equipment containing POPs with solvents or physico-chemical treatment of solvents is not undertaken at this facility. The addition of the new plant which are the subject of this permit variation will not change this. |
| BAT 10 | BAT is to periodically monitor odour emissions. | Odour is currently monitored using daily 'odour intensity' sniff test monitoring in line with an existing Odour Management Plan (OMP). The OMP is due to be updated to include monitoring in line with BAT 10 as part of existing improvement condition IC3 (to be provided under separate cover).<br><br>It is not anticipated that the new biogas boiler or biogas upgrading plant will cause odour nuisance at nearby sensitive receptors. |
| BAT 11 | BAT is to monitor the annual consumption of water, energy, and raw materials as well as the annual generation of residues and wastewater, with a frequency of at least once per year. | As noted in V007, the installation records and reports energy usage, water usage, generation of waste residues and maintains a record of raw materials. Foul water is discharged via a sealed drainage system to a holding tank and used in the digestion process so does not require monitoring. The addition of the new plant which are the subject of this permit variation will not |

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| | | change this. |
| *Emissions to Air* | | |
| BAT 12 | In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1). | Odour is currently managed in line with an existing Odour Management Plan (OMP). The OMP is due to be updated in line with BAT 10 as part of existing improvement condition IC3 and will be provided under separate cover.<br><br>It is not anticipated that the new biogas boiler or biogas upgrading plant will cause odour nuisance at nearby sensitive receptors. |
| BAT 13 | In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given below:<br>a) Minimising residence times;<br>b) using chemical treatment;<br>c) optimizing aerobic treatment. | Odour emissions are reduced on site by minimising the residence time of waste on site. $H_2S$ generated during digestion is reduced by injecting $O_2$ into the gas storage and additionally, ferric sulphate, where necessary.<br>The addition of the new plant which are the subject of this permit variation will not change this. |
| BAT 14 | In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below:<br>a) Minimising the number of potential diffuse emission sources;<br>b) Selection and use of high integrity equipment;<br>c) Corrosion prevention;<br>d) Containment, collection and treatment of diffuse emissions;<br>e) Dampening;<br>f) Maintenance;<br>g) Cleaning of waste treatment and storage area;<br>h) Leak detection and repair programme. | As per V007 the site is compliant with BAT 14. The new plant which are the subject of this permit variation are not expected to produce significant diffuse emissions to air as both the boiler and biogas upgrading plant are closed gas systems. Use of high integrity equipment in the new boiler and biogas upgrading plant will be utilized to minimise leaks in the systems; suitable containment will be implemented for new raw materials (i.e., odorant and propane) and new plant will be incorporated into the site maintenance programme. |
| BAT 15 | BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g., start-ups, shutdowns) by using both of the techniques | As per V007 the site is partially compliant with BAT 15 and has an existing improvement condition (IC4) to re-assess the capacity of the gas recovery |

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| | given in the BREF Guidance. | system. This will be provided under separate cover. |
| BAT 16 | In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given in the BREF Guidance. | As per V007 the site is compliant with BAT 16. There are no changes to the flare planned as part of this permit variation. |
| *Noise and Vibration* | | |
| BAT 17 | In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system (see BAT 1). | As per V007 BAT 17 is not considered relevant due to the location of the site, topography of the land and the fact that there are no nearby sensitive receptors (beyond the residential dwellings of the operator) in close proximity to the site. The addition of the new plant which are the subject of this permit variation are not anticipated to cause a nuisance at nearby receptors regarding noise or vibration.<br><br>An environmental noise assessment has been undertaken to assess potential impacts from the development. This has shown that the addition of the biogas upgrading plant will have no significant impact.<br><br>As such, no further control measures than already proposed (i.e., appropriately acoustically enclosed equipment) are deemed necessary.<br><br>This is considered BAT for site. |
| BAT 18 | In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given in the BREF Guidance. | As per V007 the site is compliant with BAT 18. The addition of the new plant which are the subject of this permit variation will not change this.<br>Noise and vibration emissions are reduced on site via the following measures:<br>• Operational measures;<br>• Noise and vibration control equipment - Noise-emitting plant has been enclosed within appropriately noise-attenuating materials, where practicable, to ensure compliance with the design target noise level; |

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| | | • Low noise equipment - Equipment has been screened to limit auditability of tones.<br>By employing the above mitigation measures, it is envisaged that the proposed design target noise level will be achieved and consequently no significant operational noise impacts will be likely to occur. |
| *Emissions to Water* | | |
| BAT 19 | In order to optimise water consumption, to reduce the volume of wastewater generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given in the BREF Guidance. | As per V007 the site is compliant with BAT 19. The addition of the new plant which are the subject of this permit variation will not change this.<br>Wastewater is generated by the new biogas upgrading plant process in the form of condensate removed from the biogas which will be recirculated to the digestion process as is the case for existing waste waters. Uncontaminated water streams i.e., rainwater is collected separately in the main anaerobic digestion area of site and discharged only after visual checks and routine checks have confirmed the suitability of release. The clean uncontaminated surface water run-off from the new biogas upgrading area, drains to ground.<br><br>An existing improvement condition exists (IC5) to provide information on the impermeable surface engineering standard (to be provided under separate cover) and this will include the detail on the new areas of site to house the biogas boiler and biogas upgrading process. |
| BAT 20 | In order to reduce emissions to water, BAT is to treat wastewater using an appropriate combination of the techniques given in the BREF Guidance. | N/A – there are no wastewater streams discharged from the permitted processes, including the new biogas boiler and biogas upgrading plant. |
| *Emissions from Accidents and Incidents* | | |
| BAT 21 | In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given in the guidance, as part of the accident management plan (see BAT 1). | As per V007 the site is compliant with BAT 21. The site has an Accident Management Plan which has been updated to include the new plant which |

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| | | are the subject of this permit variation, and this is provided within *Annex G*. |
| ***Material Efficiency*** | | |
| BAT 22 | In order to use materials efficiently, BAT is to substitute materials with waste. | As per V007 the site is compliant with BAT 22. The main site process is the utilization and processing of waste in order to produce biogas.<br><br>Raw materials used in the new biogas boiler will not be any different to existing site raw materials. The new biogas upgrading plant process will introduce new raw materials such as propane and odorant together with the membranes themselves, but these cannot be replaced with waste materials due to the nature of the use of the biomethane – i.e., use in the National Gas Grid.<br><br>GP Biotec will undertake annual reviews of the permitted processes and endeavour to utilize wastes where feasible. |
| ***Energy Efficiency*** | | |
| BAT 23 | In order to use energy efficiently, BAT is to use both of the techniques given below:<br>a) Energy efficiency plan; and<br>b) Energy balance record. | As per V007 an existing improvement condition (IC6) exists to implement an energy efficiency plan and energy balance record in order to meet BAT 23. This will be provided under separate cover. |
| ***Reuse of Packaging*** | | |
| BAT 24 | In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1). | As per V007 an existing improvement condition (IC1) exists to implement a residue management plan, and this will be provided under separate cover.<br>The new biogas boiler and biogas upgrading plant will require raw materials in the form of chemicals and the membranes themselves. Where possible packaging will be reused, and this will be incorporated into the residues management plan. |
| ***BAT CONCLUSIONS FOR THE MECHANICAL TREATMENT OF WASTE*** | | |

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| *Emissions to Air* | | |
| BAT 25 | In order to reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin-like PCBs, BAT is to apply BAT 14d and to use one or a combination of the techniques given below:<br>a) Cyclone<br>b) Fabric filter<br>c) Wet scrubbing<br>d) Water injection into the shredder<br><br>BAT associated emission levels for channelled dust emissions to air from mechanical treatment of waste is 2-5 mg/Nm$^3$ (average over the sampling period). | N/A Only applies to mechanical treatment of waste when it is not combined with biological treatment. |
| BAT 26 - 28 | BAT conclusions for the mechanical treatment in shredders of metal waste | N/A Only applies to mechanical treatment of waste when it is not combined with biological treatment. |
| BAT 29 - 30 | BAT conclusions for the treatment of WEEE containing VFCs and /or VHCs | N/A Only applies to mechanical treatment of waste when it is not combined with biological treatment. |
| *BAT Conclusions for The Mechanical Treatment of Waste with Calorific Value* | | |
| *Emissions to Air* | | |
| BAT 31 | In order to reduce emissions to air of organic compounds, BAT is to apply BAT 14d and to use one or a combination of the techniques given below:<br>a) Adsorption<br>b) Biofilter<br>c) Thermal oxidation<br>d) Wet scrubbing | N/A Only applies to mechanical treatment of waste when it is not combined with biological treatment. |

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| | BAT associated emission levels for channelled TVOC emissions to air from mechanical treatment of waste with calorific value is 10 - 30 mg/$Nm^3$ (average over the sampling period). Note: this only applies when organic compounds are identified as relevant in the waste gas stream. | |
| BAT 32 | BAT conclusions for the treatment of WEEE containing mercury | N/A Only applies to mechanical treatment of waste when it is not combined with biological treatment. |
| *BAT Conclusions for The Biological Treatment of Waste* | | |
| BAT 33 | Reduce odour emissions and improve overall environmental performance by selecting the waste input (to ensure its suitability for biological treatment). See also BAT 2 | As per V007 an improvement condition (IC7) has been set in the existing permit to provide information on how this BAT is met. This BAT is not applicable to the new plant that are the subject of this permit variation as both the new biogas boiler and biogas upgrading plant will receive biogas from the upstream anaerobic digestion process and will not receive waste directly. |
| BAT 34 | Reduce emissions to air of dust, organic compounds, and odorous compounds (including $H_2S$ & $NH_3$) by using one or a combination of the following techniques:<br>• Adsorption<br>• Fabric filter<br>• Thermal oxidation<br>• Wet scrubbing<br>BAT associated emission levels for channeled emissions to air from the biological treatment of waste are:<br>• $NH_3$ 0.3 - 20 mg/$Nm^3$<br>• Odour 200 - 1000 $OU_E$/$Nm^3$<br>• Dust 2.0 - 5 mg/$Nm^3$ (relates to mechanical biological | As per V007 GP Biotec Ltd currently use adsorption (activated carbon filters) to remove odorous gases. The new biogas upgrading plant will also use activated carbon filters as a pretreatment to the biogas upgrading, to remove contaminants such as $H_2S$ and VOCs.<br>For V007, GP Biotec Ltd indicated a preference for $NH_3$ and $H_2S$ monitoring rather than odour, and this remains the case for this V008 variation. The new point source emission to air from the biogas upgrading stack is therefore expected to include monitoring for $NH_3$ (and ELV of 20mg/$Nm^3$) and $H_2S$ (no ELV).<br>Dust and TVOC are not relevant as mechanical biological treatment is not undertaken.<br>The biogas boiler stack will not require any monitoring or setting of ELVs as this is not considered relevant under this BREF due to the process of |

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| | treatment only)<br>• TVOC 5.0 - 40 mg/Nm$^3$ (relates to mechanical biological treatment only) | combustion being outside of the scope of the BREF. The biogas boiler is below 1MWth and is therefore not in scope of the Medium Combustion Plant Directive either. |
| BAT 35 | Reduce the generation of wastewater and reduce water usage by using ALL of the following:<br>• Segregation of water streams (see also BAT 19f)<br>• Water recirculation<br>• Minimisation of the generation of leachate | As per V007, the operator meets BAT 35 by segregating water streams and recirculating water. The addition of the new plant which are the subject of this permit variation will not change this and the condensate generated by the biogas upgrading process will be captured via sealed drainage and returned to the digestion process, with the surface water from that area draining to ground. |
| *BAT conclusions for the biological treatment of waste (aerobic methods)* | | |
| BAT 36 - 37 | BAT conclusions for aerobic biological treatment waste | N/A Only applies to biological treatment of waste using aerobic methods. |
| *BAT conclusions for the biological treatment of waste (anaerobic methods)* | | |
| BAT 38 | Reduce emissions to air and improve overall environmental performance by monitoring and/or controlling key waste and process parameters. Include following elements:<br>• Implement a manual and/or automatic monitoring system to:<br>o Ensure a stable digester operation<br>o Minimise operational difficulties, such as foaming, which may lead to odour emissions<br>o Provide sufficient early warning of system failures which may lead to a loss of containment and explosions<br>• Monitoring and/or control of key waste and process parameters – examples below:<br>o pH and alkalinity of the digester feed<br>o Digester operating temperature | As per V007, the operator meets BAT 38. The addition of the new plant which are the subject of this permit variation will not change this. The biogas upgrading plant will include a monitoring system (including flow, temperature, pressure and $H_2S$) to ensure stable operation of the plant, and to ensure that the biomethane produced meets the requirements of the National Gas Transmission Grid and the WRAP bio-methane quality protocol. Any off specification biomethane will be diverted to the flare. |

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| | ○ Hydraulic and organic loading rates of the digester feed<br>○ Volatile fatty acids and $NH_3$ concentrations within the digester and digestate<br>○ Biogas quantity, composition (e.g., $H_2S$) and pressure<br>○ Liquid and foam levels in the digester | |
| ***BAT conclusions for the mechanical biological treatment of waste*** | | |
| BAT 39 | BAT conclusions for mechanical biological treatment waste | N/A mechanical biological treatment of waste is not undertaken. |
| ***BAT conclusions for the physico-chemical treatment of solid and/or pasty waste*** | | |
| BAT 40 -41 | BAT conclusions for physico-chemical treatment waste | N/A physico-chemical treatment of waste is not undertaken. |
| ***BAT conclusions for the re-refining of waste oil*** | | |
| BAT 42 - 44 | BAT conclusions for the re-refining of waste oil | N/A re-refining of waste oil is not undertaken. |
| ***BAT conclusions for the physico-chemical treatment of waste with calorific value*** | | |
| BAT 45 | BAT conclusions for physico-chemical treatment waste with calorific value | N/A physico-chemical treatment of waste is not undertaken. |
| ***BAT conclusions for the regeneration of spent solvents*** | | |
| BAT 46 - 47 | BAT conclusions for the regeneration of spent solvents | N/A regeneration of spent solvents is not undertaken. |
| ***BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil*** | | |
| BAT 48 - 49 | BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil | N/A thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil is not undertaken. |
| ***BAT conclusions for the water washing of excavated contaminated soil*** | | |
| BAT 50 | BAT conclusions for the water washing of excavated contaminated soil | N/A water washing of excavated contaminated soil is not undertaken. |
| ***BAT conclusions for the decontamination of equipment containing PCBs*** | | |
| BAT 51 | BAT conclusions for the decontamination of equipment containing PCBs | N/A decontamination of equipment containing PCBs is not undertaken. |
| ***BAT conclusions for the treatment of water-based liquid waste*** | | |
| BAT 52 –53 | BAT conclusions for the treatment of water-based liquid waste | N/A treatment of water-based liquid waste is not undertaken. |

# 7 IMPACT TO THE ENVIRONMENT

## 7.1 Impacts to Air

This variation will bring about the installation of two new point source emissions to air;

- A7: New biogas boiler flue; and
- A8: New biogas upgrading plant flue.

Due to the very high levels of removal efficiency provided by the gas treatment systems (activated carbon filters) used to filter the biogas prior to upgrading, the resultant biogas has very low concentrations of contaminants with hydrogen sulphide being below the LOD (0.01% v/v) even in the raw biogas (see Table 3.2).

Therefore, there will be no impacts to air resulting from the new biogas upgrading plant.

Once the biogas upgrading plant has been installed and commissioning data has been obtained, emissions tests will be carried out on the upgrading system (by suitably qualified specialists to MCERTS standards) and reported to NRW. This will allow the efficiency of the activated carbon filtration on the biogas (before biogas upgrading) to be confirmed and contaminants in the off-gas quantified. Where necessary a H1 assessment can be carried out at that time, to determine the potential air quality impacts associated with the proposed new biogas upgrading plant. It is predicted that impacts associated with the proposed variation will be insignificant to the overall air quality.

The combustion plant on site forming part of the existing permitted facility has previously been assessed as part of the original site permit application assuming full electrical load and output. Air quality impact modelling conclusions from this assessment (2014) deemed the air quality impact from site's existing operations as insignificant.

The new biogas boiler will only operate as standby plant (approximately 500 – 700 hours per annum) to supplement heat to the Anaerobic Digestion plant (i.e., when one of the main CHP engines is turned off) and has such the emissions have not been modelled as part of this permit variation due to the plant's small scale, intermittent usage, and negligible effect on the overall results.

At the identified statutory habitat sites (see *Annex C – Environmental Risk Assessment*), the predicted process contributions will need to be compared with the relevant critical levels and critical loads for relevant substances once commissioning testing has been undertaken.

## 7.2 Impacts to Land

There are no impacts to land relating to this proposed Installation.

## 7.3 Impacts to Controlled Waters

There are no impacts to controlled water relating to this proposed Installation.

## 7.4 Impacts to Sewer

There are no impacts to Sewer relating to this proposed Installation.

# ANNEXES

# Annex A Figures

# Annex B Technical Data

# Annex C Environmental Risk Assessment

# Annex D Noise Impact Assessment

# Annex E EMS Summary

# Annex F Site Condition Report

# Annex G Accident Management Plan

# Annex H WAMITAB