AD PLANT, WHITWICK MANOR, HEREFORDSHIRE - BEST AVAILABLE TECHNIQUES ASSESSMENT

STL Energy Limited

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CONTENTS

1 Introduction

1.1 This document includes an assessment of Best Available Techniques (BAT), which has been undertaken against the relevant BAT measures contained within the following documents:

- Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 Establishing Best Available Techniques (BAT) Conclusions for Waste Treatment, Under Directive 2010/75/EU of the European Parliament and of the Council[1]; and,
- How to Comply with your Environmental Permit: Additional Guidance for Anaerobic digestion. Reference LIT 8737, Version 1, November 2013.

1.2 This document has been prepared as part of the permit application for the proposed operation of an Anaerobic Digestion (AD) facility to be located at Whitwick Manor, Herefordshire. Throughout this document, reference has been made to other application documents, where relevant, which should be read in conjunction with this document.

[1] Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 Establishing Best Available Techniques (BAT) Conclusions for Waste Treatment, Under Directive 2010/75/EU of the European Parliament and of the Council.

2 BAT Assessment

2.1 Assessment of BAT Against Commission Implementing Decision (EU) 2018/1147

2.1.1 The following sections provide assessment of BAT compliance for the proposed plant against the EU BAT Conclusions Document.

BAT 1 – Environmental Management System

2.1.2 An EMS has been prepared for the operation, which has been submitted with this permit application, providing compliance with BAT 1.

BAT 2 – Improvement of Overall Performance of Plant

2.1.3 The EMS for the operation contains procedures and measures which provide compliance with BAT 2. All available information in respect of each waste stream including any chemical analysis will be reviewed in order to verify that waste is coded correctly as part of pre-acceptance procedures. Chemical samples will be analysed for each new incoming waste stream and at least one sample for each ten thousand tonnes from each source will be analysed. If it is suspected that any incoming wastes are not coded correctly or may cause the AD process not to comply with PAS 110 the incoming waste will be quarantined pending further testing and removal from site for treatment at a suitably permitted facility if necessary.

2.1.4 All incoming vehicles upon arrival are required to report to the person in charge of waste acceptance at the site. The details of the load will be recorded and the duty of care note/company documentation will be further checked by the operator to ensure that the load is acceptable at the site, including a visual check prior to the vehicle proceeding to the tipping area. Any deviation from the procedures or problems with any loads will result in tipping facilities being suspended for the offending company. Loads which are not acceptable within the above terms will be rejected.

2.1.5 Analyses of any liquid wastes will be requested and reviewed prior to the transport of liquid wastes to the site. Authorisation for tankers and other vessels carrying liquid wastes to enter the site will be granted only if the operator is satisfied that the wastes have been suitably classified in accordance with WM3 and that the waste has been coded correctly.

2.1.6 All incoming wastes will be sampled by a suitably qualified and experienced technician and tested at a UKAS accredited laboratory for the following parameters:

- Chemical oxygen demand;
- Arsenic, cadmium, chromium, hexavalent chromium, copper, nickel, lead, zinc and mercury;
- Nitrate and nitrite;
- Total organic carbon;
- Total phosphorous;
- Chemical oxygen demand; and,
- pH.

BAT 3 – Reduction of Emissions to Water and Air

2.1.7 The EMS and supporting management systems for the operation cover the requirements of BAT 3. An inventory of emissions will be included in the EMS. Any fugitive escape of methane gas will have financial consequences for the operator hence there is an incentive to minimise any escape of gas from the process insofar as possible. AD in itself is an enclosed system so should not give rise to methane emissions other than very minor such as during maintenance. A flare is provided to ensure excess gas production is burned at high temperature to destroy any methane. A CO_2 recovery plant will also capture any methane slippage in the offgas from the biomethane plant

BAT 4 – Reducing Environmental Risk Associated with Storage of Waste

2.1.8 The site design has been optimised to prevent any unnecessary handling and transport of wastes on site. Liquid feedstocks will not be stored on site and will be delivered to site within enclosed tankers, unloaded directly to the process via enclosed line. Apple pomace and

manure will be stored within a dedicated storage area located in close proximity to the feed hoppers, ensuring that feedstocks are transferred to the process over minimum possible distances. Double handling of feedstocks is also avoided since feedstocks are transferred straight to the process. Storage areas are clearly defined on the Site Layout Plan and maximum permitted storage quantities and duration of storage are defined within the site EMS and management systems. Records of storage quantities will be assessed continuously against storage limits. Waste storage durations are clearly defined within the site EMS and continuously monitored. A plant and machinery inventory will be maintained within the site EMS and procedures are documented in the EMS for safe storage of drums and vessels. The tables below outline storage arrangements and maximum storage capacity for each waste type.

Table 2.1 - Feedstock Types

Feedstock Description	EWC Waste Code	Nature of Waste and Storage Arrangements On-Site	Max Quantity Stored (Tonnes)
Poultry manure	02 01 06,	Manure will be stored in enclosed building maintained under negative pressure. Exhaust air from the building will be abated in CHP plant.	8,333 tonnes
Liquid wastes from agricultural processes/food manufacturing	02 01 01 02 03 01 02 03 04 02 03 05 02 04 03 02 05 01 02 05 02 02 06 01 02 06 03 02 07 01 02 07 02 02 07 04 19 06 03 19 06 04 19 06 05 19 06 06 19 08 09	Liquid wastes will be introduced directly to the process	3,125 tonnes
Apple pomace	N/A	Stored in clamp	16,000 tonnes
Digestate	19 06 06	Introduced direct to the process	3,125 tonnes

BAT 5 – Reducing Environmental Risk Associated with Handling and Transfer of Waste

2.1.9 Waste storage and handling procedures are covered within the site EMS. Wastes will only be handled and transferred by members of staff who are suitably trained/qualified. Appropriate training will be provided to all members of staff responsible for handling and transfer of wastes. Training procedures are documented within the site EMS. Spillage control procedures are included within the site EMS. Any spillages of fuel/oil will be cleared immediately by depositing sand or absorbents on the affected area. The sand or absorbents will be placed in a skip to be taken to a suitably permitted site for disposal. All spillages of waste and windblown litter will be cleared by the end of the working day in which they occur. All site surfaces will be inspected daily when the site is in operation. Debris will be swept as required and placed in a skip for disposal to a suitably permitted site.

BAT 6 – Monitoring of Key Process Parameters

2.1.10 Waste flow, temperature and waste quantities will be monitored at each stage of the process in order to ensure the efficient operation of the plant and optimise the generation of methane gas. Other key parameters which will be monitored will include waste mix and flow, pH and FOS/TAC (Volatile Organic Acids / Total Inorganic Carbon) for safe and efficient process control.

BAT 7 – Monitoring of emissions to water

2.1.11 Effluent from the process will undergo extensive cleaning prior to discharge to surface water at emission point W1, as shown on the layout plan. The following outlines the parameters that will be monitored, along with proposed limits. These parameters will be monitored on a monthly basis.

Table 2.2 – Water Discharge Emission Limits

Parameter	Limit
Chloride	30mg/l
BOD	6.5mg/l (O)
pH	Between 6 and 9
Phosphorous	0.05mg/l (P)

Ammoniacal Nitrogen (as N)	0.13 mg/l

BAT 8 – Monitoring Emissions to Air

2.1.12 The EU BAT Conclusions Document outlines requirement for monitoring of channelled emissions of odour or ammonia. However, there is not anticipated to be any significant channelled emissions of odour or ammonia. The very nature of the AD process includes the breaking down of odour forming substances, maximised via a lengthy retention time. The main compound with potential for significant odour arising from the process is hydrogen sulphide (H_2S) which can be form during the digestion process and be present with the biogas. However, the biogas arising from the process will undergo desulphurisation via several techniques including oxygen injection into the hoods to crystalise sulphur biologically, addition of ferrous chloride to substrate if high levels are experienced and carbon filters at various stages of CHP operation, biomethane production and CO_2 recovery

2.1.13 Therefore, potential for channelled emissions of odour from the biogas upgrading system are negligible and it is not anticipated that monitoring will be required.

2.1.14 There will be no other channelled sources of odour emissions. The CHP units, back-up boilers and safety flare are thermal processes and as a result will include thermal destruction of odour.

BAT 10 – Monitoring Odour Emissions

2.1.15 An Odour Management Plan (OMP) has been prepared for the operation which contains odour control and monitoring procedures, ensuring compliance with BAT 10.

BAT 11 – Monitoring Annual Consumption of Water, Energy, Raw Materials and Annual Generation of Residues and Waste Water

2.1.16 The site operator will maintain records of water, energy and raw material consumption, in addition to generation of residues and water on at least an annual basis.

BAT 12 and 13 – Reducing Odour Emissions

2.1.17 An OMP has been prepared for the operation which contains odour control and monitoring procedures, ensuring compliance with BAT 12 and 13.

BAT 14 – Reducing Diffuse Emissions, Particularly Including Dust, Organic Compounds and Odour

2.1.18 Diffuse emissions will be controlled as far as is practically possible on-site. The site has been designed to minimise unnecessary transfer material transfer distances. Feedstocks which are stored on site, including manure and apple pomace are to be located near to the point of introduction to the process. Apple pomace will be stored within a dedicated storage clamp. Manure will be stored within an enclosed building operated under negative pressure with exhaust air abated within CHP plant. Liquid wastes are to be introduced directly to process via enclosed line from sealed tanker. Drop heights will be minimised when loading feedstocks to the feed hopper. Speed limits will be limited on site. Tanks and pipework will be appropriately protected from corrosion.

2.1.19 The AD process is an enclosed process and therefore there is limited potential for emissions to air. The biogas produced by the process will undergo treatment to remove residual contaminants, minimising potential for odour emissions. The flare will be used for safety purposes to safely combust biogas during periods of maintenance or should an excess production of biogas arise. However, the flare will be subject to emission limits and the use of high temperature combustion will provide a high level of thermal destruction of any residual odourous compounds in the gas stream.

2.1.20 Given the nature of the feedstocks to be used, dust is not expected to be a significant issue. However, wet cleaning methods will be used and site damping down undertaken if required to prevent potential fugitive emissions of dust.

2.1.21 Regular maintenance will be undertaken on-site to ensure all plant and machinery is in good working order, including tanks and pipework. Details of the maintenance schedules have been submitted as part of this permit application.

2.1.22 The OMP and EMS submitted as part of this application outline the environmental controls which will be in place in detail. A policy of cleanliness will be maintained on site at all times.

2.1.23 Pipework will be fabricated in stainless steel or HDPE at least PN10. Stainless or PP pipe can be used in higher temperature sanitation areas. Water will be in HDPE cold, mild or stainless steel for hot water.

BAT 15 and 16 – Flaring

2.1.24 The flare will not be used routinely and is used for safety reasons in the event of excess gas. This may be during startup, maintenance of the gas upgrade unit, problem with exporting gas to the grid or other unforeseen issues.

2.1.25 An automated process control system will be used on site. The use of the flare is controlled by the gas buffer level within the secondary digester.

2.1.26 The composition of the gas entering the flare will be monitored and the number and duration of flaring events will be recorded.

2.1.27 The flare will have a capacity of 3500Nm3/hr of Biogas or 1500sm3 of Biomethane. The estimated Biogas production of the AD plant is 30,000,000Nm3/year giving an average Biogas production of 3,500Nm3/hour. The biomethane production export limit is 1500sm3/hour.

BAT 17 and 18 – Preventing and Reducing Noise Emissions

2.1.28 An Environmental Noise Assessment and Noise Management Plan (NMP) has been submitted as part of this application, ensuring compliance with BAT 17 and 18.

BAT 19 – Optimising Water Consumption

2.1.29 Water use will be monitored and opportunities to reduce water used will be taken, if available.

BAT 20 – Reducing Emissions to Water

2.1.30 The site will include multiple stages of abatement to ensure that the discharge to surface water is within acceptable limits, as outlined within the water risk assessment submitted with this permit application.

BAT 21 – Preventing or Limiting Environmental Consequences of Accidents and Incidents

2.1.31 An Accident Management Plan (AMP) has been submitted as part of this application which covers procedures which will be implemented to prevent/limit environmental consequences of accidents and incidents, providing compliance with BAT 21.

BAT 23 – Using Energy Efficiently

2.1.32 Energy use will be monitored regularly and the operator will review and record measures for improving energy efficiency on an annual basis and take any action deemed necessary by the review. A breakdown of energy consumption by type of source will be included as part of the review. Reference should be made to information submitted as part of this permit application for details of basic measures to be used to improve energy efficiency.

BAT 24 – Reducing Quantity of Waste Sent for Disposal

2.1.33 There will be no packaging associated with the wastes to be used as feedstock on the site. Wastes will be minimised as far as is practicably possible and disposed/recovered in

accordance with the Waste Hierarchy. A full list of wastes and disposal/recovery route is included as part of this permit application.

BAT 33 – Reducing Odours and Improving Overall Environmental Performance Through Selection of Waste

2.1.34 Feedstocks will be selected through consideration of dry matter content and biogas potential, which are to be sourced from the local region to minimise carbon impacts and maximise sustainability.

BAT 34– Reducing Channelled Emissions to Air of Dust, Organic Compounds and Odourous Compounds

2.1.35 The very nature of the AD process includes the breaking down of odour forming substances, maximised via a lengthy retention time. Biogas arising from the process will undergo desulphurisation via a scrubbing system and carbon filter which will remove residual contaminants, including H_2S and other organic contaminants.

2.1.36 The safety flare will combust biogas at temperatures in excess of 1,000C. Therefore, this will provide a high level of destruction of organic compounds. The flare will not be routinely operated for extended periods of time, anticipated to be used for <10% of each year cumulatively. However, emissions from the flare will be required to comply with strict emission limits for Carbon Monoxide (CO), Nitrogen Oxides (NO_x) and Total Volatile Organic Compounds (TVOC).

BAT 38– Emissions to Air an Overall Environmental Performance

2.1.37 The process will be automatically controlled by SCADA system, ensuring stable digester operation and providing alerts of potential system failures that could lead to loss of containment. The primary digesters are equipped with a foam detection system and an anti-foam dosing system. When foam is detected, anti-foam is injected in the primary digester. Biogas/biomethane composition is regularly monitored and pressure and temperature in the digesters is controlled.

2.2 Assessment of BAT Against EA AD Technical Guidance Note

2.2.1 The following sections provide assessment of BAT compliance for the proposed plant against the indicative BAT measures within EA AD Technical Guidance Note.

Waste Pre-Acceptance and Acceptance

2.2.2 The EMS includes waste stream pre-acceptance and characterisation procedures, meeting Indicative BAT. This ensures feedstock nutrients are balanced. The EMS also includes waste acceptance procedures to ensure compliance with pre-acceptance characterisation, meeting indicative BAT. This ensures that feedstock is directed to the correct reception/loading area on site.

2.2.3 All available information in respect of each waste stream including any chemical analysis will be reviewed in order to verify that waste is coded correctly as part of pre-acceptance procedures. Chemical samples will be analysed for each new incoming waste stream and at least one sample for each ten thousand tonnes from each source will be analysed. If it is suspected that any incoming wastes are not coded correctly or may cause the AD process not to comply with PAS 110 the incoming waste will be quarantined pending further testing and removal from site for treatment at a suitably permitted facility if necessary.

2.2.4 All incoming vehicles upon arrival are required to report to the person in charge of waste acceptance at the site. The details of the load will be recorded and the duty of care note/company documentation will be further checked by the operator to ensure that the load is acceptable at the site, including a visual check prior to the vehicle proceeding to the tipping area. Any deviation from the procedures or problems with any loads will result in tipping facilities being suspended for the offending company. Loads which are not acceptable within the above terms will be rejected.

2.2.5 Analyses of any liquid wastes will be requested and reviewed prior to the transport of liquid wastes to the site. Authorisation for tankers and other vessels carrying liquid wastes to enter the site will be granted only if the operator is satisfied that the wastes have been suitably classified in accordance with WM3 and that the waste has been coded correctly.

2.2.6 All incoming wastes will be sampled by a suitable qualified and experienced technician and tested at a UKAS accredited laboratory for the following parameters:

- Chemical oxygen demand;
- Arsenic, cadmium, chromium, hexavalent chromium, copper, nickel, lead, zinc and mercury;
- Nitrate and nitrite;
- Total organic carbon;
- Total phosphorous;
- Chemical oxygen demand; and,
- pH.

2.2.7 The volumes of materials within each stage of the process is the subject of continuous monitoring. Wastes will only be brought on to the site where there is sufficient capacity within the primary tanks in order to process the material. Records of the volumes of materials within each stage of the process at any one time will be kept on the site. The process will be managed by the operator in order to ensure that no individual stage of the process will be overloaded.

2.2.8 Due to the nature of the waste streams accepted at the site it is extremely unlikely that an entire load of non-conforming material will be brought to site. Each load will be the subject of a visual inspection on arrival and no unloading of material will take place if the operator suspects that an appreciable portion of the incoming load may be non-conforming. The purpose of the quarantine skip is to provide temporary storage for small quantities of non-conforming material which may have been brought onto site and not detected during the visual inspections. Any such material will be removed from site and transported to a suitably permitted facility as soon as possible. It is therefore extremely unlikely that the capacity of the 2.5 tonnes storage quarantine skip will be required. If a full load were to be rejected, it would most likely be loaded directly back onto a trailer and sent back so the quarantine skip is only to collect small contamination such as plastic.

2.2.9 The quarantine skip will be located adjacent to the waste reception area in order to maximise operational efficiency and minimise any handling and transfer of non-conforming wastes which may be necessary.

2.2.10 All loads which arrive on site will be inspected by an operative prior to unloading. In the event that any non-conforming wastes are identified the load will be rejected and the customer/waste producer will be asked to remove the load off-site.

2.2.11 Loads will also examined at the point of unloading. If they are found to be unacceptable at this point the load will be reloaded and returned to source.

2.2.12 In the unlikely event that a non-conforming load is deposited at the site, it will be immediately rejected and/or quarantined and transferred into a clearly labelled rejected/quarantine skip with a maximum capacity of 2.5 tonnes.

2.2.13 The site will have suitable arrangements in place to ensure that the skip will be segregated from other loads deposited and stored at the site. The skip will be labelled and sealed to prevent the escape of any non-conforming wastes which ensures that it is stored appropriately pending removal off-site. The skip will be removed from the site within 48 hours.

2.2.14 All non-conforming/rejected/quarantined loads will be recorded within the site diary and on the operators computerised spreadsheet prior to the load being removed from site or transferred to the rejected waste skip. The EA and waste producer will be notified of any non-conformances resulting in a rejected load.

2.2.15 A waste tracking system will be maintained by the site operator to ensure that all movements of waste within the site are logged. The system will include details of the following:

- Date of arrival on-site;
- Producers details;
- All previous holders;

- A unique reference number;
- Pre acceptance and acceptance analysis results;
- Package type and size;
- Intended treatment/disposal route;
- Record accurately the nature and quantity of wastes held on site;
- Where the waste is physically located in relation to a site plan;
- Where the waste is in the designated recovery/disposal route; and,
- Identification of operators staff who have taken any decisions on reacceptance or rejection of waste streams and decided upon recovery / disposal options.

Waste Reception and Storage

2.2.16 The site design has been optimised to prevent any unnecessary handling and transport of wastes on site. Liquid based wastes will not be stored on site and will be delivered to site within enclosed tankers, unloaded directly to the process via enclosed line. Solid feedstocks will be stored within a dedicated storage area located in close proximity to the feed hoppers, ensuring that feedstocks are transferred to the process over minimum possible distances. Storage areas are clearly defined on the Site Layout Plan and maximum permitted storage quantities and duration of storage are defined within the site EMS and management systems. Records of storage quantities will be assessed continuously against storage limits. Waste storage durations are clearly defined within the site EMS and continuously monitored. A plant and machinery inventory will be maintained within the site.

2.2.17 Liquid feedstocks are introduced directly to the enclosed process via enclosed line. Apple pomace will only be stored in a dedicated storage clamp for a limited period of time. The manure storage area will be totally enclosed within a building operated under negative pressure with residual exhaust ai from the building directed to CHP plant which will abate ammonia and odour.

2.2.18 The entire operational area, include waste reception area, will contain impermeable surfaces with sealed drainage system, as shown by the site layout plan.

2.2.19 Waste rejection procedures will be in place, as detailed within the site EMS. Spillage control procedures will be place, as detailed within the site EMS.

2.2.20 Sufficient capacity is provided for digestate storage.

2.2.21 Any animal by-products including manure will be stored within enclosed clamp prior to loading to the anaerobic digestion process. The operator will register the facility as an Animal Biproduct Processing Site with the Animal and Plant Health Agency prior to the commencement of operation.

Treatment – General Principles

2.2.22 The plant has been designed in accordance with ATEX guidelines to prevent risk of explosion and a full HAZOP assessment will be progressed as part of the detail design process.

2.2.23 Wastes will be delivered to site pre-processed to an agreed specification, suitable for direct introduction to the AD process. As such, no pre-treatment of wastes is required on-site. The site EMS outlines procedures for designation of quarantine area for rejected/unacceptable wastes.

2.2.24 The digester will include paddle mixers and submergible mixers, suitable for mixing feedstock with a high dry matter content. The mixing enables elimination of floating layers, elimination of sedimentation, elimination of temperature and density gradients, better release of gas and mixing of fresh substrate with existing substrates.

2.2.25 All tanks, pipework, valves, mechanical and electrical items will be chosen/selected to meet the design life of the plant. All wetted parts will encompass a design life of 20 years. Concrete tank headspace , of approximately 1 metre, will be chemically treated to protect it from the saturated biogas present. Gas pressure relief valves will be protected against environmental and climatic conditions through use of appropriate materials including Stainless Steel.

2.2.26 The plant will be protected against extreme climatic conditions. When ambient temperatures are below zero degrees Celsius, the system is filled with antifreeze liquid (glycerol), which is suitable for the relevant minimum temperature.

2.2.27 The process will be continuously monitored using a Supervisory Control and Data Acquisition (SCADA) control system and this will be supplemented by laboratory testing. The following parameters will be covered:

- Alkalinity;
- pH;
- Temperature and temperature distribution;
- Hydraulic Loading Rate;
- Organic Loading Rate including total solids and Volatile Solids Fractions (organic loading rate and hydraulic residence time managed to deliver a stable and sanitised digestate);
- Concentration of Volatile Fatty Acids;
- Ammonia;
- C:N ratio and other nutrient and key feedstock data;
- Gas production and composition;
- Gas pressure; and
- Gas H2S concentrations.

2.2.28 Tanks used for AD treatment will be served by high level alarms.

Biogas Treatment and Monitoring

2.2.29 The biogas will be upgraded for export to the grid. Biogas treatment and monitoring will include the following:

- Moisture removal by cooling and discharge to condensate;
- Removal of H_2S by small amount of Oxygen injection to digesters and Carbon filters, for optimum performance carbon filters need around 0.2% O2;

- Removal of ammonia (bound in condensate);
- Removal of particulates using filters;
- Carbon filters to remove H_2S and Volatile Organic Compounds
- Capture of carbon dioxide (CO_2) for production of CO_2 and dry ice;
- Monitoring of principal biogas components including methane and CO_2;
- Monitoring of pressure and inclusion of associated alarms;
- Monitoring of H_2S before and after gas cleaning to enable monitoring of removal efficiency;
- Non-condensible gases are captured in the CO2 plant and returned to the digesters ie methane slip

2.2.30 Besides the main components of the biogas, which includes CH_4 and CO_2, the biogas contains H_2S. The amount of H_2S depends on the co-digestion materials that are fed to the digester. H_2S is primarily removed from the biogas by desulphurization bacteria. The bacteria convert the H_2S in the biogas to elemental sulphur. The elemental sulphur is removed through the digestate (digested manure and residues). The desired amount of oxygen is supplied to the primary and secondary digester by an oxygen generator. The capacity of the oxygen generator is limited in capacity, so that an explosive mixture will not occur. The amount of oxygen to be dosed depends on the biogas production. The oxygen dosing will be manually adjusted to about 0.2% oxygen in the biogas before the gas upgrading. The amount of oxygen in the biogas is measured by a gas analyzer in the gas upgrading unit.

2.2.31 All equipment in an ATEX zone with biogas will be ATEX certified.

2.2.32 A continuous monitoring system will be used to monitor gas flow rates to the gas holders and consumer unit.

2.2.33 The internal pressure of the AD reactors are guarded by the pressure relief valves (PRV). The minimum pressure of the PRVs are -0.5mbar, the max working pressure of the PRVs is 4.5mbar and the working pressure is 3.5mbar. The feeding is stopped based on the liquid level in the digesters. If the liquid level in the tanks rises above a set level, the feeding is

stopped. The use of the flare is governed by the amount of biogas stored in the roof of the tanks (measured by the height/level of the inner membrane of the membrane roof. If the level is at about 90%, the flare is activated. If the flare is activated due to overfeeding of the tanks, resulting in a higher biogas production than biogas consumption, the operator will reduce the feeding level.

2.2.34 The flare will have a minimum residence time of 0.3 seconds. A flame arrestor will be fitted to the flare.

2.2.35 System pressure relief valves will be monitored during operation of the plant.

2.2.36 Pressure Relief Valves (PRV) will be set at a slightly higher level than designed operational gas pressure but at a safe level to protect the digesters and gas holders. The minimum pressure of the PRV is -0.5mbar, the maximum pressure of the PRV is 4.5mbar. The working pressure is 3.5mbar.

Biogas Storage

2.2.37 Biogas will be collected from both the primary and secondary digester. Tanks will be fitted with pressure relief valves. Pressure sensors will be included with an alarm for immediate venting to be instigated if required. A safety flare will installed to safely combust biogas in the event of excess gas being produced. Negative pressures are prevented and controlled by the SCADA control system, which will include monitoring for pressure/vacuum with alarm conditions.

Energy Efficiency

2.2.38 Reference should be made to paragraph 2.1.32 above for details of energy efficiency measures.

Digestate Treatment and Storage

2.2.39 The digestate will be subject to multiple stages of treatment to extract nutrients in a concentrated form. Details of the treatment stages are provided with the documents submitted as part of this permit application. These processes will be undertaken in sealed vessels.

2.2.40 The remaining low nutrient digestate will then be separated with screw presses and/or decanter centrifuges into a benign solid soil improver and a liquid stream. The liquid stream is still around 1% solids so requires further processing through a reverse osmosis membrane/ion exchange plant to create a liquid stream suitable for re-circulation or final polishing in a reed bed before discharge.

2.2.41 All waste feedstocks used in the process will be PAS100 compliant, ensuring a PAS110 compliant digestate product.

Point Source Emissions to Air

2.2.42 Records will be maintained of all air emissions monitoring, as detailed within the site EMS. Records will also be maintained for all periods of flare operation. The flare will be primarily used for safety purposes and biogas will not be routinely flared. Emissions from the flare will be required to comply with strict emission limits for CO, NO_x and TVOC.

2.2.43 The CHP units will have a rated thermal input greater than $1MW_{th}$. As such, they will be required to comply with emission limits within the Medium Combustion Plant Directive.[2]

2.2.44 The backup boilers will also be subject to emission limits.

[2] Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

2.2.45 Monitoring of emissions from the CHP units and backup boilers will be required on an annual basis.

2.2.46 Biogas storage capacity will be sufficient for plant production capacity. The total biogas storage capacity is 16,000Nm^3. The maximum production rate for biogas will be 3,500Nm^3. $hour^{-1}$, meaning the plant provides a storage capacity for4.5 hours of gas production.

Fugitive Emissions to Air

2.2.47 See paragraph 2.1.18 above for details of fugitive emissions controls.

2.2.48 The amount of sludge within storage and treatment vessels strongly depends on the feedstocks. Storage and treatment vessels are equipped with mixers to keep solids in suspension. Vessel cleaning (desludging) will be undertaken at a frequency of up to 3 times in a 15 year period, dependent on the feedstocks that are used.

Odour Control

2.2.49 An OMP has been prepared for the operation which contains odour control and monitoring procedures.

Point Source Emissions to Surface Water and Sewer

2.2.50 Reference should be made to the Water Risk Assessment for details of point source emissions to surface water and controls that will be in place to ensure the proposals meet BAT.

2.2.51 There will be no discharges to sewer.

Point Source Emissions to Groundwater

2.2.52 There will be no point source emissions to groundwater

Emissions of Substances Not Controlled by Emission Limits to Surface Water, Sewer and Groundwater

2.2.53 The proposed site layout is shown on Drawing No. 2106-006-02 and 01113-00-E on which the routing of the surface water system is shown. All sub-surface pipes will be installed within trenches with impervious sidewall and basal polyethylene liners or other suitable impervious liners. Leak detection systems will be installed in any trenches containing underground pipes containing liquids in order to detect fluid accumulation at the base of the trenches. Any leaks or defects detected using the leak detection system or suspected due to observations of levels or flows in above ground components of the AD process will be investigated and repaired immediately.

2.2.54 Prior to their bringing into use, all pipes, tanks and valves including their connections will be pressure tested in order to verify they can withstand their respective operating pressures plus appropriate factors of safety.

2.2.55 All components of the AD plant including all tanks, pipes, membranes and fittings will be inspected visually on a daily basis. Any evidence of leakage will be investigated immediately and repairs made as necessary. All components of the AD plant will be tested and maintained in accordance with the instructions from and at the intervals specified by the manufacturer.

2.2.56 The concrete surface comprising the external containment area will be designed and constructed in accordance with the Construction Industry Research and Information Association guidance document titled CIRIA 736 – Containment systems for the prevention of pollution and associated standards. The thickness, chemical composition and reinforcement of the concrete surface will be CIRIA 736 complaint.

2.2.57 The concrete surface will be inspected daily and any cracks or defects will be repaired immediately.

Noise and Vibration

2.2.58 An Environmental Noise Assessment and Noise Management Plan has been submitted as part of this application.

Management Systems

2.2.59 An EMS has been prepared for the operation, which has been submitted with this permit application, providing compliance with this BAT measure.

Raw Materials Selection

2.2.60 Reference should be made to document ref: 2102-006-A for details of raw materials selection. Manufacturer's guidelines will be followed when using specific fuels and consideration will be given to environmental impacts when purchasing new plant and equipment for the site. Any compounds utilised as described above will be used as recommended by specialist suppliers. Any quantities of materials used will be the minimum necessary to undertake the required process. A review of raw and auxiliary materials used on site will be carried out at least every four years to assess whether any alternative materials can be used which would result in improved environmental performance. The reviews will ensure raw materials and resources used are appropriate, are used efficiently and any options for reduction in use identified, if applicable.

2.2.61 All incoming waste will be assessed for impurities in accordance with the pre-acceptance and acceptance procedures earlier within this BAT assessment.

Waste Minimisation

2.2.62 Reference should be made to document ref: 2102-006-A for details of waste minimisation. EC Directive 2006/12/EC consolidated and replaced directive 75/442/EC but maintained the duty on member states to encourage the hierarchy approach to managing waste whereby the most desirable option is to prevent/minimise waste. The site operator is committed to following the above requirements at the installation. Opportunities for waste minimisation will be regularly reviewed.

Water Use

2.2.63 Water use will be reviewed at least every four years and opportunities for reduction in water use identified by the review.

Waste Recovery or Disposal

2.2.64 Reference should be made to document ref: 2102-006-A for details of recovery/disposal.

Accidents and Abnormal Operation

2.2.65 Reference should be made to document ref: 2102-006-K for an Accident Management Plan which details accident prevention measures. Additionally, the operator will undertake a HAZOP study.

Emissions Monitoring

2.2.66 Annual monitoring will be undertaken for CHP units and backup boilers. Monitoring of flare emissions will be undertaken upon commissioning and in the event that the flare is operational for more than 10 percent of the year.

Requirements for Environmental Monitoring (Beyond AD Facility)

As the process will operate within a sealed and bunded drainage system which will be the subject of regular inspection and maintenance as necessary it is considered unnecessary to monitor for impacts on surface water quality and groundwater quality off-site.