Measures to Demonstrate BAT

Prepared for: Bioconstruct NewEnergy Ltd

By:

ENVIROSOLUTION LTD

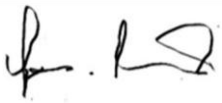
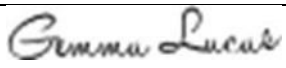
Suite 53

3a Bridgewater Street

Liverpool

L1 0AB

EnviroSolution Ltd
Document Verification

Site Address	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
Report Title	Measures to Demonstrate BAT		
Job Number	ES2520	**Document Ref.**	ES2520-14
Date Issued	April 2026	**Report Version**	V1
Prepared by	James Meredith	**Signature**	
Checked by	Gemma Lucus	**Signature**	

Disclaimer

This report has been prepared by EnviroSolution Ltd who has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant experienced in preparing reports of a similar scope.

However, to the extent that the report is based on or relies upon information contained in records, reports or other materials provided to EnviroSolution Ltd, which have not been independently produced or verified, EnviroSolution Ltd, gives no warranty, representation or assurance as to the accuracy or completeness of such information.

Table of Contents

TABLES

1 Introduction

This document is submitted in support of an Environmental Permit application for the Arrow Bio Waste recycling facility at Deeside Industrial Park, Flintshire enterprise zone. The Installation will process up to 149,000 tonnes of food wastes per annum in the form of solid packaged and unpackaged materials, and pumpable liquid wastes. The source of the waste is likely to come from food businesses and some of the local county councils (assuming 50-mile radius initially) in the form of waste trucks. The vision for the project is to provide a technologically advanced facility for the complete treatment of food waste, utilising BioConstruct GmbH's anaerobic digestion technology.

In accordance with Industrial Emissions Directive 2010 the facility will be operating as an installation under a bespoke Environmental Permit. It is a requirement of the environmental permitting regime that Operators must apply Best Available Techniques. The Operator commits to ensure that all relevant and required aspects of the NRW Technical Guidance Note 'How to comply with your Environmental Permit. Additional Guidance for: Anaerobic Digestions' (LIT 8737, v1.0 Nov 2013) and European Commission document JRC Science for Policy Report – Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), Pinasseau et.al 2018 will be met (or where appropriate justify deviations from specific measures) thus ensuring that the facility will be fully BAT compliant and operable without adverse impact under the conditions of an Environmental Permit (EP). This report provides an assessment and demonstration of how these standards have been applied/will be applied at the Arrow Renewable Energy AD site once the facility is fully operational. Reference has also been made to Sector Guidance Note IPPC S5.06, Guidance for the Recovery and Disposal of Hazardous and Non-Hazardous Waste.

The operation is designed to process up to 149,000 tonnes of waste per year received as either packaged or unpackaged solid wastes and pumpable liquid wastes. Biogas will be stored in gas bags in the head space of the digesters and digestate storage tank before being upgraded to biomethane for injection into the national gas grid network. Biomethane generated at the site will also be used as a fuel to power three combined heat and power engines. There will be one MTU 16V4000 GS CHP unit (CHP 1) with a rated thermal input of 2,149 kW providing an electrical output of 2,028 kW. Two MTU 12V4000 GS CHP units (CHP 2 and CHP 3) each with a rated thermal input of 1,608 kW providing an electrical output of 1,521 kW. These will be providing electricity for operations at the site.

The boiler (Viessmann Vitoplex 200, 1,100 kW thermal) operates on natural gas only and is used for emergency/backup heating when CHP 1 is out of service.

2 Site setting

The site is located at Arrow Renewable Energy Biogas Facility. The National Grid Reference for the site is SJ 31114 71232.

The site is located on an industrial estate adjacent to other industrial units at the site. There are other waste related activities in operation elsewhere on the estate. The residential receptors and habitats sites receptors in the vicinity of the site are detailed further in the environmental risk assessment for the site submitted with this application reference.

Geological maps for the area indicate that the Installation is underlying with:

- Made Ground (Undivided);
- Tidal Flat Deposits; and
- Pennine Lower Coal Measures.

The Tidal Flat superficial deposits are classified as a Secondary (undifferentiated) Aquifer. These are cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the soil type.

The bedrock deposits are classified as Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The site is not located within a Source Protection Zone of a licensed groundwater abstraction. There are no groundwater abstractions within 1 km of the site.

The nearest Secondary River lies 15 m to the west of the site (a drain). A Primary River (another drain) lies 80 m to the east of the site, beyond the railway line. The nearest major river is the River Dee which lies 1.9 km south of the site.

The nearest surface water feature is noted as two small ponds approximately 40 m west from the site, with several reservoirs / pond features lie 300 m west of the site.

3 Solid Waste Acceptance Procedures

3.1 Pre-Acceptance

The operation is designed to process up to 149,000 tonnes of waste per year received as packaged or unpackaged solid wastes and pumpable liquid wastes.

All waste deliveries, treatment and storage take place in the waste reception building. This building is constructed with concrete surfacing with a sealed internal drainage system that will contain spillages during deliveries. The internal drainage from the building will be collected in the internal mixing pit and re-circulated within the process. The internal drainage arrangement for the waste reception, bunding and storage shed are shown on the Site Layout Drawing in Appendix 1 and the Drainage Layout drawing in Appendix 2.

Wheel washing facilities will be available in the delivery shed area, as will foot dips for use in case of spillages of ABP wastes

The waste reception building will be fitted with fast shuttering roller shutter doors which will be closed during vehicle offloading. Refer to Appendix 3 and 4 for diagrams of the arrangement of the waste reception building.

All new suppliers of waste will be assessed pre-acceptance. This process of assessment is outlined in the Waste Acceptance Criteria and will be recorded on the New Supplier Assessment Form, included with this document as Appendix 6.

3.1.1 Waste Storage and Handling Prior to Digestion

Diagrams of the de-packaging machine are included with this document as Appendices 39.

A leak detection system will also be installed to allow for routine monitoring for leaks from the pit during operational conditions (Appendix 5). A leak test will be carried out on the mixing pit as part of the plant commissioning process and the tank will be signed off as leak free and ready for use by a qualified commissioning engineer.

3.1.2 Treatment

The operation is designed to process up to 149,000 tonnes of waste per year received as either packaged or unpackaged solid wastes and pumpable liquid wastes.

The fermentation process will take place in a dual-step continuous flow anaerobic process that operates in the mesophilic range (approx. 40^{o}C across six digesters (3 fermenters, 1 post fermentation and 2 digestate storage vessels)). The site configuration will be three primary digester tanks (fermenters) each with a capacity of 5213 m3, one secondary digester with 5213 m3 capacity and two final storage vessels each with 8040 m3 capacity. The digesters will be above ground concrete tanks situated on concrete bases and fitted with insulated cladding. All six digesters will be fitted with roof mounted double layer weatherproof and UV resistant gas storage bags above the tank space. The storage above the primary digesters will

each provide a capacity for gas storage of 425m3 and the storage above the secondary digesters will each have a capacity of 550m3. This combined with the storage capacity above the final digestate store of 550m3 will give a total biogas storage capacity of 3358 m3 which provides storage for approximately 2 hours of biogas production.

Digesters will be fitted with a heating coil which will be utilise hot water for heating of the process tanks. Each digester will be fitted with submersible mixers for agitation of substrate. The specification of the digesters and routing of ancillary pipework can be seen on Appendix 2 of this document.

Construction diagrams of the primary and secondary digesters are included in this document as appendices 12, and 13. A drawing showing the general arrangement elevations is included as appendix 14. The plant has been designed considering inspection, maintenance, and replacement schedules to ensure that a plant life of 20 years can be achieved

The anaerobic digestion process will begin in the primary digesters where most of the digestion of the substrate will be undertaken and as such most of the biogas will be produced. The digesters will be maintained at mesophilic temperatures (38-42°C) and stirred regularly to ensure stable digestion. From the primary digesters, the substrate will be transferred to the secondary digesters, which will also be operated at mesophilic temperatures. There will be an average 51 day hydraulic retention time across the two digestion steps (calculated based on 150kte HRT is (410te p/day) 51 days.) The secondary digesters will further digest the organic material, ensuring that the substrate is fully degraded prior to pasteurisation and transferring to the digestate storage tanks. The two-step process allows for maximum possible utilisation of the substrate for biogas production

The operator intends to apply the PAS110 standard to the process on site via the implementation of a quality management system. This will enable the operator to apply for certification with the Biofertiliser Certification Scheme for quality digestate. Part of the requirement for achieving this standard is the regular testing and analysis of digestate. One of the variables tested for is residual biogas potential, which gives re-assurance that the operator has achieved a high degree of utilisation of the substrate and produced a stable final product.

The combination of the heating and the mixing within the insulated tanks will ensure that the temperature and substrate are kept uniform throughout the digesters, avoiding sedimentation and development of floating layers. The outer walls of all digesters will be insulated and clad to achieve maintenance of the set point temperature.

Each digester will be fitted with an under/over pressure relief valve that can vent gas to air in the event of a build-up of pressure in the tanks. The tanks will also be fitted with foam sensors that will trigger an alarm to be sent to the operator if foam is detected. The tanks will be fitted with a dosing system for dosing with anti-foaming agent which can be applied if an alarm is received. Records will be kept regarding the use of pressure relief valves and use of the foaming dosing system and a full documented account made on occasions where these have operated. All digesters will be fitted with sample points to enable controlled substrate removal for analysis.

The digesters will be fitted with oxygen addition points in the head of the digesters for biological control of hydrogen sulphide. The digesters will also be fitted with a dosing system for ferric chloride for chemical control of hydrogen sulphide.

Access to the tanks and associated plant, equipment and controls will be via a galvanised staircase with landings and gantry, allowing safe and unrestricted access for operational maintenance. Each digester will be fitted with a viewing port with ATEX rated lights to allow the operator to view the inside of the tanks

The digesters will be situated within an impermeable concrete bund that has been constructed to a suitable specification to contain any spillages arising from the site and sized to contain at least 110% of the largest vessel or 25% of the total tankage volume.

A drawing providing details of the bund is attached as Appendix 1. Further details of the construction and properties of this bund are considered in this document in section 8.

The digestion tanks will be fitted with temperature, pressure and level transmitters, which continually report data that is displayed on the computerised SCADA monitoring screens in the control room. Temperature/flow/feed rate can be controlled by this system. If high level thresholds set for temperature, pressure, or level are breached, a high-level alarm will sound. Refer to Appendix 7.

If high or low-level alarm conditions are reported to the central control system by in-vessel transmitters, the central control system will respond accordingly in order to return the process to normal operational range. An exceedance of the high-level threshold reported by the pressure transmitter will trigger an SMS alarm, and the initiation of the flare. In the event that the gas blowers are not operational, or the gas line is blocked, the automatic pressure relief valves will operate to vent gas to air. If a low-level pressure threshold is breached, this will trigger an SMS alarm, and the gas blowers will cease to operate. The pressure relief valves are operated based on the density of water, and hence these are managed by the addition of glycol (anti-freeze) to ensure that they are available to operate in colder weather conditions

An exceedance of the high-level threshold reported by the level transmitter in the secondary digester will trigger an SMS alarm, and the feed from the primary digester to the secondary digester will stop. If the primary digester exceeds a high-level threshold for levels in these tanks, an SMS alarm will be triggered, and feed to the primary digester from the waste reception tanks will be stopped. A description of the SCADA system alarm and reporting controls is included with this document as Appendix 7.

The digesters will each have temperature probes fitted at different levels within the tanks. The temperature transmitters in the digesters are set to trigger a response if the temperature should rise or fall from optimum level by a set amount. Fluctuations in temperature will be monitored, and the heating system will be automatically adjusted accordingly. Any breach of high or low-level thresholds will also trigger an SMS alarm

Monitoring probes and equipment will be calibrated as required/recommended by the instrument supplier, and calibration records will be kept within the management system. All electrically operated monitoring equipment situated inside risk zones will be ATEX rated.

Pipework and vessels will have isolation valves fitted to enable maintenance activities or interventions

The system will be fitted with a series of non-return valves to ensure that material flows in a single direction and that the potential for uncontrolled backflow is avoided

HRT and maximum organic loading rate will be monitored via a flow meter and the retention can therefore be calculated and recorded on the central computer

The critical limits specified in Table 1 will be appraised every day on the Master Control Panel (computer) screen in the Control Room. The Master Control Panel will also be connected to the internet to allow remote connection to the system. Alarms can also be sent via SMS message.

The AD facility has a backup unit for keeping the PLC and other associated circuits live for 30 mins. This allows valves to be sent to a default position and for alarms on the system to be sent via email and SMS. Should the CHP stop producing power, the facility will automatically switch over to the imported power supply from the national grid. The site also benefits from a dual fuel biogas boiler that can provide heat to the process tanks using biogas or heating oil as a fuel, and an emergency backup diesel generator.

Further parameters/operational conditions to be monitored by in situ monitors in the digesters are:

- Level of substrate monitored via level meters and triggers high- and low-level alarms; accordingly, and
- Volume / capacity of digester tanks utilised (% capacity occupied).

The site operator will monitor the health of the digesters on at least a daily basis by analysis of samples on site. Samples will be taken on a daily basis from the primary and secondary digesters. There will be a titration machine on site to enable the operator to monitor FOS/TAC ratio on a daily basis. The results of this analysis allow actions to be taken with regard to feedstock and process management to prevent abnormal condition from developing. The Process Monitoring Plan attached to this document as Appendix 8 outlines the process monitoring schedule for the plant, the indicative ranges of parameters monitored, and range of actions to be taken if variables monitored fall outside of the normal range required for healthy operation.

The site will have an automatic closed (ground) back-up flare that can burn gas in a controlled manner, at a minimum of 1,000°C and 0.3 seconds retention time at this temperature. The flare will have the capacity to burn total biogas production in the event of plant shut down e.g., during periods of on-site/grid maintenance. The flare is fitted with a flame arrestor to prevent flashback. The flare data sheet is attached as Appendix 9. The flare will be mounted on a concrete plinth with pedestrian access for inspection and maintenance, in a location that is compliant with DSEAR and ATEX regulations

Records will be kept of the flare use on the SCADA control system, and the reasons for its use will be documented within the EMS (Environmental Management System) incident documentation process if relevant.

All vessels and pipes will be labelled and identified. All valves will be labelled and have a unique identifier number that is cited on the master control screens, and repeated on connecting cables, airlines and valves.

All pipework will be product labelled, and flow coded via stickers applied to the pipelines. Labelling will be in accordance with BS1710. The pipework labelling scheme to be used is included with this document as Appendix 10.

To achieve efficient biogas production, uniform homogenisation of the substrate is required. This is achieved by thorough mixing of the digester tanks to prevent stratification, floating layers and sedimentary layers in the fermenters. The tanks will contain ATEX rated electric mechanical mixers. Regard will be given to ease of access for maintenance work when positioning these within the tank.

The maintenance schedule for the digesters and mixers and associated plant is outlined in Appendix 11. All maintenance activity will be recorded on the computerised database system.

The digestate will be pumped from the secondary digester to the pasteurisation system via a 12mm macerator to ensure the required particle size is reached prior to pasteurisation. The manufacturer's specification for the macerator is included with this document as Appendix 12.

The pasteurisation (hygenisation) system will consist of four 30m3 tanks mounted on a concrete base. These tanks will be situated within an impermeable bund that has been constructed to a suitable specification to contain any spillages arising from the site and sized to contain at least 110% of the largest vessel or 25% of the total tankage volume The tanks will be fitted with an insulating jacket, internal heating coil, ATEX rated mixers, and a series of temperature probes at different levels within the tank. The status of the mixers and temperature probes will be shown on the SCADA system. The pasteurisation sequence will start automatically once all probes have reached 70oC or above. The substrate will be held at 70oC for a minimum of 1 hour to comply with PAS110 standards and Animal By-Products Regulations. The temperature probes will be calibrated on an annual basis as agreed with the APHA (Animal and Plant Health Agency) according to the site HACCP (Hazard Analysis Critical Control Point) assessment. There are no release points from these tanks to air. Drawings of the pasteurisation tank configuration are included with this document as Appendix 13. The location of the tanks and ancillary pipework can be seen on Appendix 2.

All plant and equipment will be subject to testing and sign off as part of the plant commissioning plan overseen by a suitably qualified commissioning engineer.

BAT Assessment Statement:
The infrastructure and processes and procedures that will be implemented to manage the treatment process will be compliant with BAT as outlined in the NRW Document 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in ‘Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018’ for the following BAT references are met: BAT 38.

4 Biogas treatment and Storage.

4.1 Treatment

The digesters, final digestate storage tank and waste pre-storage tank will be fitted with gas collection and storage facilities in the roof space. These will consist of a roof mounted gas tight collection membrane, protected by a second weatherproof and UV resistant protective layer. There will be a total storage capacity of 3358 m3 which will provide storage for 2 hours of gas production during steady state operations. The gas membrane will rise and fall in response to fluctuating gas volumes stored in the roof. The storage capacity provided will be sufficient provision to compensate for fluctuations in gas production, ensuring uniform operation of the gas utilisation equipment. The maintenance schedule for the gas storage infrastructure is included with this document as Appendix 11

The biogas collection system associated with the digesters will be fitted with pressure monitoring probes, and pressure relief valves, as described in section 4 of this document.

Qualitative data regarding the composition of biogas produced in the digesters is monitored by an in-line gas analyser. This measurement device serves as an analysis unit for biogas and has sensors for the following:

- Hydrogen sulphide H2S;
- Oxygen O2; and
- Methane CH4.

The gas analyser will report data to the SCADA control system and will undertake gas sample analyses on average every hour. Data reported to the SCADA system will be checked and logged by plant operatives daily. The data sheet for the gas analyser is included in this application as Appendix 15. The gas analyser will be calibrated per the manufacturer's specification.

Hydrogen sulphide will be managed via a combination of biological control within the head of digesters, and dosing of ferric chloride to achieve precipitation if required. Nets will be situated in the head of the digester to allow cultivation of sulphur removing bacteria. Small amounts of oxygen can be injected into the headspace of the digesters to support the growth of microaerophilic bacteria that oxidize hydrogen sulphide, converting it into elemental sulphur or sulphate, thereby reducing H_2S levels in the biogas. The dosing system is controlled by the data reported from the gas analyser within the central control system. Ferric chloride will be stored in a dedicated tank located in the main bunded area of the site. Dosing will be carried out directly from this station to the digesters. A construction drawing of the ferric chloride tank is included as Appendix 16.

Biogas production rates will be measured via a flow meter in the gas line. This device will report to the central control SCADA system, and a total volume produced can be calculated at an agreed rate at any given time when required.

All digestion tanks are equipped with gas pressure and gas level measurements and are interconnected via gas lines. Furthermore, each vessel is equipped with individual pressure

relief valves which are designed to release the volume of gas passing through the tank if a critical under/over pressure point is reached. These valves are last safeguards to protect the tank gasstorage. Under normal conditions the gas pressure sensors detect access pressure and if excess biogas is present, triggers he gas flare. The flare is a dual fuel type flare and is capable of burning biogas as well as biomethane. Biogas and biomethane can be burned at the same time at a rate of 50% of the designed flow of the gas flare in case of excess biogas production or instances where gas consumers are not available. In case of a breakdown of all consumers on site (biogas upgrading unit and flare) the flare can be used to flare off the full production of Biogas and no gas will be released through the pressure relief-valves.

The pasteurisation tanks as well as the pre-storage tanks and heated pre-storage tanks are connected to the gas storage via gas lines. Low or high pressure will equal itself through the gas lines automatically.

The total gas storage volume of the 6 gas roofs is 3358m3. During normal operation, the gas roofs are not full, but set to operate at 50% capacity and so there is suitable buffer storage available at most times to accommodate any off-spec gas returned from the upgrading system.

Condensate naturally forms in the main gas transport line from the AD plant and as a result of the upgrading process. A dedicated collection system is in place to manage condensate arising in this way. A diagram of a condensate collection pit is attached to this document as Appendix 17. The data sheet for the epoxy resin coating material used to seal the condensate collection pit is attached as Appendix 18. The main collection pit will be fitted with a level pump switch and will return condensate to the digesters via the condensate return line. The condensate pit will be accessible for regular service checks via a surface manhole lid.

The site will house 3 CHP engines with thermal outputs as shown below:

Table 1: CHP Engine Thermal Output

MCP	Thermal/Electrical Outputs	Operating Hours Per Year
CHP 1	2149 kW / 2028 kW	8760
CHP 2	1608 kW / 1521 kW	8760
CHP 3	1608 kW / 1521 kW	8760
Boiler	1100 kW / -	Emergency operation only when CHP 1 is out of service, to give the process a sufficient heat source
Emergency Generator	- / 200 kW	Emergency operation only for safety backup when the electrical grid connection is down, to have the plant in safe mode

The engines will be used to supply electricity to the process. Information about an engine is attached as Appendix 19

The CHP units will be housed in an insulated containerised unit. The Operator will ensure that the emissions from the CHP exhausts shall not exceed those quoted in the planning permission or the Environmental Permit for the site. Thermal energy from the CHPs can be utilised to provide heat to the process tanks and any pipe heating to meet the requirements of the process.

The CHP containers will be mounted on foundation plinths with safe access provided around the circumference for operational and maintenance activities. The CHPs will be fitted with gas detection systems within the CHP containers to activate both an audible and visual alarm both internally and externally to prevent access to the container should gas levels be hazardous. The alarm will initiate shutdown of the gas supply to the CHPs.

Particulates present in the biomethane that may cause mechanical wear in the CHP engines are removed via a mesh filter in the engine compartment of the CHP units. Air filters on the air intakes to the CHPs will prevent ingress of dust, airborne particles, and moisture.

The site will also be fitted with an emergency natural gas boiler (Viessmann Vitoplex 200, 1,100 kW thermal) that will provide heat for process tanks when CHP 1 is out of service. A data sheet for the boiler is included with this document as Appendix 20.

All other biomethane which is not utilised in the boiler or CHP for plant operation purposes will be upgraded and injected into the national gas grid network.

Upgrading will take place in the DMT upgrading unit. The biogas produced in the digesters will be passed through a series of membranes and carbon filters under different gas pressure and temperature conditions to remove VOC's, H2S and CO2. Propane and odorant are added to the final biomethane in order to raise the calorific value of the final gas, and to introduce a recognisable 'gas' odour for health and safety purposes. The biogas is compressed within the Biogas Upgrade Unit (BUU) to approximately 12barg and then passed through a series of membranes which strip the biogas of the methane, which is then passed to the grid entry unit for propanation and odorisation prior to injection into the grid.

The remaining carbon dioxide is upgraded in a CO2-recovery unit and stored in tanks to pump it into tanker for off-site distribution.

Biomethane that does not meet the required quality benchmarks for injection into the grid is returned to the gas storage for re-processing or burnt in the flare. The upgrading facility also has an emergency under/over pressure facility to vent gas via the CO2 vent if required. The data sheet for the gas odorant used to treat final biomethane following upgrading is attached with this document as Appendix 22.

Prior to processing in the DMT upgrading unit, biogas will be passed through an ammonium washing unit for removal of impurities as a first treatment step. The gas will be passed through a tower containing a mixture of water and sulfuric acid that will be dosed from a dedicated dosing station housing two IBCs of sulfuric acid and contained within the bunded area. The

gas will then be passed on to the upgrading unit for further treatment. A process flow explaining this can be found in Appendix 21.

All plant and equipment will be subject to testing and sign off as part of the plant commissioning plan overseen by a suitably qualified commissioning engineer.

BAT Assessment Statement:

The infrastructure and processes and procedures that will be implemented to manage biogas treatment and storage will be compliant with BAT as outlined in the NRW 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in 'Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018' for the following BAT references are met: BAT 4a – c.

5 Energy Recovery

The operator has a number of measures in place to maximise energy recovery and use on site. There will be 3 CHP engines on site that will meet the energy needs of the site. Heat from the engine cooling waters will be recovered for use in heating of tanks on site via use of a heat exchange system.

Should the CHP unit stop producing power, the plant will automatically switch over to the import of electricity from the national grid for continued plant operation. There will also be an on-site generator for further backup should grid connection be unavailable. The site also benefits from an emergency natural gas boiler that will provide heat for process tanks when the CHP is unavailable. This boiler will also be available for use during start-up of the site.

An outline of the operator's intentions to comply with BAT in this area (according to the How to Comply and the H2 guidance documents published by NRW) is included in the permit application for the site. The Operator will carry out ongoing monitoring of energy use on site, and to carry out a review of potential savings that can be made, both in process areas and from domestic facilities on site.

To provide a baseline from which monitoring and review can take place, the operator has prepared a provisional account of energy balances within the plant operations.

BAT Assessment Statement:

The infrastructure and processes and procedures that will be implemented to manage energy recovery will be compliant with BAT as outlined in the NRW Document 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in 'Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018' for the following BAT references are met: BAT11 and BAT 23.

6 Digestate Treatment and Storage

Following pasteurisation, digestate will be pumped to the digestate storage tank. The location of this tank and its ancillary pipework is shown on Appendix 2. The digestate store will be a 8553m3 circular concrete storage tank mounted on a concrete base, with a sealed gas storage bag in the headspace of the tank. There will be a 600mm freeboard space preserved at the top of the tank when in use. This exceeds the minimum requirement under SSAFO for steel or concrete slurry storage tanks of 300mm.

The tank will provide enough capacity to store approximately 1 month worth of digestate production based on the plant being designed to accept 149 kte - process loss (10%) therefore 410 per day through process (Pas to final storage.)

The tank will be fitted with three mixers and with an under/over pressure relief valves that will vent to air under emergency circumstances.

The tank will be situated within an impermeable concrete bund that has been constructed to a suitable specification to contain any spillages arising from the site and sized to contain at least 110% of the largest vessel or 25% of the total tankage volume. Further details of the bund are given in section 8.

Digestate may be separated to produce a separated liquid and solid fraction by a separator located in a dedicated hall in the waste reception building.

Separation will take place when separated liquid digestate is needed to provide additional liquid to the feedstocks to achieve a suitable consistency and dry matter content. Therefore, when separation takes place, the separated liquid digestate will be re-circulated and introduced into the process at the de-packaging machine/mixing pit and the separated solid digestate will fall into an awaiting trailer in the separation hall for storage pending removal from site for storage at the site of intended spreading.

The separated solid digestate will be moved off site in a sheeted trailer.

Whole digestate will be removed by tanker via a tanker coupling point inside the waste reception building.

Residual digestate in the tanker connection pipe following removal of digestate or delivery of feedstocks will drain to a concrete collection pit at the tanker loading/offtake area. This pit will drain to the mixing pit and so drained down liquid will be re-circulated within the process.

Digestate removed from the store by tanker will be taken either directly to land for use as an agricultural fertiliser, or to a satellite store for storage pending an appropriate spreading window.

The operator is aware that digestate cannot be spread during the closed spreading periods outlined in the NVZ regulations, and that a minimum of 6 months' storage capacity must be available to enable compliance with these regulations. The operator is also aware that any satellite storage employed must be compliant with the SSAFO regulations.

The operator plans to meet the PAS110/ADQP quality standard to enable end of waste status to be achieved on the final quality digestate arising from the process.

Digestate will be taken off site for spreading and storage by a third-party land spreading contractor. This contractor will hold a mobile plant permit for spreading of wastes to land for agricultural benefit and so will be able to manage digestate arising from the plant prior to its certification as PAS110ADQP compliant material. Suitable offsite storage for waste and PAS110 compliant digestate will also be provided and subject to contractual agreement. The potential to dispose of digestate at local permitted treatment facilities has also been explored and potential roues should they be needed for off spec material will be specified and available as a contingency if needed.

The operator will ensure that all digestate produced that is a waste will be spread to land by a landspreading operator who is the holder of a mobile plant landspreading permit. The operator will ensure that all waste is stored and spread to land according to a waste deployment issued by NRW or the Environment Agency as applicable.

Once end of waste status has been achieved, the operator will have a contingency deployment in place at all times to allow off site storage and spreading in the instance that any batches of digestate fail to meet the PAS110 criteria standards.

If the nature of the failure of the batch of off specification material is such that the digestate is not suitable to be spread to land as a waste, then the material will be removed off site and disposed of at a suitable disposal facility.

All plant and equipment will be subject to testing and sign off as part of the plant commissioning plan overseen by a suitably qualified commissioning engineer.

BAT Assessment Statement:

The infrastructure and processes and procedures that will be implemented to store digestate will be compliant with BAT as outlined in the NRW Document 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in 'Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018' for the following BAT references are met: BAT 4a-c and BAT 5.

7 Emissions Control and Abatement

7.1 Air Emissions

The point source emissions to air and water and associated monitoring points from the plant are outlined in application documents Site Boundary (Appendix 1), and List of Emissions Points (Appendix 23).

The potential for air quality impacts from emissions from the CHP engine, the flare, emergency natural gas boiler, and the biogas upgrading unit have been assessed via dispersion modelling. This modelling concludes that predicted concentrations of all pollutants were below the relevant Environmental Quality Standards (EQSs) at all locations of human exposure for all meteorological data sets modelled. Resultant impacts were classified as not significant. Impacts were also predicted at relevant ecological sites. The results indicate that emissions from the plant are not predicted to significantly affect existing conditions at any designation.

The gas consumers at the site will be subject to regular maintenance, monitoring and re-tuning to ensure optimum performance. The programme of monitoring and maintenance to be undertaken will be defined in association with the technology providers who will provide service and maintenance support once the site becomes operational. Where relevant this will also be carried out in line with relevant NRW and industry guidance for biogas and AD facilities.

All maintenance and monitoring activities related to gas consumers will be documented.

All use of the flare and PRV's will be recorded and accounted for. The PRV's will be checked and maintained regularly as outlined in the site's maintenance programme. The flare will be subject to regular maintenance and monitoring checks, to be defined in association with the service provider for the flare.

An annual monitoring exercise will be carried out for emissions from the CHP and boiler. This will be reported to NRW as required. The sample point will be identified in line with the M1 guidance. This monitoring and sample point selection will be done in association an MCERTS accredited external contractor who will be commissioned to undertake the exercise. Annual monitoring of the flare will be undertaken if it is used for more than 10% of operational time.

The odour impacts of point source emissions to air have been assessed via dispersion modelling and a report of the findings has been provided in support of the application. This assessment has concluded that predicted odour concentrations were below the relevant benchmark level at all sensitive residential locations in the vicinity of the site for all modelling years. As such, potential odour emissions from the facility are not considered to be significant.

The measures to be implemented across the site to manage odour to prevent negative impacts beyond the site boundary are outlined in Appendix 24 Odour Management Plan which has been produced in accordance with the Environment Agency's H4 Odour Management Horizontal Guidance, and document 'drafting an odour management for AD facilities – an informal guide'.

A summary of the odour abatement system to be installed is presented in the Odour Impact Modelling Assessment Report submitted with this application.

The air extraction system will achieve negative pressure within the reception hall and achieve 4 air changes per hour in the main reception hall area. Although there is no air lock system for vehicles delivering wastes to the reception shed, this number of air changes, combined with the use of fast shutting doors and compartmentalised areas for different delivery types, is considered sufficient to achieve an effective and robust containment and abatement system for odours generated in the shed.

Emissions monitoring of the odour abatement emissions will be carried out according to the requirements in the permit which are anticipated to be on a six-monthly basis and will be in accordance with the benchmark emission limit values specified in BAT 34 (table 6.7) for biowaste treatment operations.

7.2 Water

There will be one, point source emission of water to surface water from the site. This will be for the controlled discharge of surface water from the bund, where not re-used within the process, and from the roadways and downpipes at the site.

Surface water accumulating in the bund will drain into a collection sump pump chamber. A manual sample can be taken from the pump chamber and tested for water quality parameters in the onsite lab facility prior to release. The schedule of testing to be undertaken, and benchmark thresholds to be achieved to allow release are given below:

Table 2: Testing and Benchmarking for Release Levels

Parameter	Testing Frequency	Benchmark Levels for Release
pH	As required on a batch basis	6-9
COD	As required on a batch basis	<180mg/l
Ammonia	As required on a batch basis	<0.1mg/l
Suspended Solids	As required on a batch basis	<60mg/l
Total Phosphorus	As required on a batch basis	<2mg/l

If permitted benchmark thresholds are reached, the pump will be manually operated to pump the water to the site surface water drainage system which in turn will discharge to a lined attenuation pond outside of the permitted area. Surface water collecting in this pond from the Arrow site and from other units at the site will discharge into the adjacent brook when a high-level outlet point is reached.

Surface water arising from the building roof and other external concrete road and yard areas will drain to the same discharge point from site to the attenuation pond. All site drainage

from yard areas and roadways and from the bund sump will be passed through an oil interceptor prior to release.

Domestic sewage will be discharged to foul sewer having first past through a settlement chamber.

The bund sump will have a high-level alarm that will be linked to the SCADA control system and will alert the operator that the chamber needs to be emptied. In the event of high rainfall, water can be pumped into the fermenters to prevent flooding within the bund if required.

The site drainage plan included with this application, outlines the drainage system for management of surface water and domestic sewage on the site.

Two shut off valves will be installed on the drainage system one downstream of the bund sump discharge point and oil interceptor just prior to the final surface water discharge point from the site, and a second downstream of the yard and reception area but upstream of the oil interceptor and bund sump discharge point.

The Surface Water Discharge Procedure for release of surface water from the bund is included as Appendix 25.

7.3 Fugitive Emissions

There are potential sources for fugitive emissions from the site. These have been considered in the design specification for the plant, and infrastructure and operation designed to minimise these impacts where possible.

In addition to this, the operator has a Fugitive Emissions Plan for the site, incorporating a 'source pathway-receptor' assessment of the potential for releases from the site, and outlining the infrastructure, maintenance and monitoring measures to be implemented to control these potential releases during site operations. This document has considered all the potential sources listed on page 112 of the How to Comply document for Anaerobic Digestion. This document is included with this application as Appendix 26.

The fugitive emissions plan includes reference to a leak detection and repair (LDAR) programme that outlines the operators schedule of checks for gas leaks arising at the site. A draft copy of the LDAR programme framework is included with this document as Appendix 5.

The operator has outlined the measures that are in place to control and monitor odours from the site (during normal operations, and during emergency events) within acceptable limits in Appendix 24.

The operator has outlined the measures that are in place to control accidental releases and spillages in the Accident Management Plan, Appendix 27.

There will be an emergency generator installed on site for power supply during power outage, and there will be a battery backup supply for the main panel for key control systems for 30 mins.

The operator has undertaken an earthing survey to assess site requirements with regard to lightning protection, and earthing will be installed to all tanks, bases and equipment identified to require this.

A data sheet for the emergency generator is included with this document as Appendix 28.

A firewater tank will be installed at the site with a capacity of 200m3 to ensure that adequate supplies of water are available at the site at all times should this be needed for fire suppression purposes.

The operator will prepared a fire prevention plan (FPP) together with a Fire Risk Assessment which shall be prepared by a competent person. Although combustible materials will be stored on site, the risk posed by these has been assessed and preventative actions identified and scheduled via a number of alternative means.

The site has been designed according to a Hazard and Operability Study (HAZOP), and subject to a full Dangerous Substances and Explosive Atmospheres (DSEAR) assessment. A Fire Risk Assessment has been undertaken and will be reviewed on a regular scheduled basis. A firewater tank is available at the site and measures for managing risk arising from management of gas at the site are outlined in the fugitive emissions plan and accident management plan for the site. The site Management System will include an accident management plan that takes into account the potential for fires at the site and includes preventative aspects to manage ongoing health and safety aspects such as permits to work system including hot works permits, use of personal and fixed onsite gas monitors, SCADA control system with a schedule of automatic shut off alarms, and a staff training schedule tailored to operations.

The NRW guidance ‘Fire Prevention Plans: Environmental Permits states in section 3 that the guidance does not apply to biowaste treatment wet anaerobic digestion facilities. The operator considers that the objectives listed in section 1 of the NRW guidance have been met through the establishment and implementation of the measures described here and as such a fire prevention plan is not considered to be needed in addition to these aspects.

Risk of nuisance from noise arising from the site has been assessed in the Environment Statement (Appendix 29). The assessment has concluded that with reference to the guidance noise limits set within BS8233:2014 that it is demonstrated that the noise from the proposed plant would not result in adverse impact on residential amenity.

This is an extremely low level (based on the low background sound levels at the site). With selection of best technology options throughout the site to reduce noise levels as far as possible at source, the noise impact modelling assessment demonstrates that the operator can achieve a noise level of 38dBLAr,Tr at the nearest sensitive receptor with no predicted impacts on amenity. On this basis, the operator has applied for an amendment to Planning Condition 4, to set the rating level for noise from the site at 38dBLAr,Tr.

The main treatment/processing and storage infrastructure at the site are contained within an impermeable bund. The bund has been sized in order to accommodate a volume of at least 110% of the largest vessel or 25% of the total tankage volume.

The bund has been designed and will be constructed in accordance with the standard specified by CIRIA C736 - Containment Systems for the Prevention of Pollution by suitably qualified persons. Following approval of the design by the Process Provider (BioConstruct), the project civil engineering contractors have been instructed to construct the containment bund in accordance with the designs specified by a qualified engineer. The construction of the bund shall be monitored throughout the build to verify that works have been carried out according to the design.

The containment capacity is designed in accordance with Ciria C736 and it was calculated that 110% of the largest tank volume was a greater volume than 25% of the combined volume (see Appendix 15). The proposed footprint of the containment area allowed for the walls to be constructed to a minimum height of 2.5 m, which includes 250mm Freeboard capacity, (in accordance with Ciria C736). The containment bund occupies an area of 9408m3.

The facility containment bund has been designed to be impermeable. It is formed of a series of retaining walls and impermeable concrete base (slab) that enclose the key operations at the facility and provide containment for the above ground tanks containing liquids.

The bund has been designed and constructed in accordance with document CIRIA C736 - Containment Systems for the Prevention of Pollution.

All storage tanks have their concrete bases constructed on top of the concrete containment base to maintain secondary containment.

The walls have been designed in accordance with Ciria C736 and are designed to withstand the hydraulic load from a catastrophic failure.

To provide an additional containment system below the entire containment bund system an additional Bentomat liner is installed below the jointed concrete layer, and below this a Radar Gas Barrier which is intended to provide an additional safety measure for management of ground gases identified in the site survey assessment carried out prior to construction.

The impermeable surface of the bund will be subject to regular visual inspection to check ongoing integrity. This is further detailed in the fugitive emissions plan document.

All pipes, ducts and cables are fixed on cable trays and stanchions positioned above the concrete containment, to avoid penetration of the containment floor or walls. This has been designed in accordance with CIRIA C736 to ensure any potential leakages are visible to onsite operational staff whilst carrying out daily inspections of the containment bund structure.

The bund is designed to allow access to the bund by vehicles for maintenance. The bund includes a gate that provides this access to the northwest of the bund.

There are 2 floodgates on the south side of the bund to allow for access of larger vehicles for ferric chloride deliveries and specialist or large maintenance equipment. The topography and physical constraints on site mean that this method of access is necessary.

The gates are designed to work as flood gates so that the integrity of the bund is retained. The gate will only be opened to allow access at intermittent times and will never be left open. The design and specification of the floodgate are included in Appendix 30.

The floodgate is capable of withstanding static water loads greater than the bund walls and so integrity of the containment system can be maintained. The gate provides a watertight seal at all joints. The vertical joint between the two openings is sealed with a vertical jamb compression seal. The gate is designed so that the pressure of the fluid being contained increases the sealing pressure. The horizontal seal is provided via a base compression seal.

The floodgate will be opened only for very short periods of time to allow access for ferric chloride delivery vehicles on a weekly basis or to allow access for vehicles to perform maintenance activities. The floodgates will never be left open as part of this operation. While the gate is open a member of staff will always supervise the gates to allow them to be closed immediately. Ferric chloride delivery will only take place once the flood gates are closed to ensure containment of any spillages during delivery. It is considered significantly lower risk to receive these deliveries within the main containment bund.

The operator has also provided a floodgate operations procedure which is included as Appendix 30.

There is a contractual requirement for the gates to be supplied with a 20-year lifetime.

Any damage repairs to hinges via welding would be undertaken with the gate in situ. This type of damage will be avoided with the use of anti-collision barriers and the use of a banksman.

The containment system is designed to meet the requirements of BAT as set out below in the BAT assessment Statement.

All plant and equipment will be subject to testing and sign off as part of the plant commissioning plan overseen by a suitably qualified commissioning engineer.

BAT Assessment Statement:

The infrastructure and processes and procedures that will be implemented to control fugitive emissions will be compliant with BAT as outlined in the NRW Document ‘How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in ‘Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018’ for the following BAT references are met: BAT 7, BAT 8, BAT 10, BAT 12, BAT 13a and b, BAT 14, BAT 15, BAT 16, BAT 17, BAT 19, BAT21b, BAT 35.

8 MANAGEMENT

8.1 Facility Management

Arrow Bio Waste Recycling Facility will be operated by BioConstruct NewEnergy Ltd. The operator will maintain a formal controlled environmental management system that will be designed to ensure the following:

- that environmental risk and impacts are managed proactively
- that all legislative requirements are complied with; and
- that procedures are in place to enable timely and effective response to environmental incidents should they occur.

The operator has taken note of the NRW AD site assessment spreadsheet tool when developing the management system for the site to ensure compliance with the parameters included.

The operator will ensure that either the site is subject the operators' portfolio wide Competence Management System (CMS) in provision of suitable technical competence for the site, or that the site is attended for the required number of hours by a holder of a suitable WAMITAB award (MROC5). Should technical competence be provided by WAMITAB attendance, cover arrangements will also be established to ensure that the necessary attendance takes place even during staff holiday and sick periods.

The site staff team will include a full-time site manager, 2-4 full time site operatives, a technical engineer, and a team leader. The site team will also be supported by the BioConstruct on call service team as needed, or service staff for specific items of infrastructure according to contractual agreement (e.g., Uniflare for flare maintenance) and will have access to support from the Operations Manager, Senior Directors, and in-house Biologist. BioConstruct NewEnergy Limited also operates several other plants in the area and will have the facility to move staff between sites for cover arrangements if required/appropriate.

The staff team will be given support from an in-house Biologist who is qualified to degree level and will be able to oversee sampling and process monitoring activities on the site. All samples sent to third party facilities for analysis will be sent to a suitably registered or accredited lab. In addition to this, a member of onsite staff will have training to NVQ level 3 for laboratory technician skills.

The operator wishes to apply for PAS110:2014 certified status and therefore intends to implement the quality management system required for this certification.

The operator has conducted an air quality impact assessment, noise impact assessment and odour impact assessment based on the site operations. The operator has also conducted a qualitative risk assessment based on the 'source, pathway, receptor' model. These assessments have been provided with this application. Based on the outcome of these assessments, the operator has developed a number of management plans that detail measures for managing identified risks. These include an Odour Treatment of the Reception

Hall, Fugitive Emissions Plan, and Accident Prevention Management Plan. These plans outline the measures that will be taken to mitigate against potential impacts and include monitoring and maintenance procedures and specific staff training requirements. These documents have been provided with this document in the Appendices.

A Pest Management Plan for the site is included with this document as Appendix 31.

The environmental management system also includes procedures for reporting, documenting and investigating incidents, near misses, complaints, and non-compliances.

The management system includes procedures for regular maintenance checks/activities on plant machinery and infrastructure to control identified high risk activities, and external and internal audit systems. The site will also carry a supply of critical spares to enable timely response to breakdown and the need for repair. This is included in this application as Appendix 32.

All staff employed at the site will have defined job descriptions, that will define the skills and competencies required to carry out the required role. These clearly defined roles will be the basis for a staff training needs assessment, which will form the basis of the staff training plan for the site.

All staff will receive training that will enable them to understand the regulatory context in which the plant is operating, and the impact that their own particular role may have on compliance with the permit. All staff will be trained to develop an awareness of the potential environmental impacts of the operations on site, and in the reporting procedures for incident and near misses.

All staff will receive training in the implementation of the site's Accident Management Plan.

The training needs/information sharing requirement of contractors visiting the site will be considered within the training needs analysis for the site, and systems set up accordingly to ensure that contractors are equipped with sufficient training and knowledge to undertake their activities on site in a manner that is in line with the operator's systems for management of environmental risk at the site.

The operator has collated a raw materials inventory detailing tonnage of raw materials used on an annual basis. The nature and volumes of materials used on site will be reviewed on an ongoing basis and where possible efficiencies will be made, or changes will be made in the selection of materials used to ensure that low impact options are used wherever possible. This will be included in the management system and is provided to support this permit application reference List of Raw Materials (Appendix 33).

Similarly monitoring and review of wastes produced, water usage, and energy usage will be carried out in order to identify areas where efficiencies can be made.

The operator has prepared an inventory of waste water and waste gas streams produced at the site to allow suitable assessment and management of these on an ongoing basis.

The operator intends to recover all digestate arising from the AD plant in use as a fertilizer on arable land at farms in the surrounding area.

The operator has undertaken site survey work and has submitted a Site Condition Report (Appendix 34) that documents the characteristics of the site prior to development, as a baseline from which to measure the impact of operations over time. Changes/relevant events/incidents impacting on the characteristics of the site will be recorded in this report on an ongoing basis throughout the life of the plant. It will be possible to use this report as the basis of any detailed plan, or requirement for specific measures that may be needed to return the site to a fit state at the point of decommissioning.

The operator has prepared a site Closure and Programme outlining the measures that will be carried out in the event of site closure to ensure that the site is left in a state that addresses any subsequent risk to the environment arising from this process. The site will develop a Closure and Decommissioning Plan prior to operation.

The operator has undertaken a Dangerous Substances and Explosive Atmospheres (DSEAR) assessment of the site in order to inform suitable infrastructure and management of operational activities at the site. A Hazard and Operability Study (HAZOP) has also been undertaken to inform the design and commissioning process at the site.

BAT Assessment Statement:

The management system that will be established to ensure that all measures required to manage risk on site are implemented effectively will be compliant with BAT as outlined in the NRW Document 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013

The required measures outlined in 'Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018' for the following BAT references are met: BAT 1, BAT3, BAT 12, BAT 17, BAT 18, BAT 21, and BAT 22.

9 Monitoring

The operator has outlined the sampling and monitoring regime for the process in the Biogas Process Monitoring Plan included with this document as Appendix 8. This document summarises the measures in place to ensure robust process monitoring for the digestion process.

In addition to this, the management system outlines the schedule of monitoring relating to the following areas:

- Annual monitoring of CHP engine and natural gas boiler exhaust emissions (by MCERTS Certified Consultancy);
- 6 monlthy performance monitoring for odour abatement equipment according to the standard specified in the site permit;
- Monitoring/recording of Flare use (on SCADA system);
- Monitoring of critical control points in the HACCP;
- Sample analysis monitoring for PAS110 compliance;
- Ongoing monitoring of feedstock quality/compliance with agreements/incoming feedstocks procedure;
- Monitoring/recording of use of pressure vents on digesters;
- Monitoring of energy and raw material usage;
- Pollution Emissions Inventory Reporting;
- Annual performance monitoring and reporting to the Environment Agency;
- Quarterly waste returns reporting to NRW;
- Ongoing process monitoring as specified in the site EMS and permit;
- Ongoing monitoring of the effectiveness of odour abatement equipment installed on site Odour Management Plan;
- Daily odour impact monitoring at receptors (Odour Management Plan);
- Other on-site regular environmental monitoring identified by the environmental risk assessment, and specific management plans including the odour management plan, fugitive emissions plan, noise management plan, and accident management plan (these documents have been submitted with this permit application.
- Monitoring of maintenance issues/infrastructure such as bund surfacing, drainage channels, sumps and collection systems etc;
- Ongoing monitoring of ambient gases levels via visual checks, use of gas monitors and in accordance with 6 monthly LDAR;
- Ongoing monitoring and review of complaints and incidents occurring on site (Noise Complaint Form, Odour Complaint Form, Incidents and Complaints Summary and Preventative and Corrective Measures Tracking);
- Ongoing monitoring of the impact of operations on the site, via establishment of baselines in the site condition report, and collection of data regarding impact of site

operations for the life of the site (Site Condition Report submitted with this application); and

- All other monitoring outlined in the various site management plans; odour management plan, fugitive emissions plan, noise management plan, and accident management plan (these documents have been submitted with this permit application; and
- Monitoring of surface water quality parameters prior to discharge to from site.

BAT Assessment Statement:

The infrastructure and processes and procedures that will be implemented to monitor operations for a range of different purposes will be compliant with BAT as outlined in the NRW Document 'How to Comply with your environmental permit. Additional guidance for Anaerobic Digestion version 1.0 November 2013.

The required measures outlined in 'Best Available Techniques (BAT) Reference Document for Waste Treatment, Industrial Emissions Directive 2010/75.EU (Integrated Pollution Prevention and Control) Pinasseau et. al. 2018' for the following BAT references are met: BAT 3, BAT 8, BAT 10, BAT 11.

10 Impact Assessment

The operator has carried out an assessment of the potential receptors to the site, and a qualitative 'source – pathway – receptor' risk assessment of the potential impacts at these receptors

- The operator has commissioned an air quality impact assessment based on predicted impacts from the burning of biomethane in the CHP engines and biogas and biomethane in the flare, and natural gas in the boiler. This report concludes that predicted concentrations of all pollutants were below the relevant EQSs at all locations of human exposure for all meteorological data sets modelled. Resultant impacts were classified as not significant. Impacts were also predicted at relevant ecological sites. The results indicate that emissions from the plant are not predicted to significantly affect existing conditions at any designation. This report is included with the Arrow Renewable Energy permit application as Appendix 35.
- The operator has commissioned a noise impact assessment, and this is provided with the Arrow Renewable Energy permit application appendix 8. The noise impact assessment has considered the effect on residential amenity both within properties at night, and externally during the daytime period. With reference to WHO research and the guideline noise limits set within BS8233:2014, it is demonstrated that the noise from the proposed plant would not have an adverse impact on residential amenity.
- The operator has commissioned an odour impact assessment. This report has been included with the Arrow Renewable Energy permit application as appendix 31. This report concluded that predicted odour concentrations were below the relevant benchmark level at all sensitive residential locations in the vicinity of the site for all modelling years. As such, potential odour emissions from the facility are not considered to be significant.

BAT Assessment Statement:

All impact assessment modelling conducted has demonstrated that potential impacts can be managed within acceptable levels within the current proposals.