



BAT Assessment

Fernbrook Bio Limited



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SITE DETAILS

Fernbrook Bio Limited

Rothwell Lodge AD Facility

Rothwell Lodge Farm

Rothwell Road

Kettering

Northamptonshire

NN16 8XF

OPERATOR DETAILS

Fernbrook Bio Limited

Rothwell Road

Kettering

Northamptonshire

NN16 8XF

PERMIT REFERENCE

EPR/EP3894SC

DOCUMENT REFERENCE

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Wiser Environment Ltd, Suite 11 Manor Mews, Bridge Street, St Ives, PE27 5UW
94 Xuan Thuy, Thao Dien Ward, District 2, Ho Chi Minh City, 713385
+44 1480 462 232 | www.wiserenvironment.co.uk | info@wisergroup.co.uk

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APPENDICES

APPENDIX	REFERENCE	TITLE
Appendix A	VHE 222-022	Schematic Process Overview
Appendix B	No. 0950-7972-0366-5210-9060; 9756-4015-0766-0900-2291	Energy Performance Certificate. Recommendation Report

1. INTRODUCTION

This Best Available Techniques (BAT) Assessment has been produced on behalf of Fernbrook Bio Limited to support the application for a Substantial Variation to the existing Bespoke Environmental Permit (EPR/EP3894SC) at Rothwell Lodge Anaerobic Digestion (AD) Facility, Rothwell Road, Kettering, Northamptonshire, NN16 8XF. The site is located at NGR SP 82389 80138.

The facility is listed in Schedule 1 of the Environmental Permitting (England and Wales) Regulations 2016 (as amended) and operates as an Installation (*S5.4 A(1) (b) (i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 100 tonnes per day*) and also in accordance with The Animal By-Products (Enforcement) (England) Regulations 2013 and PAS110:2014.

The AD facility provides anaerobic digestion of organic wastes from a variety of agricultural, commercial and industrial sources. The process involves the breakdown of organic material by bacteria in the absence of oxygen; this provides both a volume and mass reduction of the input materials whilst liberating 'biogas' (methane & carbon dioxide) which is used as a fuel to produce heat energy for use in the process and generates power which is sent to the National Grid.

The resultant nutrient rich whole digestate is produced to be compliant with PAS 110:2014 and the Quality Protocol for Anaerobic Digestate (ADQP) and used as a replacement for artificial fertilisers.

This BAT Assessment should be read in conjunction with the other supporting Management System documents, specifically the site's Management Plan (K114.1~09~006).

A schematic overview of the anaerobic digestion process is illustrated in Appendix A. The main process areas can be identified as:

- Waste reception & acceptance;
- Pre-digestion processing & storage;
- Feedstock storage;
- Digestion;
- Pasteurisation;
- Separation;
- Digestate storage;

- Product dispatch;
- Odour abatement;
- Biogas storage and combustion; and
- Biogas upgrading.

2. PRE-ACCEPTANCE PROCEDURES

Waste contracts are secured by using the services of food waste brokers to source suitable source-segregated biodegradable wastes in addition to those contracts which are sourced directly by Fernbrook Bio Ltd. Weekly communication with waste brokers allows for the scheduling of pre-booked deliveries.

Prior to delivery, all contracts are secured following the same waste acceptance criteria consisting of pre-acceptance documentation including: *Input Materials Procedure (SC01)*, *Input Material Supply Agreement (SC01/F01)* and *Input Material Waste Categories (SC01/F02)*.

Upon arrival, wastes are accepted in accordance with *SOP001 – Waste Reception and Acceptance*. Liquid wastes are subjected to further assessment prior to acceptance in accordance with *Protocol for Accepting Liquid Waste* and *SOP020 – pH Determination of Liquid Loads* to ensure wastes are suitable for the AD process.

Operational staff are trained in the site's waste acceptance procedures, to ensure that all acceptance criteria are met and maintained.

Where waste is found to not comply with the waste acceptance criteria they shall be rejected, and either:

- a) Removed from the site; or
- b) Moved to the designated quarantine area pending removal.

Records of all waste transfers/rejection, feedstock analysis results and pH readings from liquid wastes, will be maintained onsite.

3. RECEPTION, HANDLING AND STORAGE OF WASTE

3.1. Reception

Only those wastes permitted by the site's Environmental Permit (Condition 2.3.4 and Schedule 2, Table S2.2) shall be accepted at the site. All material delivered to the site shall arrive in suitably covered vehicles.

3.2. Handling and Storage

The handling and storage of waste is outlined below and is carried out in accordance with *SOP002 – Waste Storage*.

Palletised waste is stored in a designated area within the reception building and manually depackaged prior to being discharged into the reception pit.

Bulk deliveries of loose waste are tipped directly into the reception pits.

Liquid is discharged into the depackaging unit from the liquid tank in a controlled manner to ensure feedstock material is of the desired consistency to avoid blockage prior to being macerated and distributed to one or both of the buffer tanks.

Digestate produced to the AD Quality Protocol (ADQP) and PAS110 is no longer considered to be waste and storage capacity for this material is excluded from the figure below. However, allowance has been made for the storage of digestate that does not comply with the Biofertiliser Certification Scheme. Figures in Table 1 below are approximations only.

Table 1. Storage Capacity

LOCATION	DESIGN CAPACITY	DESCRIPTION
Reception	300 m ³	Palletised waste storage; packaged and loose reception pit.
Buffer Tank	2,200 m ³	Capacity of 4 tanks
Liquid (FOG) Storage	100 m ³	Capacity of 1 tank
Potable Water	100 m ³	Capacity of 1 tank
Digestion	15,400 m ³	Capacity of 4 digesters
Whole Digestate (Biofertiliser)	5,000 m ³	Capacity of 1 tank
<i>Solid Digestate</i>	<i>N/A</i>	<i>At time of writing solid digestate (fibre) is not being produced on site.</i>

3.3. Drainage

All waste reception, storage and pre-processing activities are undertaken within the reception building over an impermeable surface with sealed drainage which drains into the waste reception pits. The pre-storage of material awaiting digestion, the digestion process and storage of whole digestate occurs within a containment area underlain by a geosynthetic clay liner incorporating a manually operated isolation valve to prevent the discharge of contaminated runoff from site.

Site drainage is illustrated on drawing E02 Rev E Drainage Design.

4. DESCRIPTION OF THE TREATMENT PROCESSES

4.1. Pre-Digestion Processing

Feedstock preparation prior to interim storage is carried out in accordance with *SOP003 – Pre-Digestion Processing*.

Packaged waste from the reception pit(s) is loaded into the hopper of the depackaging unit(s) using a crane with a clam-shell bucket.

Depackaged waste is blended with liquid waste returned from the fats, oils and greases (FOG) tank (BV300) to achieve a homogenous 'soup' consisting of approx. 15% dry matter, whilst ensuring that the particle size has been reduced to <12 mm in any one plane to comply with the Animal By-Products (ABP) Regulations 2013 (as amended).

A dedicated processing line for non-waste crop residues (e.g. maize) will be installed externally co-located with a separate concrete storage bay. Deliveries would be on an on-demand basis meaning no prolonged or significant storage will be needed.

4.2. Feedstock Storage

In order to ensure that the digestion process has a constant supply of feedstock 'soup' available, this homogenised material is stored in Buffer tanks in accordance with *SOP004 – Feedstock Storage*.

The buffer tanks are hydraulically stirred, but sedimentation of grit is encouraged. The tanks are degritted every 12 months to prevent excessive grit being transferred to the digester(s). The tanks are not heated. Daily samples are taken to enable the calculation of the Organic Loading Rate (OLR).

4.3. Anaerobic Digestion

The digestion process is mesophilic with digester temperature maintained at approx. 40°C. Retention times will vary according to the levels in the tanks and the volumetric feed rate but is around 45 days under normal operating conditions.

Feed rates are determined twice daily in accordance with *SOP005 – Feeding the Plant*, *SOP006 – Digester Monitoring* and *SOP016 – Preventing Foam*. Each Digester is fed 12 times per day every other hour and hydraulically mixed. Adjustments to the feed rate are made using the Supervisory Control and Data Acquisition (SCADA) system.

Key operational parameters are monitored within the Digesters to highlight potential process instability and maintain good biological health in accordance with *SOP006 – Digester Monitoring* and *SOP019 – Preventing Crust Formation*.

4.4. Pasteurisation

The Animal By-Products (Enforcement) (England) Regulations 2013 requires that if food waste is treated in an AD plant, then the process must be operated to strict standards. The maximum particle size of the waste must be 12 mm (one of the reasons for the shredding operations in the reception hall) and the material must be held at a minimum temperature of 70°C for a minimum period of one hour in a pasteurisation step either before or after the digester (post-digestion in this AD plant) to denature potentially harmful pathogens such as salmonella, *E.coli* and *faecal streptococci* in accordance with *SOP007 – Pasteurisation*.

Batches of up to 20 tonnes of digested material are pumped to the pasteurisation system. The frequency and volume of these batches will be dependent upon the daily operations, specifically the current feed rate, levels in the digesters and the available capacity in the digestate storage tank.

The control of the Critical Limits (temperature and residence time) are set, monitored and recorded by the SCADA system (see *SOP010 – Process Control*). Digestate in the pasteuriser cannot be discharged to the storage tank until the Critical Limits have been achieved and manual verification of the dataset. To ensure that the temperature is achieved the Critical Limit for temperature is set to 71°C to achieve an additional level of assurance.

Temperature probes are to be checked monthly and calibrated annually with calibrated replacement probes held as critical spares in accordance with *SOP011 – Process Inspection & Maintenance*.

4.5. Digestate Separation

Whole digestate is pumped from the storage tank via enclosed pipework, to a separator located on an elevated platform within the reception building. The separator is operated manually, during daylight hours only, and has a maximum flow rate of 40 m³/h. The operator enters the required volume into the interface screen and a measured volume is processed. This operation is undertaken in accordance with *SOP031 – Borger Operation*.

Following the expansion of the reception building, the separator will be relocated outside to a separate building.

4.6. Power Generation and Biogas Upgrading

Biogas produced by digestion, will be used to generate heat and power, or be upgraded and exported directly as biomethane into the gas grid.

A desulphurisation unit is located on the gas line between the digesters and the Combined Heat and Power (CHP) units. This removes sulphur from the biogas, which increases the operational life of the engines.

A Biogas Upgrading Unit (BUU) will be also installed, comprising of the following components:

- Four gas scrubbing columns;
- Gas clean-up container;
- Compressor unit;
- Distribution kiosk;
- Six propane gas tanks; and
- Grid entry unit.

The idea is to convert the flared gas into the biogas upgrading system to produce biomethane fuel. The flaring is estimated to only to occur during normal maintenance shutdown and breakdown of the Anaerobic Digestion plant and the CHP plant.

The configuration of the BUU in connection to the rest of the process is represented in Figure 1.

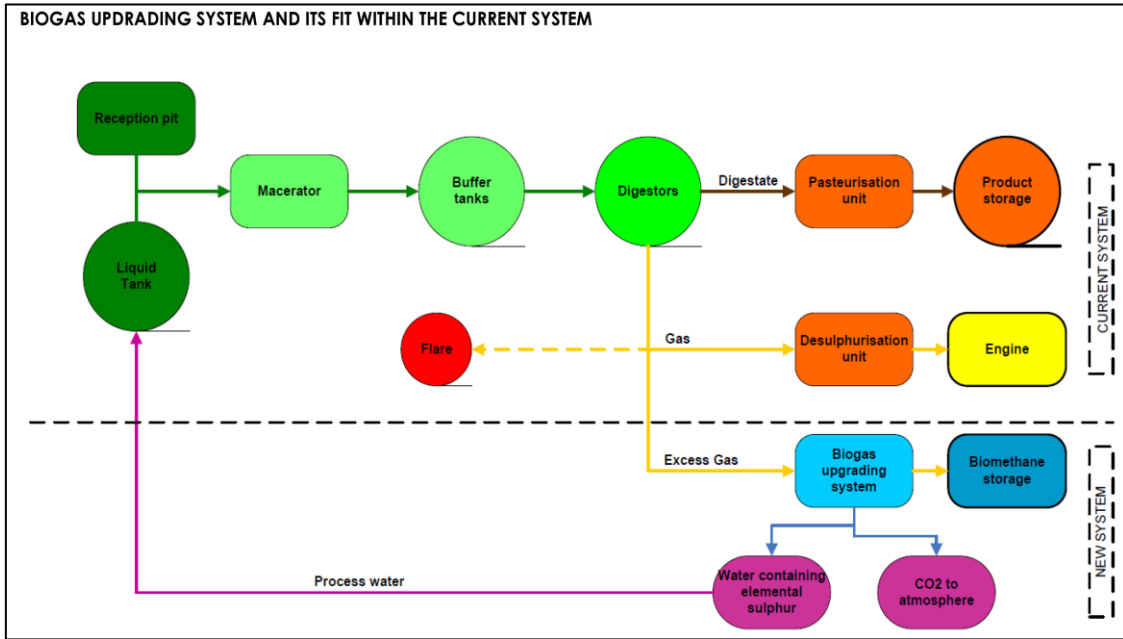


Figure 1 Biogas Upgrading Unit

The unit is fitted with a gas cleaning system that works through scrubbing. The scrubbing system produces process water (where water soluble gases such as CO₂, H₂S and siloxanes) are absorbed.

A high volume of fresh air (i.e. 4,000-5,000 Nm³/h) is blown into the degasser tower at its bottom to have a counter flow with the falling /dripping water from the top, through the high surface area packing bed (pall rings). The oxygen in the air helps to neutralise the acidity of the untreated water and satisfy the Biological Oxygen Demand (BOD), and Chemical Oxygen demand (COD) to produce fresh water which is stored at the bottom the Degasser tower.

The freshened water is collected in the degasser water tank which is then pumped again by the scrubbing water pump into the Scrubbing cylinders to upgrade further raw biogas. This process continues as a closed loop circuit.

The water is recycled through the AD process in the liquid tank to help the liquid feedstock achieve the desired consistency.

The engines are housed within the process building with walls constructed to achieve specific sound reduction ratings. The biogas powers the engines producing electricity that can be fed in to the National Grid providing a source of renewable energy.

Heat produced during power production is transferred via a heat exchanger and is used to heat the digesters, and to pasteurise the digestate.

Acoustic panel work screen and shrouds along with the manufacturer's specialist casing around the blower are included in the installation of the new BUU.

A noise assessment has been undertaken to evaluate the potential noise impact of the proposed BUU equipment at the closest existing residential receptors. The assessment has been carried out in accordance with national planning guidance and the requirements of the Kettering Council and BS4142:2014,

The assessment predicted that the noise levels will meet the requirements of the Local Authority during all periods of operation and at the closest noise sensitive receptors to cause no adverse impact.

4.7. Product Storage and Dispatch

The screened material is stored in the final storage tank until dispatched from site. High level probes prevent overfilling and limit the actual volume to 90% of the total capacity of the end storage tank (4,500 m³). The area is fully bunded and provides 110% capacity of the storage tank volume.

Whole digestate is stored prior to off-site use as a biofertiliser in accordance with *SOP008 – Storage of Digestate*.

As the digestate is produced in compliance with the ADQP and PAS 110, it will no longer be subject to waste management controls.

The dispatch of PAS110 certified biofertiliser is managed in accordance with the procedure for *Dispatch, Labelling, Marking and Use of Digestate (SC02)*.

All relevant information will be recorded on the *Product Supply Form (SC02/FO1)* and *Product Dispatch Note (SC02/F02)*. Records are maintained onsite.

5. EMISSIONS AND MONITORING

5.1. Emissions to Water

All waste reception, storage and pre-processing activities are undertaken within the reception building over on impermeable surface with sealed drainage which drains into the waste reception pits.

The pre-storage of material awaiting digestion, the digestion process and storage of whole digestate occurs within a containment area underlain by a geosynthetic clay liner incorporating a manually operated isolation valve to prevent the discharge of contaminated runoff from site. Site drainage is illustrated on drawing E02 Rev E Drainage Design.

Operational roadways and service yards are surfaced in reinforced concrete providing an impermeable surface. These are drained into gullies served by pipes outfalling, via catch pits, to a Class 1 bypass separator. The separator is designed, installed, and maintained in accordance with the requirements of PPG3 *Use and design of oil separators in surface water drainage systems (WITHDRAWN)*. The oil separator captures hydrocarbons falling on these areas. Clean water from the separator is discharged to a trench type soakaway to the south east of the site.

Discharge to this soakaway will only be of clean, uncontaminated water from the containment areas. The discharge of clean, uncontaminated water shall only occur under controlled conditions i.e. an appropriately competent member of staff will visually inspect any water held within the catchment pit from the containment areas, prior to opening the shut off valve for discharge and closing the shut off valve immediately once the clean, uncontaminated water is discharged (see *SOP024 - Surface Water Management in Containment Area*).

5.2. Emissions to Air

5.2.1. Odour

Any odour complaints received at the site will be recorded on the *Odour Complaint Form (K114.1~19~002)* and investigated by the TCM or Site Manager in accordance with the site's Odour Management Plan (K114.1~09~013) and *SOP012 Odour Control*. The findings of any investigation will be recorded on the *Odour Report Form (K114.1~19~001)* with all corrective/preventative actions logged in the Site Diary.

Best Available Techniques have been employed to capture, contain and minimise the potential for odour generation from the AD process, specifically; the reception building, pasteuriser

system, buffer tanks, digestate storage and dispatch apparatus). Odour abatement systems have been designed to comply with BAT; comprising of extraction allied to activated carbon filtration, with a minimum of 3 air changes per hour and to discharge treated air via a dedicated 12 m stack at no greater than 1,000 ou_E/m³. Further specific details of each of these odour abatement systems and how they are operated are provided in sections 4 & 5 of the Odour Management Plan.

5.2.2. Hydrogen Sulphide and Ammonia

Hydrogen sulphide and ammonia are minor constituents of biogas and can be found in the headspace of all tanks and vessels onsite. They are principally controlled by passing the extracted air through one or more carbon filters with appropriately sized vessels and ensuring a minimum of 3 air changes per hour. If the concentrations of hydrogen sulphide or ammonia exceed 5 ppm or 20 ppm respectively at the outlets, on two consecutive days, the carbon media is replaced in accordance with the procedure, *SOP012 Odour Control*.

5.2.3. Biogas Upgrading Unit

The biogas upgrading unit is not operational at the time of writing this document; however, this is expected to be incorporated in the process in the future and a description has been incorporated in the document.

The BUU is designed to capture the surplus gas generated from the additional waste inputs and digesters into biomethane. This biomethane will be injected into the gas grid to displace natural gas usage and help decarbonise the heating and transport sectors.

The BUU is equipped with the following gas treatment units:

- Desulphurisation: removal of sulphur dioxide (H₂S) through activated carbon media.
- VOC purification: volatile organic compounds (VOCs) are removed through activated carbon media.
- Dust filter: to remove any carbon particles from the desulphurisation media.

Oil removal system: oil remaining in the biogas after compression is reduced to ppm levels (<0.01 mg/Nm³) through a nonactivated carbon media.

In accordance with the requirements of BAT Conclusions and the Environmental Permit, the odour measurements will be repeated once every six months.

5.2.4. Other Combustion Gases

Combustion emissions (e.g. oxides of nitrogen, sulphur dioxide, carbon monoxide and volatile organic compounds (VOCs)) in the event that the biogas had to be diverted to the auxiliary flare. In that case, emissions are limited to those in Table S3.1 of the Environmental Permit. All plant and equipment is inspected and maintained by specialist contractors in accordance with the manufacturer's guidelines.

5.3. Monitoring and Records

Records of all monitoring required by Schedule 3, Tables S3.1, S3.2 & S3.3 and Schedule 4, Tables S4.2, S4.3 & S4.4 of the Environmental Permit must be retained for at least 6 years, unless they relate to off-site environmental effects, matters which affect the condition of the land and groundwater when they shall be retained until permit surrender.

6. NUISANCE MANAGEMENT

6.1. Noise

Noise management practices are detailed within the *Environmental Risk Assessment* (K114.1~11~001) and section 12.4 of the site's *Management Plan* (K114.1~09~006).

In summary the following measures ensure effective noise control:

- Deliveries & collections are limited to normal daytime hours associated with industrial use;
- Reception of waste activities conducted indoors;
- Reception area fully enclosed with rapid closing doors;
- Machinery will be operated in accordance with manufacturer's instructions and subject to regular maintenance;
- Limits on operational hours;
- Operation of external vehicles & equipment is limited to normal daytime hours associated with industrial use;
- Process machinery contained within process building;
- Plant operated in accordance with manufacturer's instructions and subject to regular maintenance;
- Building designed to provide acoustic attenuation;
- Equipment with greater potential noise source located within built enclosures sited away from sensitive receptor;
- Machinery and equipment will be fitted with noise reduction devices as appropriate;
- White noise reversing alarms used where necessary;
- Enforced site speed limit; and
- Landscaping of site incorporates bunds which aid noise attenuation.

6.2. Pests, Scavenging Birds & Other Vermin

The nature of the material accepted at the site has the potential to attract birds, vermin and insects.

Management practices are detailed within the *Environmental Risk Assessment* (K114.1~11~001) and section 12.5 of the site's *Management Plan* (K114.1~09~006).

In summary the following measures ensure effective control of birds, vermin and insects:

- Reception area fully enclosed with rapid closing doors;
- Efficient and prompt unloading of delivery vehicles;
- Frequent inspection of operational areas;
- Appropriate use of insecticides/bait stations, etc., as necessary;
- Contract with pest controller/contractor as necessary;
- Pre-storage & digestion undertaken in sealed tanks preventing access or suitable harbouring locations;
- Liquid digestate stored in sealed tanks; and
- All vehicles will be covered.

Delivery vehicles may contain waste that is attractive to pests; all vehicles will be covered, delivery and off-loading undertaken within the reception building.

6.3. Litter

Due to the nature of the materials to be stored, handled and treated on site, and the operation conducted thereon, litter and debris is unlikely to be generated by the permitted activities.

Litter and debris management practices are detailed within the *Environmental Risk Assessment* (K114.1~11~001) and section 12.1 of the site's *Management Plan* (K114.1~09~006).

In summary the following measures ensure effective litter and debris control:

- Wastes received unlikely to contain loose litter and other light fractions;
- All reception and sorting activities conducted indoors;
- Reception area fully enclosed with rapid closing doors;
- Incoming materials will be discharged directly to place of processing within the reception building;
- Controlled discharge of loads;
- Packaging removed by the Haarslev "Hammermill" (depackaging unit) and discharged directly into container for collection and removal offsite;
- Digestion process is fully enclosed;
- Liquid digestate held in tanks and discharged directly into tankers for use off site;
- Vehicles bringing materials to site will be covered; and
- Vehicles removing solid digestate from the site will be covered.

6.4. Complaints

All complaints are dealt with in accordance with the *Complaints* (CS01) procedure and recorded on the *Complaints Form* (CS01/F01) with all corrective/preventative actions logged in the *Site Diary*.

7. RAW MATERIAL USAGE

Any fuel (e.g. diesel and LPG) and machinery oils for use in site plant and equipment is stored appropriately and in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001. Only minimal quantities are stored onsite and any waste oils are either removed by the maintenance contractor or by the contracted waste management company.

Storage tanks are located over impermeable surfaces with sealed drainage. The bunded area has a volume in excess of 110% capacity of the largest tank, ensuring any spillage is completely contained.

8. ENERGY EFFICIENCY

8.1. General

The main facility processes with energy yields are mobile plant, mechanical equipment (including odour abatement systems), biogas upgrade unit and lighting. To maintain an efficient process, the site is inspected and maintained in accordance with manufacturer's recommendations and all relevant statutory legislation to ensure optimum operating conditions. Portable appliances and fixed wiring installations are inspected and tested as required and any defects rectified.

Energy efficiency is reviewed annually and where electrical items are in need of replacement, consideration is given to the procurement of low energy alternatives (e.g. replacing light bulbs with LEDs). External lighting is operated via photocell with a pre-set timer. Internal lighting is activated by photocell and passive infrared (PIR) sensors to ensure only occupied rooms are lit.

Site operatives have procedures to follow to ensure high maintenance standards and are trained in these areas of the operation.

An *Energy Performance Certificate* (No. 0950-7972-0366-5210-9060) was issued on 12th May 2016 and reports an Energy Performance Asset Rating of "B" (28.72 kgCO₂/m²) for the main building. A copy of the certificate is presented in Appendix B.

A limited number of improvements were suggested in the *Recommendation Report* (No. 9756-4015-0766-0900-2291 dated 12th May 2016) with one categorised as of **MEDIUM** potential impact with payback of less than 3 years;

"In some spaces, the solar gain limit in criterion 3 of Approved Document L2A is exceeded, which might cause overheating. Consider solar control measures such as the application of reflective coating or shading devices to windows."

9. STANDARDS

Fernbrook Bio Ltd operate the site in accordance with their Environmental Permit and their own Integrated Management System, and other associated documentation.

They also follow the appropriate legislation and other EA guidance notes:

- Best available techniques: environmental permits;
- Best Available Techniques (BAT) Reference Document for Waste Treatment (2018);
- Control and monitor emissions for your environmental permit: environmental permits;
- Environmental Permitting (England and Wales) Regulations 2016 (as amended);
- H4 Odour Management;
- Sector Guidance Note: S5.06 Guidance for the recovery and disposal of hazardous and non-hazardous waste;
- The Animal By-Products (Enforcement) (England) Regulations 2013;
- PAS 110:2014 Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials; and
- The Waste (England and Wales) Regulations 2011.



Helping clients prosper through compliance

Suite 11 Manor Mews, Bridge Street, St Ives, PE27 5UW
01480 462 232 | www.wiserenvironment.co.uk | info@wisergroup.co.uk

