

Plant Design Capacity & Pollution Control

Technical overview

1.0 General introduction

This technical overview has been produced in support of a permit variation application for the Westwood Anaerobic Digestion Facility. This variation is to incorporate the export of biomethane to the national grid alongside the current gas to engine operations for electricity generation and to increase the maximum waste throughput from the current 65,000 to 110,000 tonnes per annum. This document demonstrates how both the new and existing plant design capacity, site infrastructure, containment measures and the process controls in place are appropriate to accept, treat and process an additional 45,000 tonnes of feedstock per annum.

In summary, this proposal includes:

1. Increase the permitted waste annual throughput from 65,000 to 110,000 tonnes.
2. There will be no increase or changes to the current permitted area or expansion in the geographical footprint of the site.
3. The current 1140m³ Raw Waste Buffer Tank (RWBT) will be replaced with a new tank of the same capacity;
4. Total initial design Digester storage capacity of 12,620m³ will remain unchanged, comprised of 4,560m³ (2 x 2280m³ digesters) to continue to serve the CHP engines and 8,060m³ (2 x 2280m³ and 1 x 3500m³ digesters) for gas generation to the national grid.
5. Digesters 1, 3, and 4 will be rebuilt to the current dimensions. The current Digester 2 will remain in use for CHP generation.
6. Digester 5 was never built as part of the original installation except for the concrete base, although the design storage capacity of the tank was included in the original secondary containment design capacity. Digester 5 will be constructed but with a larger tank diameter than the original planned digester but at the same height as the other 4 digesters at 14 metres. A new digester 5 will have a diameter of 17 metres instead of 14 metres.
7. Pasteuriser tanks 1 & 2 will be rebuilt to the same diameter but with an increased height from 7 to 8 metres high which is significantly less than the height of the digesters and the RWBT, which will increase the storage capacity of each tank from 140m³ to 170m³. These will be equipped with a digestate chiller system.
8. The current redundant 140m³ Fats, Oils and Greases (FOG) tank will remain and will be recommissioned as a Water Tank to store captured rainwater from within the bund for treatment pending discharge to the onsite attenuation pond.
9. An additional gas holder will be installed to serve the Gas to Grid operations. The existing gas holder serving the CHP engines will remain.
10. An additional gas flare will be installed to serve the Gas to Grid operations. The existing gas flare serving the CHP engines will remain but will be relocated adjacent to the new Gas to Grid auxiliary flare.

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11. Installation of Gas to Grid infrastructure including, but not limited to, a Biogas Upgrade Plant (BUP), Gas Entry Unit (GEU) and propane storage.
12. The current 3 x CHP engines (1 x 0.8 MW, 2 x 1.63MW) will remain in operation. The existing emissions stack will remain unchanged.
13. A new replacement carbon filtration system will be installed to treat extracted channelled air from the waste reception and process building pending emission to air via a stack to aid dispersion. This will include new replacement ventilation and extraction ducting with point source extraction vents/hoods positioned close to all predominant sources of odour within the building.
14. The existing below ground sump in the waste reception building is no longer used for its original intended purpose to store treated feedstock and for digester return. As such, the odour concentration within the sump is significantly less and therefore the existing cockle biofilter treating the extracted channelled air from the sump has been isolated and decommissioned (as agreed with the Environment Agency) and can be removed from the permit as a specified abatement system.
15. A new sealed separator room will be purpose built to house the screw press separator for digestate screening together with a contaminates skip. Extracted air from the separator building will be channelled through to a new acid scrubber for treatment prior to emission to air via a stack to aid dispersion. This is a new abatement system and emission point to be listed in the permit. Digestate screening currently takes place in the open with no odour abatement.
16. Digestate Storage Tank 1 will be subject to a full de-grit, and recommissioning with improvements pending use for PAS110 compliant digestate storage.
17. Improvements to the existing clay lined secondary containment bund where required.

There are no other proposed changes to current operations, including no new waste types to be accepted as part of this permit variation. The site will continue to accept predominantly source segregated food waste from households, commercial and industrial sources intended for consumption.

The environmental benefits associated with anaerobic digestion have been widely recognised and further expansion of biomethane production at Westwoods pending export to National Grid will further enhance these green credentials. Independent research conducted on behalf of the government has identified anaerobic digestion as the preferred technology due to its impeccable green credentials.

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2.0 Technical introduction

This section provides a technical overview of the Westwood AD facility and the standards, operations and procedures employed to control emissions from the process.

The Westwood AD installation is located in a rural area approximately 3km from Rushden. The nearest residential receptor is located approximately 600 metres from the site boundary.

Figure 1.0 below shows an aerial image of the current Westwood AD Facility layout.

Figure 1.0.



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Figure 2.0 below illustrates a simplified schematic of the current AD plant process at Westwood.

Figure 2.0.

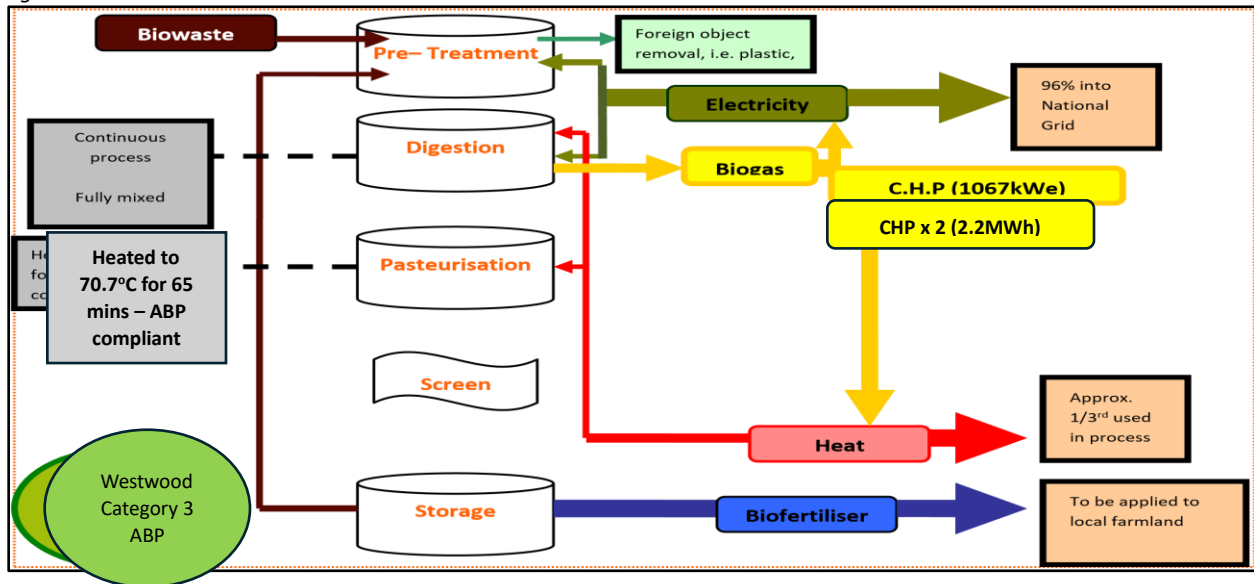
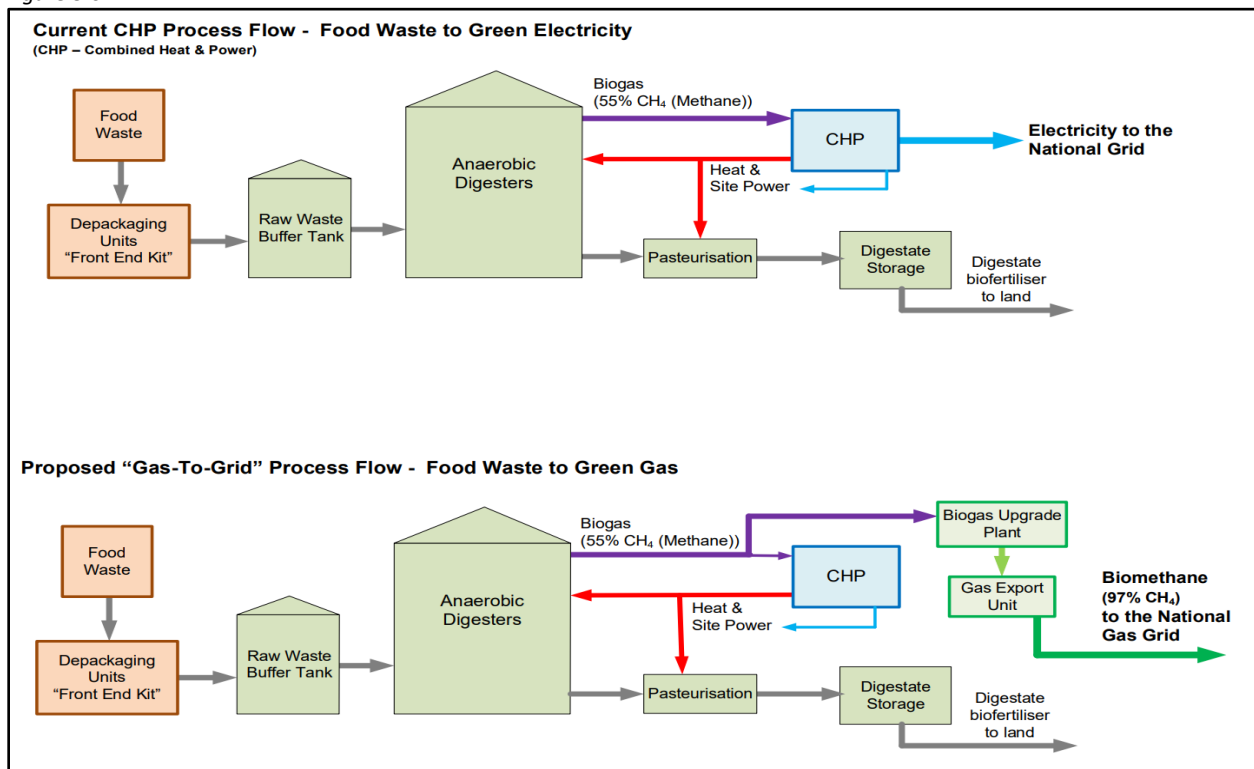


Figure 3.0 below shows a simplified schematic of the proposed operations as part of this variation application to continue CHP gas to electricity generation and the addition of gas to grid generation.

Figure 3.0.



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Segregation in the anaerobic digestion process at Westwood relates to the different stages of treatment where control measures are in place to ensure partially treated material cannot come into contact with fully treated material. This is controlled through engineering, including both software control and hardwired controls as part of a HAZOP process.

Following pre-treatment (see section 4.0 below) material is discharged into the process tanks via enclosed pipework. The new purpose built tanks receiving and storing feedstock will be built to have a minimum 30-year design life in accordance with BS ISO 15686 Part 1 and incorporate the relevant international standards. The tanks and pipework are pressure tested to ensure integrity. Pipework is fitted with pressure alarms and flow meters, and Pressure Relief Valves (PRVs) are installed to all process tanks and gas holders.

The process tanks will be gas tight vessels and therefore do not release to atmosphere. The RWBT, Digesters 1 and 2, and both Pasteurisers will be connected to the common gas line to serve the gas holder for the CHP engines. Digesters 3, 4 and 5 will be connected to the gas holder serving the gas to grid infrastructure. All of the transfer pipework will be sealed and therefore there is no potential for release. The integrity of the process tanks will continue to be inspected daily as part of the Daily Checks Procedure. All storage tanks will be subject to an independent recorded structural integrity assessment following a de-grit.

In addition, Biogen has purchased a Opgal Eyesite gas detection camera at considerable cost. Where a methane leak is detected, corrective actions will be put in place. By having their own gas detection camera, Biogen are in a position to not only fulfil the six monthly Leak Detection and Repair (LDAR) requirement, but to also address any potential concerns around methane slippage which can be investigated and resolved. Biogen has an appointed Technical Compliance Manager who oversees the LDAR schedule and monitoring schedule.

SCADA provides a continuous automated process monitoring system for tank levels, gas levels, gas pressure and tank temperatures for example which is remotely accessible to all relevant staff including Site Managers, Duty Managers, General Managers and the Senior Management Team. Any process monitoring parameters not monitored with the use of SCADA are recorded daily on a live Plant Monitoring Spreadsheet. Gas quality readings are also taken with the use of RSAE tubes and portable gas analysers.

Gas entering the Biogas Upgrade Plant (BUP) pending export to the national grid will be subject to further H₂S and VOC removal, compression, and condensate removal prior to the gas upgrading membranes. CO₂ removal is achieved through a series of membranes which are impermeable to CO₂ and allow CH₄ to pass through with a minimum CH₄ composition >97% to produce biomethane.

Secondary containment for all process tanks is provided by an impermeable ground bearing concrete slab with concrete upstand perimeter walls, and an unlined earth (clay) base and surrounding embankment walls. The bund was originally designed in 2009 which is prior to the publication of CIRIA c736. A flood gate is provided for vehicle access and egress to the secondary containment area.

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The volume of the secondary containment bund at Westwood exceeds that required by C736 guidance, and it is constructed using appropriate materials. Subject to relatively minor repair and remedial works, the bund is considered to be satisfactory for a low risk / class 1 site (see section 13.0 below). Unlined earth bunds are an allowable design for class 1 sites, with C736 specifying a minimum thickness of 1 metre of Clay with an impermeability lower than 1×10^{-09} m/s. The bund at Westwood exceeds these minimum criteria, with a greater thickness of material with significantly lower permeability. The available containment volume for the bund is modelled as 14,008m³ which exceeds the required volume of 10,875m³ (**document reference WWCA1**).

3.0 Feedstock pre-acceptance procedures

Biogen has an established Feedstock Pre-acceptance Procedure (**document reference WWFPAP1**) which demonstrates how Biogen meets the BAT requirements and those in sections 2.1.2. of Sector Guidance Note IPPC S5.06.

Pre-acceptance requires a three-stage sign-off by a representative from the Operations, Compliance and Laboratory/Research team. Samples are requested and analysed where appropriate on a risk basis.

This procedure is directly linked to the Feedstock Pre- Acceptance Form (**document reference WWFPAP1**) which is completed prior to any of the waste being accepted. The form, in addition to the above, also ensures the relevant information stated as part of the guidance is obtained including:

- Information and contact details for the current holder of the waste.
- Description of the waste.
- Description of the process giving rise to the waste.
- Whether it is considered a high-risk feedstock, an example could be a liquid feedstock high in fat/oils or yeast which require careful management to preserve biology, or one where it is deemed a risk because of the nature in the way waste is collected. This requires additional signoff at Director level.
- The EWC/LOW code assigned to the waste.
- The SIC code assigned to the producer of the waste.
- The physical form the waste is in, e.g., solid, liquid, sludge.
- Whether it contains Animal By-Products Regulations (ABPR) material, if yes, which category.
- Whether it contains packaging, if yes, what type of packaging and estimated percentage.
- The anticipated quantities of waste.
- Waste testing (this is primarily for liquid-based feedstocks). Biogen undertake an extensive sampling program and work with an external laboratory to cover the following determinands: Total Solids % w/w, Organic Dry Matter % w/w, Total Nitrogen % w/w, Ammonium Nitrogen (mg/kg), Total Phosphorus (P) (mg/kg), Total Potassium (K) (mg/kg), Total Magnesium (Mg), Total Copper (Cu), Total Zinc (Zn), Total Sulphur (S), Total Molybdenum (Mo), Total Lead (Pb), Total Cadmium (Cd), Total Mercury (Hg), Total Nickel (Ni), Total Chromium (Cr), Total Sodium (Na), pH, Chloride, Fluoride, Total Arsenic (As), Total Selenium (Se), Water Soluble Sodium, CLS Fat Test (g / 100g), Microbial inhibition at pH 6.0, Microbial inhibition at pH 7.2, Microbial inhibition at pH 7.4, Microbial inhibition at pH 8.0, Biological Methane Production (LCH4/kg VS), Electricity Production (kWh/ AD tonne), COD (g/L). Routine samples are taken prior to

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acceptance and then either on a 6-monthly or 12-monthly basis, this is decided on a risk basis (*example of results for a customer attached*). In instances where there is cause of concern over variance, the research team will increase the frequency of testing for determinants of concern. Biogen have an agreed Feedstock Agreement; it stipulates that the customer must notify Biogen if there is a deviation from the feedstock described in their Agreement. This is a legally binding document that had input from legal advisors. It is signed by the customer.

- Whether there are any special handling requirements with respect to health and safety of personnel or in respect of the environment.
- Any hazards associated with the waste.
- Haulier details, including Waste Carriers Licence, ABPR approval where applicable.
- The type of vehicle the waste will be transported in.

The initial sampling is undertaken prior to waste acceptance due to the turnaround times; however periodic sampling thereafter is coordinated by Biogen’s own Research Team.

Biogen has a documented Delivery Offloading Procedure (**document reference WWDOP1**), this includes a requirement for the weighbridge operator to confirm the load with the driver at the point of weigh-in and prior to tipping. Here they will also check the EWC/LOW code, and the Waste Transfer Notes (WTN)/Duty of Care (DOC) paperwork and ensure they are booked in on the pre-agreed Commercial schedule.

The waste pre-acceptance process would rule out any incoming material that couldn’t be mixed at the waste acceptance stage or in the RWBT, or at the very least, would identify maximum volumes that could be accepted at any one time/over a period. Biogen has an established Research Team who form part of the pre-waste acceptance team and provide feedback and advice on new feedstocks and process monitoring.

The anaerobic digestion process operates on a continuous flow process and with Biogen’s strict pre-acceptance waste procedures in place, the maximum storage capacity for feedstock within the reception building will not be exceeded. In the unlikely event further feedstocks cannot be accepted on site, Biogen would divert feedstocks elsewhere to any of the other 11 food waste anaerobic digestion sites within the company, with the closest sites being at Twinwoods (7 miles) and Bygrave (34 miles).

4.0 Pre-treatment

This section provides a summary of the pre-treatment activities prior to digestion which will continue to take place as part of the gas to grid expansion proposals at the Westwood AD facility.

Source segregated food waste is delivered to the plant in sealed or covered vehicles. The waste reception at Westwood is enclosed and served by a negative air extraction system providing at least three air changes per hour preventing odorous air from escaping from the building. All predominant sources of odour within the reception building, including the waste storage bays and the Hammermills for example will be served by new purpose designed point source extraction hoods in accordance with BAT. Odorous air from the Hammermills is to be initially extracted independently through to a new purpose designed

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activated carbon filter for treatment. Air from the building will also be extracted and channelled through to the new carbon filtration system for treatment prior to treated air being emitted to atmosphere via a stack to aid dispersion (see section 14.0 Emissions to Air).

Vehicles are allowed to reverse into the waste reception building under supervision once the shutter doors are opened. Following entry into the building, the fast acting shutter doors are immediately closed. Only when fully closed is the vehicle allowed to discharge into the bay as overseen by site foreman where the waste is visually inspected for non-conforming items. Once fully discharged, the shutter doors are reopened, and the vehicle is allowed to depart in accordance with the traffic management restrictions.

From here, the load is visually inspected again prior to being picked up with a materials handler and loaded into a hopper. Contamination tends to be objects which could cause mechanical damage to front end processing equipment as opposed to hazardous waste materials. However, to ensure this does not pose a risk, training is also provided to employees on hazardous waste, and this is also covered under the Disposal of Hazardous Waste Procedure. A designated quarantine area for non-conforming wastes is labelled and available within reception at all times.

Feedstocks are stored within the waste reception hall bays pending pretreatment (**document reference WWSLP1**). The current three large waste reception bays will be consolidated down to two to create one large bay and one existing bay. This will ensure adequate storage capacity is available at all times. The bay rotation system helps demonstrate the ‘first in, first out’ principle, ensuring the oldest feedstocks are processed first where possible. It is not within Biogen’s best interests to allow feedstocks to deteriorate or to accept feedstocks subject to depreciation. This is because any deterioration in the quality and digestive nutritional value of feedstocks is likely to generate low gas yields and/or produce malodours. The waste reception bays are periodically cleared of all waste which can be demonstrated by CCTV footage. Due to the continuous nature of the anaerobic digestion process, feedstocks cannot remain in the reception hall for long periods, as continuous feeding of the digesters is essential for digester health and biogas production. Consequently, uninterrupted pre-treatment of feedstocks must take place. If necessary, liquid waste is added to form the required constituency before it is discharged into the RWBT. Biogen also recirculate from the RWBT or from the Digesters to the front end to achieve the optimum viscosity or utilise harvested rainwater to offset mains water consumption.

The maximum storage time for feedstock within the reception building prior to processing is 48 hours. This is a worst-case scenario and would only approach this length of time in the event of significant plant malfunction.

The maximum storage capacity in the reception building is approximately 400 tonnes at any one time. An increase in the maximum annual throughput to 110,000 tonnes is equivalent to approximately 301 tonnes of feedstock to be accepted each day between Monday to Sunday which equates to only an additional 123 tonnes per day. This is comparable to approximately 5 additional articulated vehicle loads per day. As part of the gas to grid expansion proposals, the Westwood facility will be operational 24 hours a day 7 days a week due to the nature of the AD process (excluding waste acceptance). However, waste processing will take place between 06:30-18:00hrs Monday to Sunday giving a total of 80.5 hours maximum process time per week. Currently waste processing takes place between 07:00-19:00hrs

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Monday to Friday and between 07:00-13:00hrs on Saturdays giving a total of 66 hours maximum processing time. The reception hall is designed to provide more than adequate storage capacity under an increased annual throughput of 110,000 tonnes per annum. Should no pre-treatment or processing of feedstocks take place, in accordance with the proposed increase in feedstocks to a maximum of 301 tonnes per day, it would take approximately 1.5 days to exceed the maximum storage capacity available within the reception building.

Following loading into the hoppers, the feedstock will continue to be passed through 1 of 2 process lines each comprised of a hammermill (de-packaging plant) and a macerator to process material down to a particle size of 12mm (currently 25mm at front end and then macerated down to 12mm prior to digestion). There will be 3 macerators in total to serve each of the process lines and the below ground sump in the reception hall. The hammermills are subject to routine maintenance and Critical Control Point (CCP) checks take place for the macerators.

Each hammermill can process approximately 138 tonnes (276 tonnes combined) per day throughout the 11.5 hour shift pattern which is equivalent to approximately 12 tonnes per hour each. Removed contamination predominantly in the form of plastics is subject to hot washing then compaction to be 'squeezed' prior to collection within a designed RoRo container pending removal from site for disposal elsewhere. The 12mm macerators are to be maintained in accordance with documented maintenance procedures which can process a maximum of approximately 25 tonnes per hour. Once de-packaged and following maceration, feedstock is discharged into the new RWBT tank via a pump averaging approximately 50m³/hr. A spare standby macerator and pump are held onsite in the event of malfunction to enable processing to continue with minimal disruption. Each hammermill will be subject to a complete overhaul as part of the proposals.

The 2 hammermills with a processing rate of 12 tonnes per hour would enable the maximum storage capacity of 400 tonnes at any one time within reception to be processed within approximately 16 hours processing time (assuming no new feedstocks were accepted).

No upgrade to existing front end plant and equipment or new items of plant or equipment are required for the proposed increase in annual throughput from 65,000 to 110,000 tonnes per annum. All existing front end critical plant and equipment, including the hammermills, macerators and the separator (see section 11.0 Screening) are more than capable of achieving the required increase in processing rate as part of this variation application.

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5.0 Raw Waste Buffer Tank (RWBT)

To achieve optimum biological conditions, the contents of the new replacement 1140m³ RWBT will continue to be hydraulically agitated to ensure a homogenous mix. The waste pre-acceptance process would rule out any incoming material that couldn't be mixed at the waste acceptance stage or in the RWBT, or at the very least, would identify maximum volumes that could be accepted at any one time/over a period. The tank level and temperature are continuously monitored by the Supervisory Control and Data Acquisition (SCADA) system and recorded on a Plant Monitoring Spreadsheet.

In order to maintain essential nutrient balance for effective biological digestive health to achieve maximum biogas yields, a Trace Element Additive (TEA) will continue to be applied directly into the in feed line to the RWBT on a periodic basis. The concentration and composition of TEA applied is dependent on current feedstocks and plant biology. Samples are routinely taken from the RWBT and sent for analysis by our established Research Team who determine the level of dosing required. Any additional so-called TEA 'hits' required to improve plant biology are dictated by our Research Team. All weekly TEA additives including 'hits' are recorded on a live Plant Monitoring Spreadsheet and can be made available on request.

To minimise the corrosive nature of H₂S throughout the anaerobic digestion process, ferrous chloride dosing will take place directly into the RWBT. Ferrous chloride will be securely stored in a new 30m³ self-contained (double skinned) storage tank positioned within the secondary containment area. The daily quantities and dosing rates and associated data are recorded on a Plant Monitoring Spreadsheet. The decision to dose with ferrous chloride is dictated by the H₂S concentration within the biogas which is tested with the use of RAE tubes and portable gas analysers at least 2 to 3 times per week.

Due to the continuous nature of the anaerobic digestion process and the control measures in place including, but not limited to, tank level detection including high level probes, adequate storage capacity availability will be maintained at all times within the RWBT to store and process an additional 123 tonnes of feedstock per day throughout the year. All incoming feedstocks are scheduled in advance including liquid wastes which are discharged directly into the RWBT following maceration. This enables site operatives to manage the raw waste levels accordingly to maintain feeding into the digesters and ensure adequate freeboard is available at all times. High level detection probes will continue to be tested monthly. High level detection probes are hardwired and when triggered shut off all feed pumps into the tank to stop any further feeding into the tank.

As a result of the continuous nature of the anaerobic digestion process and the control measures in place, there is more than adequate storage capacity available within the 1140m³ RWBT to store and process an additional 45,000 tonnes of feedstock throughout the year. To demonstrate this, figure 4.0 below shows the mean (average) daily percentage tank levels recorded on SCADA within the current RWBT each month within the last 12-months (at the time of producing this document).

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Figure 4.0.

Month / Year	RWBT Level mean (%)
November 2024	52.7
December 2024	41.5
January 2025	60.4
February 2025	60.9
March 2025	58.7
April 2025	49.2
May 2025	55.9
June 2025	59.1
July 2025	55.5
August 2025	49.7
September 2025	56.4
October 2025	50.1

Between the period of November 2024 to October 2025 the mean tank level within the 1140m³ RWBT was only 54.2%. Although the new replacement RWBT will have the same storage capacity as the existing tank, there will be an additional larger Digester 5 at 3500m³ for the RWBT to feed with each Digester being fed typically at 30 minute intervals. Even with the RWBT tank being rebuilt to the same capacity with a freeboard allowance of 10% maintained at all times, there will be more than adequate storage capacity with the tank to process an additional 45,000 tonnes per annum based on a typical Hydraulic Retention Time (HRT) of 2.4 days.

6.0 Digestion

Digestion is a continuous flow process whereby feedstock is delivered from the RWBT into the Digesters at regular intervals. The new maximum total Digester storage capacity will be 12,620m³ comprised of 4,560m³ (2 x 2280m³ Digesters 1 & 2) to continue to serve the CHP engines and 8,060m³ (2 x 2280m³ Digesters 3 & 4 and 1 x 3500m³ Digester 5) for gas generation to be exported to the national grid. Digesters 1, 3 and 4 will be rebuilt to the current dimensions. Digester 5 was never built as part of the original installation. Digester 5 will be constructed but with a larger tank diameter than the original planned digester but at the same height as the other 4 digesters at 14 metres. The new digester 5 will have a diameter of 17 metres instead of 14 metres.

Each Digester will be typically fed at 30 minute intervals on a sequence via a series of pumps, each Digester having its own designated pump. Under a varied annual tonnage increase to 110,000 tonnes per year, the typical daily feed rate within Digesters will increase to a maximum of 301 tonnes per day and based on total Gas to Grid digester capacity of 8,060m³, the HRT will be approximately 36.3 days which exceeds the minimum BAT requirement.

Feeding rates into the digesters together with tank levels and temperatures will be continuously monitored by SCADA and recorded daily on a Plant Monitoring Spreadsheet. Although figures will include the addition of returned water, based on a maximum daily feed rate of 301 tonnes it would take approximately 1.5 days to clear and process 450 tonnes of feedstock (maximum storage capacity within the waste reception hall at any one time) assuming no further feedstocks were accepted.

All Digesters will be fitted with 2 new high level detection probes and will be continuously monitored and connected to SCADA. In addition to this they will be hard-wired to automated valves and feed pumps. Pressure transducers will automatically shut down all feeding into the digesters when activated. The high-level tank detection probes will continue to be subject to monthly testing.

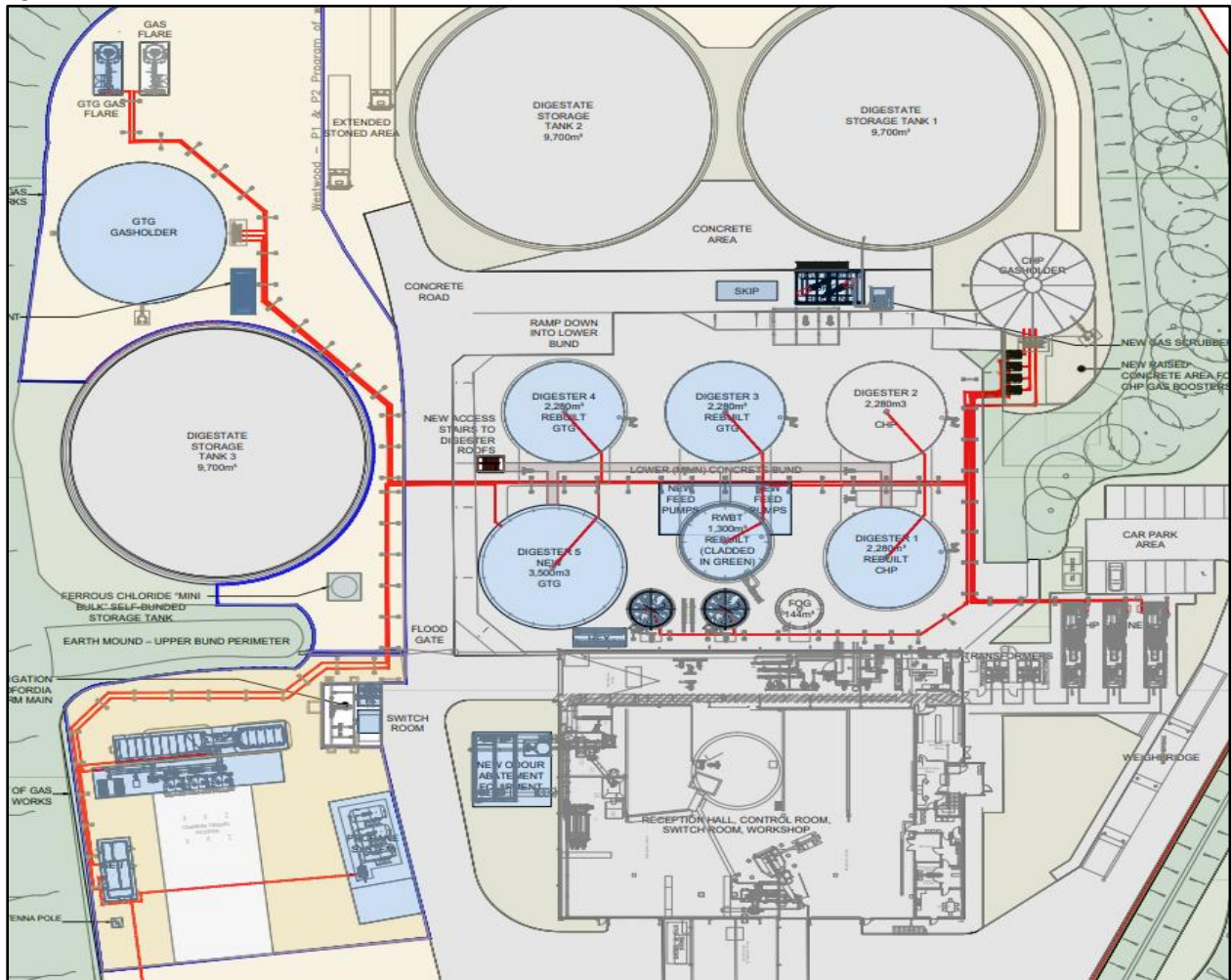
The continuous nature of the AD process together with the engineering controls in place will ensure surplus tank storage and processing capacity is available at all times within the 5 Digesters to allow for an increase in feedstock acceptance.

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7.0 Gas storage & safety measures

The RWBT, Digesters 1 and 2, and both Pasteurisers will all be connected to the gas line to serve the gas holder for the CHP engines. Digesters 3, 4 and 5 will be connected to the gas holder serving the gas to grid infrastructure as shown in the gas system diagram below in figure 5.0 (document reference WWSLP3).

Figure 5.0.



The gas generated from within Digesters 1 and 2 will be stored in an existing 1820m³ gas holder before being used as fuel in the 3 existing Combined Heat and Power (CHP) units (see section 8.0). Gas generated in Digesters 3, 4 and 5 will be stored in a new 3500m³ gas holder prior to being transferred to a Biogas Upgrade Plant (BUP) and a Gas Entry Unit (GEU) pending export to the national grid via an approximate 6km gas pipeline (document reference WWPRP1).

Both gas holders will consist of an inner membrane which contains the gas and an outer membrane which is inflated by forced ventilation. The new gas holder will be specially designed and installed to the

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highest specification. The site is subject to periodic DSEAR conformance assessments. DSEAR plans will be available on site and electronically, which have been revised in advance of any infrastructural changes.

The continuous nature of the process together with the engineered safety controls in place ensures additional storage capacity will be available within both gas holders at all times. As above, gas from Digesters 1 and 2 serving the CHP engines will be stored in a separate gas holder to the gas produced from Digesters 3, 4 and 5 which will be stored in a larger gas holder. A larger gas holder is to be installed to provide greater storage contingency and/or gas can be returned to Digesters 3, 4 and 5 in the event gas cannot be injected to the national grid. The gas holders will be maintained at an optimum gas pressure at all times. Gas pressures are continuously recorded on SCADA.

In the event of elevated gas pressures, the site has been designed and engineered that if all 3 CHP engines derated at the same time, the auxiliary gas flare would auto activate in order to burn any excess biogas prior to the Pressure Relief Valves (PRVs) releasing at 25mb. The ultimate fail-safe would be the release of the gas traps (condensate traps) at 32mb. The auxiliary gas flare would auto ignite when the capacity of the gas holder reaches a pre-set level or a pre-determined gas pressure to reduce the gas holder volume and pressure. The existing auxiliary gas flare is designed to have a maximum design burn flow rate of 1750m³/hr. Likewise, in the event biogas couldn't be upgraded and injected into the national grid, gas would be returned to Digesters 3, 4 and 5. Failing this, the new auxiliary flare would auto ignite when the gas holder reaches a pre-determined volume and/or gas pressure to reduce the gas holder volume. Pressure Release Valves (PRVs) will be installed on the RWBT, all 5 Digesters, both Pasteurisers, and both gas holders.

As a result, storage capacity within the existing gas holder will be available to allow for an increase in feedstock acceptance and biogas production for the CHP engines. In addition, the new purpose designed gas holder will be installed to serve the gas to grid operations providing almost double the gas storage capacity as the existing holder. The sites critical control measures would continue to demonstrate the gas mass balance would be maintained at equilibrium at all times throughout both the gas to engines and gas to grid operations.

The existing CHP engines will continue to provide heat to Digesters 1 and 2 and for pasteurisation. 2 new gas boilers will be installed in the pump room to provide heat for Digesters 3, 4 and 5 for Gas to Grid. The boilers will utilise gas from Digesters 1 and 2.

In the event of complete loss of power to site, 2 backup generators will provide power to all main services known as protected supply equipment including all gas holder blowers, both auxiliary flares, SCADA, roller shutter doors and main electrical sockets. A new additional generator will be installed to serve the gas to grid infrastructure whilst the existing generator will remain for the CHP operations. Each generator will be tested monthly and subject to an annual service.

The current auxiliary gas flare serving the CHP operations was utilised for 161 hours in 2024 which equates to 1.83% of the total available operational hours for the year and was comfortably within the allowable 10% limit. In 2023 the flare was utilised for 97 hours which equates 1.1% and in 2022 215 hours which is equivalent to 2.45% usage.

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Both auxiliary gas flares will be used during essential plant maintenance and/or in an emergency. CHP gas flow rates, gas to grid gas flow rate, flare flow rates and flare operating hours will be recorded on SCADA and on a Plant Monitoring Spreadsheet. Gas pressures are also recorded on SCADA.

A proposed increase in annual throughput from 65,000 to 110,000 tonnes will increase biogas generation by approximately 5,723,100m³ per annum based on 127.18m³ of biogas produced per tonne of feedstock to 13,989,800m³. This would equate to approximately 1597m³ of biogas produced per hour for both CHP and gas to grid operations. Of this 13,989,800m³ of biogas, approximately 64% is likely to be generated for export to gas to grid at approximately 8,953,472m³ per annum which is equivalent to approximately 1022m³ of biogas produced per hour. Of the 13,989,800m³ of biogas generation, approximately 36% is likely to be produced for gas to engine generation at approximately 5,036,328m³ per annum which is equivalent to approximately 574m³ of biogas produced per hour.

In the unlikely event all CHP engines derated, and the gas to grid network was unavailable all at the same time, both gas flares will have a minimum burn rate of 1750m³/hr which would be more than satisfactory to burn the maximum volume of biogas produced in a day should the rate and level of biogas generation not decrease through reduced feeding and mixing.

A revised Gas Mass Balance can be seen in **document reference WWGMB1**.

8.0 Combined Heat & Power (CHP) engines

The Westwood AD facility will continue to operate all 3 CHP gas engines in accordance with the current permit comprised of 2 x 1063MW and 1 x 832kW engines. All engines are Jenbacher CHPs to convert biogas into electricity and heat with an actual combined generation capacity of 71.1MW/24hr. The electricity is initially utilised within the plant and the remainder is sold via purchase power agreement to National Grid or to a third-party user. The heat generated will be used back in the process to maintain the temperatures of all Digesters 1 and 2 and to heat both pasteurisers).

A Plant Monitoring Spreadsheet is used to record daily electricity export and import (kWh) readings as well as the amount of electricity consumed by the facility (parasitic load). This same spreadsheet will be used to record daily gas exported to the national grid including flow rate via the GEU to the approximate 6km pipeline (**document reference WWPRP1**). Also recorded on SCADA will include the CHP generation meter.

The CHP units will continue to be subject to routine servicing to maintain combustion efficiency. Records of all monitoring undertaken and for maintenance carried out are stored and available on request. Biogen operates a very intensive maintenance regime to ensure the optimal performance of all their CHP engines. This is contracted to a specialist third party.

The engines are fitted with a ‘Leanox System’, which evaluates the gas quality and adjusts itself to ensure the most efficient burn of the gas and eliminating any methane slippage that could occur. By having this advanced technology on the CHP engines and also by maintaining it to such a high level, Biogen believe they are operating to the current highest level of BAT.

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Emissions from the combined CHP engine stack are subject to annual MCerts testing. All 3 engines ran for a total of 25,581 hours in 2024 (97.07% of availability). This is an increase compared to 24,873 hours or 94.65% of availability in 2023. The site has spare capacity to run all 3 CHP engines at 100% for increased biogas production as a result of the proposed increase in annual throughput in addition to gas to grid injection.

The site generated a total of 22,561 MWh in 2024; this is the total generation before the parasitic load has been removed. A parasitic load of 536 MWh was used on site equating to 2.37% of the total generation.

Biogen has capacity within the CHP engines for further output by way of higher Operational Equipment Effectiveness (OEE) and this combined with additional Gas to Grid capacity allows for the increase in food waste throughput.

The site’s existing engineering and gas safety control measures for the CHP operations do not require any upgrade in response to the proposed increase in annual throughput from 65,000 to 110,000 tonnes. There will be no increase in mass emissions from CHP operations. Latest CHP engine emissions testing demonstrated that all emissions were within their permitted ELVs.

The current auxiliary gas flare was utilised for 161 hours in 2024 which equates to only 1.83% of the total available operational hours for the year and comfortably within the allowable 10% limit. The auxiliary flare has been utilised for a total of 125 hours in 2025 which equates to only 1.42% of total operational hours. An additional flare will be installed to serve the gas to grid operations, so there will be 2 auxiliary flares onsite operating independently, 1 serving the CHP operations and the other gas to grid. Both auxiliary flares will be propane ignited.

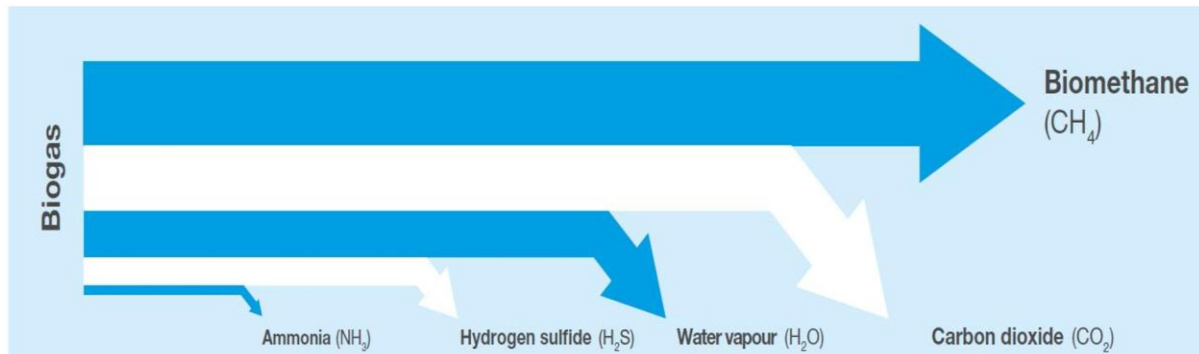
9.0 Gas to national grid

This is a new permit activity. Gas produced through the digestion process within Digesters 3, 4 and 5 will pass through a new gas scrubber prior to be stored in a new 3500m³ gas holder. The gas holder will feed the Biogas Upgrade Plant (BUP) whereby the gas will first be subject to cooling where moisture and contaminates such as ammonia (NH₃) and hydrogen sulphide (H₂S) will be filtered and removed. Additional filtration will then take place through activated carbon to remove further H₂S, ammonia and Volatile Organic Compounds (VOCs). The next treatment stage is compression of the gas to the required pressure prior to entering the membrane system. The heat of drying the biogas, from the compressor, and from the cooling can be recovered. The remaining gases include methane (CH₄) and carbon dioxide (CO₂). The CO₂ can be recovered and liquified. The separated biomethane has a typical concentration of >97% biomethane.

The membrane phase involves the compressed gas passing through a multiple membrane system where the CO₂ and CH₄ are separated as illustrated in the simplified process diagram below in figure 7.0.

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Figure 7.0.



Following treatment through the BUP, biomethane is continuously analysed and propane injection takes place to increase the calorific value and an odorant added called tetrahydrothiophene (THT) (C₄H₈S). Biomethane then enters the Gas Entry Unit (GEU) whereby biomethane passes through a gas chromatography unit to test for quality (purged with nitrogen or helium) pending entry into the pipeline for export to National Grid.

Methane compression can take place to enable methane to be compressed to less than 1% of the volume it occupies at standard atmospheric pressure. This can be achieved via a screw compressor and can be stored in hard containers at a pressure of 20-25 megapascals in cylindrical or spherical shapes. In the event gas to grid connection via transfer pipeline to the national grid is temporarily unavailable, compressed methane can be transported via road tankers to be utilised elsewhere.

10.0 Pasteurisation

Digested material is discharged into 2 new purpose built pasteuriser tanks alternating accordingly with each batch. Pasteuriser tanks 1 and 2 will be rebuilt to the same diameter as existing tanks but with an increased height from 7 to 8 metres high which is significantly less than the height of the Digesters and the RWBT, which will increase the storage capacity of each tank from 140m³ to 170m³.

The pasteurisers are heated for a minimum of 65 minutes at 70.7°C to remove any pathogens as required by the Animal By-Product Regulations. Each tank is equipped with temperature probes positioned at the top, middle and bottom. All temperature probes are subject to annual testing and calibration by an independent third party. Each pasteuriser will take 2.5 hours to fill and take approximately 18 hours to achieve full pasteurisation per batch prior to discharge which will also take 2.5 hours. Following pasteurisation, digestate is discharged to the separator for screening to remove contaminates down to <2mm. Both tanks will be equipped with a digestate chiller system to reduce the temperature of the digestate from >70.7°C to <40°C. This will significantly reduce ammonia concentration and odour. The pasteurisers will be connected to the gas line and diverted through the CHP engines.

As a result of a proposed increase in waste acceptance by an additional 45,000 tonnes per annum, an extra 40,500 tonnes of digestate is likely to be produced. There is sufficient capacity within the two new pasteurisers which have increased storage capacity of 20m³ (140m³ to 166m³) each compared to the

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existing tanks to process an additional 40,500 tonnes per year of digestate. Current batch sizes are restricted but as a result of this variation, batch sizes will be significant increase. A proposed total maximum annual throughput of 110,000 tonnes would generate approximately 99,000 tonnes of digestate a year (based on 90% of feedstock). 2 batches processed every 24 hours at 170m³ will equate to approximately 124,100m³ of processed digestate per annum.

As a result of a proposed increase in waste acceptance by an additional 45,000 tonnes per annum, an extra 40,500 tonnes of digestate is likely to be produced which would require a minimum of 271 tonnes of digestate to be processed per day. A maximum of 320m³ of digester material (if both pasteurisers completely full) could be processed at any one time per day, however multiple batches processing alternatively will take place to ensure a continuous process and to manage digester levels demonstrating sufficient storage and processing capacity.

11.0 Screening

Following pasteurisation, digestate is fed through to a separator for screening to remove contaminates predominantly plastics down to <2mm particle size. After screening, Digestate is transferred to one of 3 digestate storage tanks at 9700m³ capacity each. All pipework is enclosed to transfer the material to and from the screening process.

A new purpose built fully enclosed and sealed screening room is to be constructed which will be served by a negative air extraction system providing a minimum of 10 air changes per hour. Air from the separator building will then be extracted and channelled through to a new purpose designed acid scrubber for treatment prior to emission to air via a 4 metre stack to aid dispersion. The acid scrubber will be subject to six monthly emissions testing.

Separators are designed to process approximately 25 tonnes per hour each which is more than adequate to process an increase in digestate production of 40,500 tonnes per annum. A maximum revised annual throughput of 110,000 tonnes would generate a total digestate quantity of approximately 99,000 tonnes per annum (based on 90%). If screening takes place each day (Monday to Sunday) for a maximum of 11.5 hours per day at a rate of 25 tonnes per hour with one separator, this would allow approximately 288 tonnes of digestate to be processed each day and a total of 104,937 tonnes of digestate to be processed in any given year. An increase in 40,500 tonnes of digestate a year would only generate an additional 110 tonnes of digestate to be screened a day which can be processed within less than 5 hours with one separator.

In addition to this, there will be a standby separator in the screening room kept on site at all times in the event of malfunction or additional processing requirements. The separators will be maintained in a safe and controlled manner in accordance with the Standard Operating Procedure (SOP).

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12.0 Digestate storage

PAS 110 compliant digestate is stored in 3 purpose built Digestate Storage Tanks at 9700m³ each (29,100m³ total) equipped with mechanical mixing. The PAS 110 digestate is then utilised as a biofertiliser on receiving farms.

Digestate Storage Tank 1 is covered with a sealed roof whilst tanks 2 and 3 are open and provided with a floating cover layer of Hex-a-blocks.

Digestate Storage Tanks 2 and 3 have a floating cover layer of hex-a-blocs. As per the previous submission to the EA for installing these, Hex-a-blocs work on the same principle as the Lightweight Expandable Clay Aggregate (LECA) in that they form a floating cover, sitting immediately on the liquid surface, rising and falling with the liquid level in the tank. They are comprised of recycled polypropylene segments which float to create a flexible cover. Hex-a-blocs are proven to be highly successful in minimising malodour emissions when installed as a floating cover on Digestate Storage Tanks including at a number of our other AD sites. The hexagonal pieces fit together and offer an effective way to significantly reduce emissions. The manufacturers state they prevent ~95% of emissions by blocking light out and gas in. Their life expectancy is 25 years and they are heat and frost resistant, as well as windproof.

Although a proposed increase in annual throughput from 65,000 to 110,000 tonnes will increase digestate production by approximately 40,500 tonnes per year, no increase in on site digestate storage capacity is required. This is because the site benefits from an agreement with a third party who is contractually obliged to collect all PAS 110 digestate pending storage elsewhere for use for agricultural benefit. This contractual agreement ensures the third party collects and manages all digestate regardless of expected throughput and must do so without compromising PAS110 status, site operations or processing. There is also an irrigation ring main on site to pump digestate directly to local arable Bedfordia land.

Digestate Storage Tank levels are recorded daily on SCADA and on a [Plant Monitoring Spreadsheet](#). In addition to this, dip tests are periodically taken to verify the SCADA readings. As aforementioned, we work very closely with the contractor and receiving farmers and to this end have additional stores available to us on farm and at the point of use for the PAS 110 compliant product. This will ensure our product has sufficient storage to enable it to be used for agronomic benefit whilst complying with legislation.

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13.0 Secondary & tertiary containment

The Westwood AD facility was constructed in 2009, and so predates the publication of CIRIA 736 which was published in mid-2014. The secondary containment on site is largely provided by an unlined engineered clay bund, with minor sections of concrete walls. A containment review was conducted by SLR Consultancy based on C736 as this represents current best practice (**Document reference WWCCA1**). A Bund Ground Investigation was also completed to prepare a factual Ground Investigation Report (**Document reference WWBGIR1**).

A permeability assessment was previously completed for the bund during 2009 as part of the original design and construction works. This assessment determined the site to be underlain by 20 metres of glacial clay with a permeability significantly less than $1 \times 10^{-09} \text{m/sec}$ which was classed as acceptable in accordance with the guidance at time (since superseded by C736).

Dynamic sampling boreholes were drilled using a P60 slope climbing rig to a maximum depth of 6.20m bgl between the 6-7th August 2024. Boreholes were drilled to allow for logging, sampling and in situ testing of the underlying ground and groundwater conditions. Standard Penetration Tests were also undertaken to a maximum depth of 4.20 metres bgl to obtain information on the relative density of strata encountered. The Coefficient of Permeability values were found to be significantly lower than the required threshold of $1 \times 10^{-9} \text{m/s}$, demonstrating that the material complies with the permeability requirements outlined in C736.

SLR Consultancy were appointed by Biogen (UK) Ltd to undertake a review of the existing secondary containment arrangements, which was completed in January 2024 including a:

- Topographic survey of the existing containment bund and hydraulic modelling to enable its capacity to be accurately determined (**Document reference WWTP1**);
- Geotechnical investigation of the earth bund and underlying in situ soils to establish composition and permeability; and
- Completion of C736 risk assessment for the site to determine the required environmental risk rating and design classification (**Document reference WWADBARA1**).

CIRA 736 guidance recommends that the secondary containment volume is the larger of 25% of the bund capacity or 110% of the largest tank which is determined as:

- 25% of $43,500\text{m}^3 = 10,875\text{m}^3$
- 110% of $9,700\text{m}^3 = 10,670\text{m}^3$

(see Containment Assessment **document reference WWCCA1**).

In this case 25% of the total inventory dominates and the required secondary containment capacity is $10,875\text{m}^3$. A topographical survey determined that the total secondary containment capacity provided by the existing bund of $14,008\text{m}^3$ exceeds the required figure of $10,875\text{m}^3$, and therefore the secondary containment bund has adequate volume (assuming that the low point identified is remediated). This low point identified by the survey is to be remediated as part of the Gas to Grid expansion proposals where the earth bund meets a concrete bund wall in the northwest corner of bund. This will also include remediating the additional actions to address issues with the bund including works to a section of

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precast concrete wall within the bund and repair works to concrete joints (see Containment Spill Model **Document reference WWCSM1**).

SLR Consultancy completed a C736 risk assessment for the site using the Anaerobic Digestion and Bioresources Association (ADBA) methodology (see ADBA Risk Assessment **document reference WWADBARA1**). The risk assessment indicates that the site is considered to be 'low' risk, and therefore requires a class 1 design. Unlined earth bunds are an allowable design for class 1 sites, with C736 specifying a minimum thickness of one metre of Clay with an impermeability lower than 1×10^{-09} m/s. The bund at Westwood exceeds these minimum criteria, with a greater thickness of material with significantly lower permeability.

The volume of the secondary containment bund exceeds that required by C736 guidance, and it is constructed using appropriate materials. Subject to relatively minor repair and remedial works, the bund is considered to be satisfactory for a low risk / class one site.

14.0 Emissions to air

A proposed increase in annual throughput from 65,000 to 110,000 tonnes per annum will increase biogas generation by approximately 5,723,100m³ per annum based on 127.18m³ of biogas produced per tonne of feedstock. The site's existing and new critical control measures will continue to ensure the gas mass balance would be maintained throughout the facility. The revised gas mass balance calculations can be seen in **document reference WWGMB1**.

The proposed increase in annual waste acceptance will not exceed the existing maximum storage capacity within the building of 400 tonnes at any one time. As such, there is no requirement to increase the size of the waste reception building which will remain at approximately 13,000m³ based on a minimum of 3 air changes per hour so total air flow will be 39,000m³/hr. Consequently, there will be no increase in the volume of air to be treated within the reception building. For that reason, the volume of air and the rate of extraction from the waste reception building will remain the similar and the rate of extracted air passing through the newly designed carbon filtration system will be largely unaffected. There will be no increase in the mass of emissions released to air. The air residence time or contact bed time within the carbon filter is designed at 1.5 seconds. There will be no changes to the nature of feedstocks and no changes to the composition of the extracted air passing through the carbon filter. Odour dispersion emissions modelling is provided in **Document Reference WWEM1**. The carbon filter design specification can be seen in **Document Reference WWCFDS1**.

The new carbon filter will be a deep bed carbon adsorber system utilising a horizontal bed arrangement to facilitate a twin layer approach to the carbon media. Based on 70% Virgin Activated carbon coal granules and 30% Copper impregnated carbon. New galvanised spiral ducting is proposed with the introduction of ventilation louvres at low level on the opposite wall to supply fresh incoming air. The location of the supply air provision is key to ensure replacement air is allowed in under controlled conditions and well distributed throughout the building and to provide acceptable working conditions to staff with the roller shutter doors closed. To ensure the building is maintained under sufficient negative pressure, air will be supplied via well-placed pressure relief dampers and weather louvres at low level.

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The abatement system will be based on a recommended 1.5 second dwell time across the activated carbon bed for optimal life on deep bed carbon systems for waste reception halls. The carbon bed will be a dual-layered system to target specific compounds including ammonia, and VOCs for example, however, the filter will be a horizontal bed system to enable additional carbon to be added should it be necessary. Point source extraction will be installed together with new extraction ducting within the waste reception and process building. This will include separate extraction hoods positioned above the two hammermills.

A new purpose built sealed separator room is to be constructed where all screening operations will take place. Currently screening operations take place outside with no extraction or abatement. Therefore, the construction of a purpose built separator room with extraction for abatement will significantly reduce odour and ammonia.

Air from within the separator building will be subject to at least ten air changes per hour and will be extracted and channelled through to a new acid scrubber for treatment prior to emission to air via a stack to aid dispersion. The separation building will be approximately 4,400 mm (W) x 8,000 mm (L) x 6,000 mm (H) giving a total volume of 211.20 m³ with an airflow requirement of 2,112 m³/hr. The acid scrubber will be comprised of 16mm pall ring media and variable fan speed settings will be available. See **Document Reference WWASDS1** for the acid scrubber design specification.

The emissions from the abatement systems on site will be subject to six monthly testing against specified ELV's in the permit and against BAT. This includes for NH₃, H₂S and odour concentration (where applicable) including an odour removal efficiency test. All attempts at reducing NH₃ levels are targeted at source as much as possible. This includes pre-acceptance checks and feedstock management.

No additional CHP engine is required and no upgrade to the existing CHP engines is necessary and there will be no increase in emissions. The engines will continue to be subject to a rigorous maintenance and servicing regime by an independent third party to maintain the highest level of efficiency. The emissions to air will continue to be MCerts tested on an annual basis in accordance with the permit and BAT. The existing CHP engines will continue to provide heat to Digesters 1 and 2 and for pasteurisation.

2 new gas boilers will be installed in the boiler room to provide heat for Digesters 3, 4 and 5 for Gas to Grid each with their own 8 metre high emission stack to aid dispersion. The boilers will burn gas generated from Digesters 1 and 2. See Emissions Modelling Report in **Document Reference WWEM1**.

The existing CHP auxiliary flare will remain in operation but will be relocated to be adjacent to a new additional flare to serve the Gas to Grid operations.

See **Document Reference WWPSEAP1** for a plan showing all point source emissions to air.

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15.0 Emissions to water

Captured rainwater from within the secondary containment area is to collect in a below ground sump and pumped to an above ground 140m³ Water Tank (formerly known as a FOG tank). The captured rainwater within the tank is to be subject to treatment to reduce ammonia in the form of aeration and/or with the addition of a bacterial compound (if required). Ammonia readings will be taken throughout storage and treatment prior to being discharged to the onsite surface water attenuation pond. No discharge shall take place with an ammonia concentration limit of >2ppm. All sample results will be recorded and available for inspection.

The pond is equipped with an aerator to further improve dissolved oxygen levels within the surface water body. From here, subject to water level, a penstock is manually opened to allow water to drain from the pond through to a drainage ditch and reedbed system (see point source emissions to water plan in **Document Reference WWPSEWP1**).

In the event ammonia levels exceed 2ppm following treatment, the water will be returned to the front end and put through the treatment process and will not be discharged to the pond.

The maximum flow rate of discharge to the pond will be 2.5 litres per second. Treated water will be discharged into the onsite pond via a discharge pipe and concrete headwall at NGR SP 98884 63286. The treated water will be subject to testing from a designated sample chamber located at approximate NGR SP 98900 63223 or at the outlet. The rate of discharge will be dependent on rainfall and seasonal variability with a maximum daily discharge of 400m³/day.

The pond area is approximately 1370m² with an average depth of 0.5 metres and a maximum depth of 1.5 metres to store approximately 495m³ of water.

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