Best Available Techniques Assessment - Horse Close AD Plant, Courteenhall, Northamptonshire, NN7 2QF

On behalf of:

Acorn Bioenergy Operations Limited

ETL747/2024

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V1.0 Issue 0	07/02/2025	First Issue	A Trelawny	A Becvar
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Contents

Abbreviations

ADBA	Anaerobic Digestion and Bioresources Association
ABL	Acorn Bioenergy Operations Limited
ACPH	Air changes per hour
AD	Anaerobic Digestion/er
ADQP	Anaerobic Digestate Quality Protocol
AQIA	Air Quality Impact Assessment
BAT	Best Available Techniques
BMP	Biochemical methane potential
BREF	BAT reference documents
BUU	Biogas upgrade unit
CH_4	Methane
CHP	Combined heat and power
CIRIA	Construction Industry Research and Information Association
CMMS	Computerized Maintenance Management System
COMAH	Control of Major Accident Hazards (2015)
CO_2	Carbon dioxide
dB(A)	A-weighted decibels
DSEAR	The Dangerous Substances and Explosive Atmospheres Regulations 2002
EA	Environment Agency
EMS	Environmental Management System
ETL	Earthcare Technical Limited
EVCS	Electric Vehicle Charging Station
EWC	European Waste Catalogue
HAZOP	Hazard and operability study
H_2S	Hydrogen sulphide
HSE	Health and Safety Executive
LDAR	Leak detection and repair
MAPP	Major Accident Prevention Policy
MCPD	Medium Combustion Plant Directive (2015)
N_2	Nitrogen
NH_3	Ammonia
NMP	Noise Management Plan
O_2	Oxygen
OMP	Odour Management Plan
PRV	Pressure relief valve

PVCu	Poly Vinyl Chloride
PVRV	Pressure and vacuum relief valve
REA	Renewable Energy Association
SCADA	Supervisory control and data acquisition
SOP	Standard operating procedure
SSBRA	Site specific bioaerosol risk assessment
TPA	Tonnes per annum
UV	Ultra violet
VOC	Volatile Organic Compounds

1 Introduction

The Best Available Techniques (BAT) Assessment has been prepared by Earthcare Technical Ltd (ETL) on behalf of Acorn Bioenergy Operations Limited (ABL) to support an application for a new bespoke installation permit for an anaerobic digestion (AD) plant including the use of resultant biogas, biogas upgrader, with carbon dioxide capture and liquefaction at Horse Close AD Plant, Courteenhall, Northamptonshire, NN7 2QF (the site). The plant will be operated by Acorn Bioenergy Operations Limited (the Operator). The key equipment suppliers are Biogest® (Biogest) who designed the AD plant and are building and commissioning it. Bright Renewables UK are supplying and commissioning the biogas upgrade unit (BUU) and carbon dioxide liquefaction equipment.

This document has been written by ETL in collaboration with the Operator.

This report comprises a review of the operation, activities, infrastructure, management systems, etc. for the site, in comparison to the requirements of indicative BAT as stated in the BREF document 'Best Available Techniques Reference Document for Waste Treatment'[1] to ensure that all relevant areas are included. In addition, the assessment considers the requirements of the Medium Combustion Plant Directive (MCPD).[2] The Environment Agency (EA) guidance 'Appropriate measures for biological treatment' is also referenced where applicable.[3]

The Energy Efficiency Directive[4] has not been considered as it is not deemed to be applicable to the proposed development.

The aim of this report is to provide confidence to the EA that the Operator has both considered the requirements of BAT and will operate the site in compliance with the requirements of indicative BAT.

The report is structured in table format in the same order as set out in 2018 Best Available Techniques (BAT) Reference Document for Waste Treatment, to ensure a logical review of the requirements of indicative BAT. Next to each relevant requirement there is a summary of the proposals and a comparison against indicative BAT.

The final section comprises conclusions and recommendations.

[1] Best Available Techniques (BAT) Reference Document for Waste Treatment, European IPPC Bureau, 2018

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

[3] Biological waste treatment: appropriate measures for permitted facilities, Environment Agency 21 September 2022, https://www.gov.uk/guidance/biological-waste-treatment-appropriate-measures-for-permitted-facilities

[4] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast)

2. BAT Assessment for Horse Close AD Plant

Environmental Management System

BAT 1	**BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features**	
a	Commitment of the management, including senior management;	Senior management of ABL have committed to the establishment and maintenance of an environmental management system (EMS). The organisation's Environmental Policy outlines the environmental commitments of the Operator with respect to its operations, activities, and overall environmental performance. The Environmental Policy forms part of the company wide Acorn Integrated Management System (AIMS) (**ABL-QUAL-SHEQ-MAN-P1)**.
b	Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	The Environmental Policy includes a commitment to monitoring and continuously improving the environmental performance of the installation.
c	Planning and establishing the necessary procedures, objectives, and targets, in conjunction with financial planning and investment by the management;	The EMS documents are detailed within the EMS Manual **(HRCL-ETL-EMS-MAN-P1)** and the Master Document Control File **(HRCL-ETL-MASTER DOCUMENT CONTROL FILE-QUL-P1)** and include Standard Operating Procedures (SOPs). The Environmental Policy includes a number of environmental commitments. Specific environmental objectives and targets will be set going forwards. The EMS has been developed and approved by senior management who are also responsible for financial planning and investment decisions.
d	Implementation of procedures paying particular attention to: • structure and responsibility, • recruitment, training, awareness and competence, • communication, • employee involvement, • documentation,	There are management system documents and procedures covering all these elements as detailed in the EMS Manual **(HRCL-ETL-EMS-MAN-P1)** and summarised in the Master Document Control File **(HRCL-ETL-MASTER DOCUMENT CONTROL FILE-QUL-P1).** • Roles and responsibilities are detailed within Section 10 of the EMS Manual **(HRCL-ETL-EMS-MAN-P1)** and the Staff Organogram **(HRCL-ABL-Staff Organogram-QUL-P1)** in addition to roles and responsibilities within individual procedures. • Staff training is carried out in accordance with Training Procedure **(ABL-QUAL-TRAINING-PRO-P1).**

BAT 1	**BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features**	
	• effective process control, • maintenance programmes, • emergency preparedness and response, • safeguarding compliance with environmental legislation;	• There is a commitment within the Environmental Policy to regularly communicate environmental standards and practices to employees and other significant stakeholders. • Document control is in place and all documents benefit from version control which is managed in accordance with the Document Control Procedure **(ABL-QUAL-DOCUMENT REFERENCE PROCEDURE-PRO-P1)** and recorded within the Master Document Control File **(HRCL-ETL-MASTER DOCUMENT CONTROL FILE-QUL-P1).** All EMS documents will be held and accessed on the Computerized Maintenance Management System (CMMS) to ensure only current versions are used. • The process is monitored and controlled in accordance with Process Monitoring Procedure **(HRCL-QUAL-Process Monitoring-WI16-P1)**. • All plant and equipment are subject to a planned preventative maintenance programme in accordance with the monitoring and maintenance schedules of the EMS **(HRCL-MP-01, HRCL-MP-04** & **HRCL-MP-05)** as detailed under BAT 14; • There is a site-specific Accident Management Plan (AMP) Manual **(HRCL-ETL-AMP-RPT-P1)** in place which references out to a set of Emergency Standard Operating Procedures. Due to the proposed volume of flammable gases to be stored on site, the site is designated as a Lower Tier Control of Major Accident Hazards (COMAH) site and therefore there will also be a Major Incident Prevention Policy (MAPP), to comply with Health and Safety Executive (HSE) requirements, in place which will be linked to the AMP Manual. • The Operator will monitor on an ongoing basis the environmental performance of the site in accordance with the Environmental Monitoring Procedure **(ABL-ENV-ENVIRONMNETAL REPORTING-PRO-P1)** as required to determine environmental performance and control environmental risks, as determined through the site environmental permit and the site-specific Environmental Risk Assessment (Appendix A of the EMS Manual **(HRCL-ETL-EMS-MAN-P1)**).
e	Checking performance and taking corrective action, paying particular attention to: • monitoring and measurement, • corrective and preventive action, • maintenance of records,	The environmental management system incorporates: • An Environmental Monitoring Procedure **(ABL-ENV-ENVIRONMNETAL REPORTING-PRO-P1)** and a Process Monitoring Procedure **(HRCL-QUAL-Process Monitoring-WI16-P1)**. • Corrective and preventative action will be determined in accordance with the Preventative Action, Non-conformance, Corrective Action, Improvement Procedure **(ABL-QUAL-NC-PRVE & CORRE ACTION, IMPROVEMENT-PRO-P1).** Non-conformance and corrective action will be logged and tracked via the Non-conformance & Corrective Action Log **(ABL-OD-05)**.

BAT 1	**BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features**	
	• independent (where practicable) internal or external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained.	• Records will be maintained in accordance with the Control of Records, Section 11 of the EMS Manual **(HRCL-ETL-EMS-MAN-P1)**. • Once the basic EMS is embedded, Internal Audit and Management Review will be incorporated to assess the ongoing suitability of the EMS.
f	Review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;	Senior Management are responsible for reviewing the EMS procedures and processes ensuring any changes to the EMS are planned and implemented.
g	Following the development of cleaner technologies;	ABL are members of the industry bodies: the Anaerobic Digestion and Bioresources Association (ADBA) and the Renewable Energy Association (REA) and have a network of contacts within the industry to keep well informed of industry developments. ABL is funded by Qualitas Energy, linking them to a global developer of renewables. ABL will take the opportunity to adopt cleaner technologies where possible.
h	Consideration for the environmental impacts from the eventual decommissioning of the plant at the stage of designing a new plant, and throughout its operating life;	There is a Site Decommissioning Plan **(ABL-QUAL-SITE DECOMMISSIONING-PLA-P1)** in place which considers the environmental impacts from the eventual decommissioning of the plant.
i	Application of sectoral benchmarking on a regular basis;	The Environmental Policy includes an objective to meet relevant legislative, regulatory, and environmental codes of good practice as minimum standards for environmental performance. Through industry connections and networking including as ADBA and REA members ABL compare environmental performance with other operators and strive to improve their performance through environmental objectives going forwards.
j	Waste stream management (see BAT 2);	See BAT 2
k	An inventory of waste water and waste gas streams (see BAT 3)	See BAT 3

BAT 1	**BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features**	
l	Residues management plan - A residues management plan is part of the EMS and is a set of measures aiming to: • minimise the generation of residues arising from the treatment of waste, • optimise the reuse, regeneration, recycling and/or recovery of energy of the residues, and • ensure the proper disposal of residues.	There are no residues from the waste streams treated.
m	Odour management plan	See BAT 12.
n	Noise and vibration management plan	See BAT 17.

Waste Management Measures

BAT 2	**In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.**	
Waste pre-acceptance		
a	Set up and implement waste characterisation and pre-acceptance procedures.	Waste feedstocks undergo pre-acceptance and acceptance checks including sampling and testing in accordance with the Waste Pre-Acceptance Procedure **(ABL-ENV-WASTE PRE ACCEPTANCE-PRO-P1)**, Feedstock Acceptance and Rejection Procedure **(ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1)** and Sampling & Analysis Procedure **(ABL-ENV-SAMPLING & ANALYSIS-PRO-P1).**
Waste acceptance		
b	Set up and implement waste acceptance procedures	All feedstocks (including waste) will be checked, accepted and / or rejected as appropriate in accordance with the Feedstock Acceptance and Rejection Procedure **(ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1).**
Waste tracking		
c	Set up and implement a waste tracking system and inventory. A waste tracking system and inventory aims to track the location and quantity of waste in the plant. It holds all the information generated during waste pre-acceptance procedures (e.g., date of arrival at the plant and unique reference number of the waste, information on the previous waste holder(s), pre-acceptance and acceptance analysis results, intended treatment route, nature and quantity of the waste held on site including all identified hazards), acceptance, storage, treatment and/or transfer off site.	The maximum waste storage capacity and the storage location(s) are set within the site design and are detailed in Table 1 under the response for BAT 4 below. All non-waste and waste feedstock deliveries are weighed over the weighbridge and recorded within weighbridge system. The following are recorded for each load of waste accepted at the site: • *a unique identifier reference number for the load (generated at weighbridge).* • *date and time received;* • *tonnage / volume received;* • *producer details.* Waste that is rejected whether this is at pre-acceptance stage, at the weighbridge or once it has been tipped will be logged on a Feedstock Rejection Form **(ABL-QUAL-Feedstock Rejection AQD03-R1)** in accordance with the Feedstock Acceptance and Rejection Procedure **(ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1)**.

BAT 2	**In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.**	
		Note: All Pre-acceptance, acceptance and rejection data will be held for at least 2 years providing full traceability on waste materials. The daily feed recipe for the digesters will determine the tonnages of waste to be fed into the digesters daily. The tonnages of waste accepted into site will be tracked and recorded by the Site Manager. The data will be shared with the Feedstock Manager to ensure a consistent supply for the AD process whilst ensuring that maximum storage capacities on site will not be exceeded and to inform decisions on the tonnages of manures, slurry and any other wastes under supply contracts that are required. The Site Manager will be responsible for tracking waste tonnages against permitted limits and the production of figures for quarterly waste return submissions to the EA. **Data Entry Responsibilities** The **Logistics Administrator** is responsible for ensuring that the following data is entered into the waste tracking system: • For each load of material in: ○ Type of material (description) ○ European Waste Catalogue (EWC) code ○ Source ○ Waste Transfer note reference ○ Net weight of waste ○ Date and time accepted ○ Haulier ○ Haulier's license number ○ Origin of waste ○ Time and date ○ Record declaration of previous load acceptable and wash out certificate provided if required ○ Vehicle registration number • For each load of digestate out: ○ Date and time ○ Net weight ○ Destination

BAT 2	**In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.**	

		• For each load rejected at the weighbridge:
		  ○ Type of material
		  ○ EWC code
		  ○ Source
		  ○ Waste Transfer note reference
		  ○ Tonnage
		  ○ Date & time rejected
		  ○ Reason for rejection / potential hazard as appropriate
		  ○ Rejected by (name of staff member)
		  ○ Destination of rejected material
		
		The **Site Manager** is responsible for checking the following data is entered into the waste tracking system correctly:
		• Waste that has been booked in
		• Waste that has been received
		• Waste that is rejected

Output quality		
d	Set up and implement an output quality management system	<u>Digestate quality</u> In accordance with section 11.4 of the EMS Manual **(HRCL-ETL-EMS-MAN-P1):** • *The separated fibre digestate and separated liquor digestate will be sampled and analysed to determine their characteristics at a suitable accredited laboratory. Results will be provided to the end user and their agronomist such that a nutrient management plan may be made prior to the digestate being used.* • *The samples are taken and dispatched to the laboratory in accordance with the Sampling and Analysis Procedure **(ABL-ENV-SAMPLING & ANALYSIS-PRO-P1)** which includes a recommended sampling frequency schedule.* <u>Biogas quality</u> Gas quality is continuously via 3 No. in-line analysers. The following parameters are measured within the ranges detailed below: • *Methane (CH_4)- 0-100% vol.* • *Cardon dioxide (CO_2)- 0-100% vol.*

BAT 2	**In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.**	
		• *Carbon monoxide (CO)- 0-100% vol.* • *Hydrogen Sulphide (H_2S)- 0-500ppm* • *Oxygen (O_2)- 0-25% vol.* • *Hydrogen (H_2)- 0-50,000ppm & 0-100% vol.* Inline gas readings will be verified through weekly checks with a handheld gas monitor. The hand-held gas monitor is calibrated annually or sooner if there is a significant difference between the in-line and handheld device readings. Results are compared to acceptable limits for use within the Combined Heat and Power (CHP) Engine and Biogas Upgrade Unit (BUU).
Waste segregation		
e	Ensure waste segregation. Waste is kept separated depending on its properties in order to enable easier and environmentally safer storage and treatment. Waste segregation relies on the physical separation of waste and on procedures that identify when and where wastes are stored.	Wastes and non-waste feedstock materials will be segregated in storage as detailed in Table 1 (BAT 4). Manure will be stored with the Manure Reception Building and slurry in the Liquid Feedstock Tank. Any additional liquid waste will be stored within the Liquid Feedstock Tank.
f	Ensure waste compatibility prior to mixing or blending of waste	Due to the nature of the proposed feedstocks and waste pre-acceptance checks there is no potential for issues with waste compatibility.
g	Sort incoming solid waste	Sorting of incoming solid wastes is carried out as described above.

Inventory of Waste Water and Waste Gas

<table>
<tr><td>BAT 3</td><td colspan="2">In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:</td></tr>
<tr><td>i</td><td>Information about the characteristics of the waste to be treated and the waste treatment processes, including:

• simplified process flow sheets that show the origin of the emissions;
• descriptions of process-integrated techniques and waste water/waste gas treatment at source including their performances;</td><td>Origin of Emissions / Emission Points

A process flow diagram is provided as Appendix A. An Emission Point Plan is provided as Appendix C and an emission point table, Table 1 is provided below:

Table 1- Emission Point Table
<table>
<tr><th>Emission Point Reference</th><th>Source</th></tr>
<tr><td colspan="2">Emissions to air</td></tr>
<tr><td>A1</td><td>Combined Heat and Power Engine stack 1</td></tr>
<tr><td>A2</td><td>Combined Heat and Power Engine stack 2</td></tr>
<tr><td>A3</td><td>Emergency Flare stack</td></tr>
<tr><td>A4</td><td>Emergency Boiler stack</td></tr>
<tr><td>A5</td><td>Emergency Generator stack</td></tr>
<tr><td>A6</td><td>Emissions abatement plant stack (Manure Reception Building)</td></tr>
<tr><td>A7</td><td>Biogas upgrade unit Pressure Relief Valve (PRV)</td></tr>
<tr><td>A8</td><td>Biogas upgrade unit CO2 vent</td></tr>
<tr><td>A9</td><td>Carbon dioxide recovery plant PRV1</td></tr>
<tr><td>A10</td><td>Carbon dioxide recovery plant PRV2</td></tr>
<tr><td>A11</td><td>Compressor PRV 1</td></tr>
<tr><td>A12</td><td>Compressor PRV 2</td></tr>
<tr><td>A13</td><td>Underground Leachate Tank vent</td></tr>
<tr><td>A14</td><td>Pressure and Vacuum Relief Valve (PVRV) on Primary Digester 1</td></tr>
<tr><td>A15</td><td>PVRV on Secondary Digester 1</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>BAT 3</td><td colspan="2">In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:</td></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>A16</td><td>PVRV on Primary Digester 2</td></tr>
<tr><td>A17</td><td>PVRV on Secondary Digester 2</td></tr>
<tr><td>A18</td><td>PVRV on Tertiary Digester</td></tr>
<tr><td>A19</td><td>Covered Digestate Storage Lagoon carbon filter outlet</td></tr>
<tr><td>A20</td><td>Liquid feedstock tank carbon filter outlet</td></tr>
<tr><td>A21</td><td>Liquid Digestate off-take point carbon filter outlet</td></tr>
<tr><td>A22</td><td>PVRV on liquid digestate storage lagoon</td></tr>
<tr><td>A23</td><td>Carbon dioxide recovery plant unit CO2 vent</td></tr>
<tr><td>A24</td><td>Liquid Digestate off-take point carbon filter outlet (principal loading point)</td></tr>
<tr><td colspan="2">Emissions to water</td></tr>
<tr><td>W1</td><td>Clean surface water from Lagoon storage</td></tr>
</table>

Note W1 is not a release of wastewater per se. It constitutes the discharge of clean rainwater via the northern Clean Water Lagoon from the designated clean areas of the site including:
• roofs; and
• run off from areas of hardstanding including the access road and vehicle movement areas (excluding the secondary containment bund) which has passed through a full retention separator.

All dirty water and rainwater collecting in the secondary containment system is collected, stored in tanks within the secondary containment area and used within the AD process. Additional buffer storage is provided by the Dirty Water Lagoon (510m^3). In the case of abnormal excess water levels due to an extreme rainfall event clean water from the secondary containment system may be released to the wider environment following pre-determined checks detailed within the Discharge of Flood Water Procedure (HRCL-QUAL-Draining Management and control-WI23-P1). In these circumstances, if the visual and olfactory checks confirm that there have been no spillages, and onsite testing confirms that parameters for emissions to water are at acceptable levels, then the water will be pumped out to the surface water crate system as clean water.
</td></tr>
</table>

BAT 3	**In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**	
		Water Treatment Techniques The water from the Clean in Place (CIP) for the UV system will be in the region of 24m^3 per year which will go into the process water tanks and then be treated through the AD process. There is no other wastewater treatment other than within the AD process itself. Air Treatment Techniques *Biogas treatment* Biogas is stored within the void space of the PowerRing Digesters and within the double membrane gas storage dome over the Tertiary Digester. Hydrogen sulphide (H_2S) levels within the digesters will be tested and monitored on the Supervisory control and data acquisition (SCADA) system. H_2S is reduced within the biogas in the digester head space by means of sulphate reducing bacteria. The bacteria require a source of oxygen, at low concentrations, to reduce hydrogen sulphide in the biogas to sulphur. Oxygen is injected into the head space of the digesters, at controlled, low concentrations, to provide suitable conditions for the bacteria to carry out this function. For this purpose, oxygen needs to be created and injected into the digestors. First, atmospheric air is compressed and then it is forced towards a purifying substrate to isolate and store oxygen, which is supplied to the digesters through valves and oxygen lines. A regulating valve will be in charge of injecting the right amount of O_2 in the upper part of the Digesters (gas zone). Biogest® state that the oxygen demand in an AD plant is approximately 0.8% of the biogas flow, resulting for the proposed plant in a requirement of around 17 Nm^3/h of gaseous oxygen. Due to high flows required, two oxygen generators have been implemented in current layout of the plant. Ferric hydroxide powder will be used to further control H_2S levels if needed. It will be stored on site and fed via the feed hoppers as and when required. Raw biogas is also treated within the BUU thorough a series of steps: • *Biogas cooling to approximately 5^0C to remove water.* • *Carbon filtration (2 No. filters to remove H_2S and 1 No. filter for Volatile Organic Compounds (VOCs))*

BAT 3	**In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**	
		• *Compression* • *Three-stage membrane filtration which separates the biogas into methane (CH_4) and carbon dioxide (CO_2).* The CO_2 is passed to the CO_2 capture unit for liquefaction in preparation for temporary storage prior to dispatch of site for use. The CH_4 is compressed and stored prior to dispatch from the site via gas tankers to a grid injection point. This is referred to as a virtual pipeline. *Treatment of air from Manure Reception Building* The air handling and emissions abatement plant which will serve the Manure Reception Building utilises a multi-stage treatment process to reduce odorous compounds, these are: • *Sulphuric acid scrubber to remove ammonia.* • *High intensity ultraviolet (UV) light which performs cold oxidation of VOCs a treatment termed 'ColdOx UV'. which provides two wavelengths of UV light to both breakdown complex compounds and to produce ozone, which is used to oxidise VOCs.* • *Double layer carbon filter as a final polishing step. The carbon media is a catalyst for ozone which ensures there is no carryover of ozone to the exhaust gas and this reaction prolongs the life of the carbon media.* • *The treated air is released via the emission stack to meet levels below 1,000 ou/m^3.* *Treatment of displaced air from the pasteurisers* *Displaced air* is passed through the Sulphuric acid scrubber (part of the emissions abatement plant serving the Manure Reception Building) before release to mitigate ammonia within emissions. *Treatment of off-gas from digestate storage lagoon* Any digestate stored within the lagoon should be stable due to the treatment it has undergone within the AD plant. The digestate storage lagoon has gas capture. Any captured gasses are piped via a sealed system to an impregnated carbon filter for treatment prior to any emission. *Treatment of displaced air from liquid feedstock tank* Displaced air is passed through an impregnated carbon filter before release to mitigate emissions.

BAT 3	**In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**	
		Treatment of displaced air from liquid digestate off-take points. Displaced air at each off-take point is passed through an impregnated carbon filter before release to reduce ammonia and trace gas emissions.
ii	Information about the characteristics of the wastewater streams	There is no wastewater as all dirty water generated is used in the AD process.
iii	Information about the characteristics of the waste gas streams, such as: • average values and variability of flow and temperature; • average concentration and load values of relevant substances and their variability (e.g., organic compounds, POPs such as PCBs); • flammability, lower and higher explosive limits, reactivity; • presence of other substances that may affect the waste gas treatment system or plant safety (e.g., oxygen, nitrogen, water vapour, dust).	The process will be monitored and controlled to produce good quality biogas and relevant treatment techniques employed. After the initial commissioning and ramp up period it is proposed that methane concentration in the biogas will be approximately 56% and hydrogen sulphide below 1,000ppm. The biogas is stored within the void space of the PowerRing Digesters and in the gas storage dome above the Tertiary Digester. Biogas has a lower explosive limit of approximately 6% by volume and a higher explosive limit of approximately 12% by volume. Waste gas may arise in the form of biogas during periods of extended breakdown and maintenance. Waste biogas will be burnt in the flare. In the case of off-specification biomethane being produced by the BUU, it will be blended back together with the associated CO_2, (which will also be off- specification), and this blended pure biogas stream will be returned to the gas storage dome. In the unlikely event that this causes any over pressure, biogas would be flared. Predicted emissions to air from all release points are detailed or their exclusion justified within the Air Quality Impact Assessment (AQIA) that accompanies the permit application.[5]

[5] Earthcare Technical Ltd (June 2025) Horse Close AD Plant Air Quality Impact Assessment (Doc ref ETL747_HRCL_AQIA_V1.1)

Waste Storage

BAT 4	**In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.**	
a	Optimised storage location. This includes techniques such as: • the storage is located as far as technically and economically possible from sensitive receptors, watercourses, etc.; • the storage is located in such a way so as to eliminate or minimise the unnecessary handling of wastes within the plant (e.g., the same wastes are handled twice or more or the transport distances on site are unnecessarily long).	Manure will be stored in a dedicated Manure Reception Building benefiting from fast-acting roller shutter doors and an air handling and emissions abatement plant. The Manure Reception Building contains a storage area for manure, an internal hopper and a premix system which enables the manure to be blended with digestate separated liquor to be pumped directly into the 2 No. PowerRing Digesters. Therefore, there will be no unnecessary handling of waste just deliveries into the Manure Reception Building. To reduce exposure times, this process will be managed in accordance with the Feedstock Loading & Management Procedure **(HRCL-QUAL-Feedstock Management-WI13-P1**). Slurry and liquid wastes will be delivered into the covered Liquid Feedstock Tank and from there be fed into 2 No. PowerRing Digesters, an enclosed process. The Manure Reception Building is over 298 m away from the nearest residential receptor, Courteenhall East which comprises a collection of residential and commercial buildings, which have been considered within the AQIA[5] for the site. These techniques will reduce the associated environmental risks of handling waste.
b	Adequate storage capacity. Measures are taken to avoid accumulation of waste, such as: • the maximum waste storage capacity is clearly established and not exceeded taking into account the characteristics of the wastes (e.g., regarding the risk of fire) and the treatment capacity; • the quantity of waste stored is regularly monitored against the maximum allowed storage capacity; • the maximum residence time of waste is clearly established.	The waste storage infrastructure can accommodate the proposed waste tonnages with contingency. Annual feedstock tonnages are provided in Table 2 below.

BAT 4 — **In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.**

Table 2 – Feedstock description, sources, form, storage location and proposed maximum tonnages.

Feedstock description	Status (waste / non-waste)	& EWC Code	Source(s) of feedstock	Form	Storage location	Approximate tonnages accepted / treated per year
Maize silage	Non-waste	NA	Grown on farm	Solid	Silage clamp	24,000
Wholecrop	Non-waste	NA	Grown on farm	Solid	Silage clamp	23,600
Straw	Residue	NA	Grown on-farm	Solid	Straw treatment building & silage clamps	20,000
Farmyard manure	Waste	02 01 06	Local farms	Solid	Manure Reception Building	13,800
Chicken manure	Waste	02 01 06	Local farms	Solid	Manure Reception Building	3,000
Pig slurry	Waste	02 01 06	Local farms	Liquid	Liquid Feedstock Tank	*4,500
Cattle slurry	Waste	02 01 06	Local farms	Liquid	Liquid Feedstock Tank	*6,000
Dirty and clean water	Non-waste as utilised	NA	Produced on site	Liquid	Process water tanks	As required to balance tank dry matter
Sludges from washing, cleaning, peeling, centrifuging and separation	Waste	02 03 01	See Note 1	Liquid	Liquid Feedstock Tank	**As required - may replace process water volume as a contingency
Materials unsuitable for	Waste	02 03 04	See Note 1	Liquid	Liquid Feedstock Tank	As above

BAT 4	In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.	

consumption or processing							
sludges from on-site effluent treatment	Waste	02 03 05	See Note 1	Liquid	Liquid Feedstock Tank	As above
Sludges from on-site effluent treatment	Waste	02 04 03	See Note 1	Liquid	Liquid Feedstock Tank	As above
Materials unsuitable for consumption or processing	Waste	02 06 01	See Note 1	Liquid	Liquid Feedstock Tank	As above
Wastes from preserving agents	Waste	02 06 02	See Note 1	Liquid	Liquid Feedstock Tank	As above
Wastes from washing, cleaning and mechanical reduction of raw materials	Waste	02 07 01	See Note 1	Liquid	Liquid Feedstock Tank	As above
Wastes from spirits distillation	Waste	02 07 02	See Note 1	Liquid	Liquid Feedstock Tank	As above
Materials unsuitable for consumption or processing	Waste	02 07 04	See Note 1	Liquid	Liquid Feedstock Tank	As above
Sludges from on-site effluent treatment	Waste	02 07 05	See Note 1	Liquid	Liquid Feedstock Tank	As above
Approximate annual tonnage feedstocks (excluding dirty water and liquid wastes)						**94,900**

*Note 1 – quantities provided are estimated values, should the Site accept slurry to replace manure and process water volume to balance dry matter.

<table>
<tr><td>BAT 4</td><td colspan="2">In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.</td></tr>
<tr><td></td><td></td><td>** Note 2 - the quantities of any additional non-hazardous liquid waste will vary with any inputs replacing process water volume as a contingency. The potential quantities that might be accepted are explores further within the Odour Management Plan (OMP) (HRCL-ETL-OMP-RPT-P1).

Waste storage capacities and theoretical maximum residence times are detailed in Table 3 below:
Table 3 – Theoretical maximum Waste Storage Capacities & Residence Times
<table>
<tr><th>Waste type</th><th>Storage location</th><th>Maximum residence time</th><th>Maximum stored at any one time (tonnes)</th></tr>
<tr><td>Chicken manure, farmyard manure</td><td>Manure Reception Building</td><td>21 days</td><td>400</td></tr>
<tr><td>Slurry (pig or dairy)</td><td>Liquid Feedstock Tank</td><td>14 days</td><td>402</td></tr>
<tr><td>Liquid Wastes (02 03 01, 02 03 04, 02 03 05, 02 04 03, 02 06 01, 02 06 02, 02 07 01, 02 07 02, 02 07 04, 02 07 05)</td><td>Liquid Feedstock Tank</td><td>14 days</td><td>*402</td></tr>
<tr><td colspan="3">Total maximum tonnage of waste at any one time</td><td>802</td></tr>
</table>
*Note 1 – any liquid waste listed will be in place of process water and Slurry. With no additional storage for liquid wastes other than that provided by the Liquid Feedstock Tank. The maximum tonnage of waste stored on Site at any one time will be 802 tonnes.</td></tr>
<tr><td>c</td><td>Safe storage operation. This includes measures such as:
equipment used for loading, unloading and storing waste is clearly documented and labelled;
wastes known to be sensitive to heat, light, air, water, etc. are protected from such ambient conditions;
containers and drums are fit for purpose and stored securely.</td><td>The wastes streams accepted for processing are not sensitive to heat, light, air, water etc. and therefore do not need to be protected from ambient conditions.

Storage buildings and tanks ensure that materials are stored securely.</td></tr>
<tr><td>d</td><td>Separate area for storage and handling of packaged hazardous waste. When</td><td>Hazardous waste is not accepted.</td></tr>
</table>

BAT 4	**In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.**	
	relevant, a dedicated area is used for storage and handling of packaged hazardous waste.	

Waste Handling & Transfer

BAT 5	**In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures.**	
	Handling and transfer of waste are carried out by competent staff.	All waste handling and transfer activities are carried out by trained staff in accordance with the Feedstock Acceptance and Rejection Procedure **(ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1).**
	Handling and transfer of waste are duly documented, validated prior to execution and verified after execution;	All feedstocks coming into site will be recorded on the weighbridge and the data stored on the weighbridge computer. This includes feedstock type, tonnage, date, and time. Waste feedstocks will be fed into the manure hopper within the Manure Reception Building in accordance with a Daily feed recipe and the Feedstock Loading & Management Procedure **(HRCL-QUAL-Feedstock Management-WI13-P1)**. Slurry and any supplementary Liquid Wastes will be pumped from the Liquid Feedstock Tank into the 2 No. PowerRing Digesters in accordance with the Daily feed recipe. The actual feedstocks tonnages will be recorded for each feeding event.
	Measures are taken to prevent, detect and mitigate spills;	The Standard Operating Procedures include measures to prevent spillages occurring. However, in the case of a spillage occurring an Accident Management Plan Manual **(HRCL-ETL-AMP-RPT-P1)** and associated emergency procedures including the Spill Control/Use of Spill Kit Procedure **(HRCL-QUAL-Spill control/Use of spill kits-WI24-P1)** are in place.
	Operation and design precautions are taken when mixing or blending wastes (e.g., vacuuming dusty/powdery wastes).	Wastes will not be mixed until they enter the enclosed AD infrastructure of pipes and vessels.

Monitoring

BAT 6	**For relevant emissions to water as identified by the inventory of waste water streams (see BAT 3), BAT is to monitor key process parameters (e.g., waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g., at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).**
	There are no emissions to water. Dirty water from the silage clamps and feeder loading area, separator bunker and secondary digestate offtake point is collected and reused in the process. Water collecting within the secondary containment system and roofs is used within the AD process under normal operating conditions. Clean rainwater from the designated clean areas of the site including vehicle access and movement areas (via a full retention separator) and roofs may be discharged from the Clean Water Lagoon through a flow control device as the restricted rate of 32.88 litres per second into the watercourse to the north west Site boundary.

BAT 7	**BAT is to monitor emissions to water with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.**
	Not applicable, see BAT 6.

Monitoring of Point Source Emissions to Air

BAT 8	**BAT is to monitor channelled emissions to air with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.**	
H_2S	Once every six months. No EN standard available. See BAT 34	Monitoring of the Manure Reception Building emissions abatement plant to be carried out in accordance with permit requirements.
NH_3	Once every six months. No EN standard available. See BAT 34	As above
Odour concentration	Once every six months EN 13725. The monitoring of NH_3 and H_2S may be used as an alternative to the monitoring of the odour concentration. See BAT 34	As above

BAT 9 Not Applicable

BAT 10	**BAT is to periodically monitor odour emissions.**	
	Odour emissions can be monitored using: • EN standards (e.g., dynamic olfactometry according to EN 13725 in order to determine the odour concentration or EN 16841-1 or -2 in order to determine the odour exposure); • when applying alternative methods for which no EN standards are available (e.g., estimation of odour impact), ISO, national or other international	An Odour Management Plan forms part of the Environmental Management System **(HRCL-ETL-EMS-MAN-P1).** Daily olfactory qualitative monitoring checks will be carried out in accordance with the Odour Monitoring Procedure **(HRCL-ETL-Odour Monitoring -WI19-P1)** as part of daily checks and recorded within the Daily Checks **(HRCL-QUAL-Daily Checks-AQD 24-P1).** If there are no odour issues detected, then this frequency may be reduced. Quantitative odour and / or ammonia monitoring will be carried out as required in accordance with BAT and permit requirements (BAT 8).

	standards that ensure the provision of data of an equivalent scientific quality. The monitoring frequency is determined in the odour management plan (see BAT 12).	

Material Efficiency

BAT 11	**BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.**	
	Monitoring includes direct measurements, calculation or recording, e.g., using suitable meters or invoices. The monitoring is broken down at the most appropriate level (e.g., at process or plant/installation level) and considers any significant changes in the plant/installation	ABL will maintain a record of: • Wastes accepted for treatment via weighbridge computer and Waste Transfer Notes • Energy used • Raw materials used: Oil, Diesel, Ferric Hydroxide Powder, carbon, Sulphuric Acid, Oxygen, Glycol, Ad-Blue, De-foaming Oil (e.g. Biodegradable Oil), Activated Carbon, Propane, Odorant and Natural Gas. An inventory of Raw Materials is provided as part of the permit application.[6] • Digestate produced • Biomethane production • Electricity generation and use • Heat generation and use ABL will report the following to the EA on an annual basis, or as stipulated in the Environmental Permit. • Waste in and out (waste returns) on a quarterly basis • Digestate production • Raw material usage • CHP engine usage • CHP engine efficiency • Flare operation • Biomethane exported • Energy usage; and • Water usage

[6] Earthcare Technical Ltd (December 2024) Horse Close AD Plant Raw Materials Inventory (ETL747/Raw Materials/V1.0)

Fugitive Emissions to Air

BAT 12	**In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**	
	A protocol containing actions and timelines;	An Odour Management Plan (OMP) **(HRCL-ETL-OMP-RPT-P1)** is in place as part of the Environmental Management System and includes a protocol containing actions and timelines.
	A protocol for conducting odour monitoring as set out in BAT 10;	The OMP contains a section on odour monitoring as described in BAT 10. Point source emission monitoring from the emissions abatement plant stack will be carried out periodically and in accordance with EN standards (e.g., dynamic olfactometry according to EN 13725 in order to determine the odour concentration), if required by permit conditions.
	A protocol for response to identified odour incidents, e.g., complaints;	The OMP contains a section detailing the protocol for responding to odour incidents including complaints.
	An odour prevention and reduction programme designed to identify the source(s); to characterise the contributions of the sources; and to implement prevention and/or reduction measures.	The OMP includes an odour prevention and reduction programme designed to identify the source(s); to characterise the contributions of the sources; and to implement prevention and/or reduction measures.

BAT 13	**In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given below.**	
a	Minimising residence times	The maximum storage time for solid manure is 21 days and for liquid waste including slurry is 14 days.
b	Using chemical treatment	The emissions abatement plant for the Manure reception building utilises chemical treatment: • *Sulphuric acid scrubber to remove ammonia.* • *High intensity ultraviolet (UV) light treatment termed 'ColdOx UV' which provides two wavelengths of UV light to both breakdown complex compounds and to produce ozone, which is used to oxidise VOCs.* • *Followed by carbon filters for polishing.* The carbon filter for the Liquid feedstock tank, Digestate storage lagoon and Digestate off-take points will be impregnated to assist in ammonia removal.
c	Optimising aerobic treatment	This technique is not used.

BAT 14	**In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below.**	
a	Minimising the number of potential diffuse emission sources. This includes techniques such as: • appropriate design of piping layout (e.g., minimising pipe run length, reducing the number of flanges and valves, using welded fittings and pipes); • favouring the use of gravity transfer rather than using pumps; • limiting the drop height of material; • limiting traffic speed; and • using wind barriers.	The plant design is optimised to reduce pipe run lengths, flanges, and valves. Vehicles are restricted to 7 miles per hour on site as a health and safety measure; this also reduces potential noise and dust emissions. Materials that are liable to release diffuse emissions are stored appropriately to minimise emission release: • *Manure will be stored and treated in a Manure Reception Building* • *Straw will be stored in a dedicated Straw Treatment Building, with the moist extruded Straw stored externally within the Straw Bunker prior to feeding. Approximately 4,000 tonnes of straw will be stored within the clamps for up to 10 weeks prior to the maize harvest. See Section 3 Conclusions and Recommendations for discussion.* • *Silage is stored within backfilled silage clamps, which are covered and kept with a tidy cutting face in accordance with the Feedstock Management & Loading Procedure (**HRCL-QUAL-Feedstock Management-WI13-P1**).* • *Digestate liquor is stored within a covered Digestate Storage Lagoon.* • *Digestate separators and the resulting fibre digestate are stored within a covered bunker. The bunker has a roof and a roller shutter door opening. The digestate fibre will be removed periodically during the day from site to destination field heaps. The front roller shutter door is only open for 20 minutes whilst loading and closed thereafter. This is carried out in accordance with the Digestate Handling Procedure (**HRCL-QUAL-Digestate Handling (Solid and liquid)-WI25-P1**).* Fugitive emissions of odour are monitored daily in accordance with the Odour Monitoring Procedure **(HRCL-ETL-Odour Monitoring -WI19-P1)** and controlled in accordance with the Odour Management Plan **(HRCL-ETL-OMP-RPT-P1)** and recorded in the Daily Checks **(HRCL-QUAL-Daily Checks-AQD 24-P1).**
b	Selection and use of high- integrity equipment. This includes techniques such as:	All equipment and systems on site are supplied as per vendors original specification and are maintained to that standard or above thereafter when replacing. There are examples within the site infrastructure of all the techniques listed.

BAT 14	**In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below.**	
	• valves with double packing seals or equally efficient equipment; • high-integrity gaskets (such as spiral wound, ring joints) for critical applications; • pumps/compressors/agitators fitted with mechanical seals instead of packing; • magnetically driven pumps/ compressors/agitators;	
c	Corrosion prevention	Materials are selected for suitability and longevity. Biogest® have stipulated that Digesters are to be fitted with Agrotel CenoTec concrete protection WireTarp which operates as corrosion protection layer. The WireTarp is comprised of polypropylene loop fabric (on concrete side) and full-surface polypropylene coating (shuttering side). It is impermeable to gas and liquids ensuring resistance to aggressive materials All piping containing digestate will be constructed of stainless steel or HDPE. All biogas carrying pipework will be constructed of stainless steel.
d	Containment, collection and treatment of diffuse emissions	The Manure reception building benefits from an air handling and emissions abatement plant to collect and treat diffuse emissions. The Liquid feedstock tank benefits from a carbon filter to treat displaced air. All the tanks (except the liquid feedstock tank) are enclosed with pressure and vacuum relief where required. The digestate separator is in a covered bunker but there is no collection and treatment of diffuse emissions. The bunker doors are open only for periodic loading of digestate fibre. See Section 3 Conclusions and Recommendations for discussion. The digestate liquor is stored in a covered storage lagoon with gas capture and treatment through a carbon filter. There is a carbon filter on each vent for displaced air during off-take of digestate liquor from the lagoon.

BAT 14	**In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below.**	
e	Dampening	Dust raising will be minimal due to the hard surfaces throughout the site which will be kept clean. However, if there are any emissions of dust observed as part of daily site inspections (Daily Checks (**HRCL-QUAL-Daily Checks-AQD 24-P1)** then dust suppression will be carried out with a water bowser (Dust Procedure **(HRCL-ENV-Dust Control-WI17-P1)).**
f	Maintenance	All plant and equipment are subject to a planned preventative maintenance programme in accordance with the Maintenance Planner **(HRCL-QUAL-Maintenance Planner-AQD 27-P1).**
g	Cleaning of waste treatment and storage areas	The Manure Reception Building will be cleaned down periodically when empty. Spillages will be identified during Daily Checks **(HRCL-QUAL-Daily Checks-AQD 24-P1)** and cleaned up as soon as practicably possible.
h	Leak detection and repair (LDAR) programme	There will be a Leak Detection and Repair (LDAR) Programme in place for the operational site which will be used to measure levels of VOCs, including methane from a number of monitoring points around the site as identified through a Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) risk assessment **(HRCL-ABL-DSEAR Risk Assessment-H&S-P1)** and LDAR programme. LDAR inspections will be carried out by a third party annually, as a minimum as well as more regularly by the Operator.

Emissions from Flaring

BAT 15	**BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns) by using both of the techniques given below.**	
a	Correct plant design. This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves.	Biogas will not be routinely flared to atmosphere. The flare will only used during periods of extended BUU maintenance and during abnormal operating conditions should the biogas storage become full. Biogas storage is provided within the void space of the PowerRing Digesters and the double membrane gas storage dome located on the Tertiary Digester. The total biogas storage capacity is 6,129m^3 which is more than 2.65 hours of production. This storage capacity allows for planned routine BUU maintenance events when the gas storage levels will be reduced prior to shut down. Biogas pressure is measured by gas pressure sensors within the gas storage infrastructure and is controlled by site control systems, to ensure process parameters are optimised such that gas production meets demand, and storage capacity is not exceeded, preventing a release to atmosphere via Pressure and Vacuum Relief Valves (PVRVs). If, due to equipment or system failure, excess biogas is produced the flare will automatically and immediately ignite and burn the biogas to ensure it is not released to the atmosphere. The flare is a ground enclosed BAT compliant flare which is sized appropriately; it can burn between 500 to 2,600 Nm^3hr (variable) of biogas. The theoretical maximum production of biogas is 2,315Nm^3/hr. Given that the CHP plant will also consume biogas, the expected maximum production of biomethane from the BUU is around 1,301 Nm^3/hr. The appropriate flare capacity has been calculated considering these figures and worst-case scenarios for production of off-specification biomethane. The setting on SCADA will dictate that the emergency flare will automatically start before the PVRVs will release gas, meaning that they are only in place for unforeseen emergency use.
b	Plant management. This includes balancing the gas system and using advanced process control.	Gas pressure monitors are in all the gas holding domes and tanks. Gas pressure is monitored via SCADA and is primarily regulated via utilisation in the BUU. Biogas may also be used in the CHPs in biogas mode or by the emergency boiler.

BAT 15	**BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns) by using both of the techniques given below.**	
		The regulation of gas pressure is fully automated and SCADA links gas pressure readings with mixing within the tanks. SCADA is set such that the flare will automatically operate at a lower pressure than that at which the PVRVs are set to release. SCADA will alarm if: • *the emergency flare is in operation.* • *the BUU trips.* • *the emergency boiler in biogas mode trips* • *the CHP(s) trips* The Site Manager or Nominated Competent Person is responsible for evaluating the root cause of the alarm and acting accordingly to resolve the problem. This may require re-setting of equipment.

BAT 16	**In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use (both of) the techniques given below.**	
a	Correct design of flaring devices. Optimisation of height and pressure, assistance by steam, air or gas, type of flare tips, etc., to enable smokeless and reliable operation and to ensure the efficient combustion of excess gases.	The emergency flare is a ground enclosed high temperature flare (Himmel MTU 3000-HT) which can burn up to 2,600 m^3/hr of biogas. In line with Appropriate measures for biological treatment[3] the flare burns at >1,000°C for in excess of 0.3 seconds. The flare stack is 10.5m high and 1.86m in diameter.
b	Monitoring and recording as part of flare management. This includes continuous monitoring of the quantity of gas sent to flaring. It may include estimations of other parameters (e.g., composition of gas flow, heat content, ratio of assistance, velocity, purge gas flow rate, pollutant emissions (e.g., NO_X, CO, hydrocarbons), noise). The recording of flaring events usually includes the duration and number of events and allows for the quantification of emissions and the potential prevention of future flaring events.	The number of operating hours for the flare will be recorded on the SCADA system and this information will be submitted to the EA annually in accordance with the Environmental Permit. The recording of the time that the flare is in use along with a cumulative gas flow meter on the gas line allows a calculation to be made to estimate the quantity of emissions. It is in the economic interests of the ABL to reduce the amount of biogas lost to flaring and to conduct a root cause analysis to reduce the potential for future flaring events.

Noise & Vibration

BAT 17	**In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**	
	A protocol containing appropriate actions and timelines;	The applicability of BAT 17 is restricted to cases where a noise or vibration nuisance at sensitive receptors is expected and/or has been substantiated. The Environment Agency's Qualitative Noise Screening Assessment Tool (QNST) has been completed for the Site and is included with the permit application. The QNST concludes that neither a Noise Impact Assessment nor a Noise Management Plan are required for the permit application. If noise emissions are detected off-site then corrective actions will be taken as soon as possible and a Noise Management Plan (NMP) will be developed, submitted to the EA and implemented. The NMP would incorporate all the elements of BAT 17. A Noise Impact Assessment was carried out as part of the planning permission application for the site.[7] The findings verified those of the report concluded: *The numerical assessment during the daytime has concluded a low impact at the noise-sensitive receptors; the plant emissions rating level has been predicted to lie significantly below the representative background sound level, in the order of at least 12 dB(A).* *The numerical assessment during the night-time has concluded a low impact at the noise-sensitive receptors; the plant emissions rating level has been predicted to lie 6 dB(A) below the representative background sound level at West Lodge Farm or at least 10 dB(A) below the representative background sound level at all other receptors.* *The impact from the proposed plant has been considered in context in accordance with BS 4142 guidance; the contextual considerations have been shown to support an assessment of low impact development based on the very low predicted noise emissions rating level and the character of the industrial sound and the character and magnitude of the residual sound.* *It is concluded that noise should not present reasonable grounds for planning refusal. The likely acoustic effects have been established about the NOAEL and LOAEL thresholds of the NPSE, such that noise is*

[7] Noise Impact Assessment, Ref: 404.11923.00004_0015, SLR Consulting, Version No: Final, November 2022

		not expected to cause any change in behaviour or attitude. Following local Council guidance and policy interpretation, the impact has been described about the 'NOEL - No Observed Effect Level' where the rating level is below the background sound level. Mitigation has been included in the noise emissions predictions, to include proprietary plant equipment attenuation including CHP stack silencers." The M1 is approximately 190m, as the crow flies, from the proposed site. In addition, the nearest sensitive receptor to the site is Courteenhall East Lodge is located approximately 211m north of the proposed site boundary and comprises a collection of residential and commercial buildings.
	A protocol for conducting noise and vibration monitoring;	As above.
	A protocol for response to identified noise and vibration events, e.g., complaints;	As above.
	A noise and vibration reduction programme designed to identify the source(s), to measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.	As above.

BAT 18	**In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below.**	
a	Appropriate location of equipment and buildings. Noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating building exits or entrances.	The nearest sensitive receptor to the site is Courteenhall East Lodge where there is a collection of residential and commercial buildings approximately 211m north of the proposed site boundary. The site layout is such that the nearest sensitive receptors benefit from natural screening in the form of a 6.5 ha area of woodland immediately adjacent to the northern site boundary. Noise mitigation has been incorporated into the design to include proprietary plant equipment attenuation including CHP stack silencers.
b	Operational measures. This includes techniques such as: • inspection and maintenance of equipment; • closing of doors and windows of enclosed areas, if possible; • equipment operation by experienced staff; • avoidance of noisy activities at night, if possible; • provisions for noise control during maintenance, traffic, handling and treatment activities.	Operational measures to reduce noise emissions include: • Planned preventative maintenance of plant and equipment including the flare and the CHPs in accordance with the Maintenance Planner **(HRCL-QUAL-Maintenance Planner-AQD 27-P1).** • Only trained staff are able to operate equipment. • The normal operational hours for the site are 0700 to 1900, Monday to Sunday inclusive, thus avoiding night-time operations. The planning permission restricts deliveries of agricultural by-products to the site to between 0800- and 1800-hours Monday – Friday and 0800 to 1300 Saturday. The export of digestate is restricted to take place between the hours of 0800- and 1800-hours Monday – Friday and 0800 to 1300 Saturday and Sunday. In addition to the above hours, during periods of specific agronomic crop benefit in March, May and July the export of digestate can take place between 0800- and 1800-hours Monday – Sunday.
c	Low-noise equipment. This may include direct drive motors, compressors, pumps and flares	The compressed air distribution system utilises piston compressors which are fitted with lightweight low-noise reed valves. The CHPs emit up to 93dB(A) at a distance of 1m.

BAT 18	**In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below.**	
d	Noise and vibration control equipment. This includes techniques such as: • noise reducers; • acoustic and vibrational insulation of equipment; • enclosure of noisy equipment; • soundproofing of buildings.	The CHPs, BUU, biomethane compressors and CO_2 compressors will be provided with acoustic enclosures
e	Noise attenuation. Noise propagation can be reduced by inserting obstacles between emitters and receivers (e.g., protection walls, embankments and buildings).	This technique is not used.

Emissions to Water

BAT 19	**In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below.**	
a	Water management. Water consumption is optimised by using measures which may include: • water-saving plans (e.g., establishment of water efficiency objectives, flow diagrams and water mass balances); • optimising the use of washing water (e.g., dry cleaning instead of hosing down, using trigger control on all washing equipment);	The water required for the straw pre-treatment is primarily sourced from rainwater harvesting on site. The water for the AD process will be provided from dirty and clean water collected on site, from emptying the secondary containment sump and from reuse of rainwater. Penstocks in the clean water system allow for diversion of clean water into process water capture at times of low rainfall. In exceptional circumstances if additional water is required it will be sourced from the mains water supply.
b	Water recirculation	The recirculation of clean and dirty water is optimised as described above and shown in Appendix B Drainage Process Flow Diagram.
c	Impermeable surface. Depending on the risks posed by the waste in terms of soil and/or water contamination, the surface of the whole waste treatment area (e.g., waste reception, handling, storage, treatment and dispatch areas) is made impermeable to the liquids concerned.	The dirty areas benefit from an impermeable concrete surface with sealed drainage back to the AD process. Clean water from hard surfaces is collected separately and the excess is discharged to the Clean Water Lagoon. Lower risk areas where a hard surface is not required for vehicle movement have natural surface drainage to allow groundwater recharge where possible.
d	Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels. Depending on the risks posed by the liquids contained in tanks and vessels in terms of soil and/or	All the tanks benefit from high level sensors and alarms. If a high-level alarm in a digester is activated the SCADA system will automatically stop the feed pumps until alarms are cleared Operational procedures ensure regular direct monitoring of digester levels are undertaken to confirm the sensor levels. These monitoring levels are recorded and compared with set feed rates to prevent

BAT 19	**In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below.**	
	water contamination, this includes techniques such as: • overflow detectors; • overflow pipes that are directed to a contained drainage system (i.e., the relevant secondary containment or another vessel); • tanks for liquids that are located in a suitable secondary containment; the volume is normally sized to accommodate the loss of containment of the largest tank within the secondary containment; • isolation of tanks, vessels and secondary containment (e.g., closing of valves).	overfilling. Liquid level sensors will prevent any more liquid going into a tank and hence prevent overflow occurring. The secondary containment system has been designed in accordance with Construction Industry Research and Information Association (CIRIA) 736F[8]; the containment capacity calculations have allowed for110% of the largest tank capacity as this is greater than 25% of the of the total tank volume in accordance with the CIRIA guidance. Full details on the secondary containment system design can be found in a report by GGP Consult (consulting engineering company) which supports this permit application.[9] The sump within the secondary containment bund is isolated and can only be emptied via actively pumping out to the process water tanks (2 No. Dirty Water Tanks and the Silage Effluent Tank). Additional buffer storage is provided by the Dirty Water Lagoon (510m^3).
e	Roofing of waste storage and treatment areas	Manure will be stored and treated within the Manure Reception Building and fed via sealed pipework into the digesters. Slurry and liquid waste will be stored in the covered Liquid Feedstock Tank, piped to the digesters, and treated within tanks.
f	Segregation of water streams	The site has been designed with segregation of clean and dirty water as described in Section 6.3 of the EMS Manual **(HRCL-ETL-EMS-MAN-P1)**.

[8] Containment systems for the prevention of pollution (C736F), CIRIA, London 2014

[9] Primary & Secondary Containment Report With Bund Capacity Calculations, Horse Close AD, GGP-29384-CON-03, GGP Consult, February 2025

BAT 19	**In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below.**	
g	Adequate drainage infrastructure. The waste treatment area is connected to drainage infrastructure. Rainwater falling on the treatment and storage areas is collected in the drainage infrastructure along with washing water, occasional spillages, etc. and, depending on the pollutant content, recirculated or sent for further treatment.	All dirty water from waste or non-waste feedstock storage and treatment areas including water from the secondary containment system is collected and used within the AD process under normal operating conditions. The drainage system and process water storage capacities have been sized appropriately to allow for flood events and accounting for climate change. The drainage strategy is detailed in the Drainage Impact Assessment[10] for the site which supports this permit application.
h	Design and maintenance provisions to allow detection and repair of leaks. Regular monitoring for potential leaks is risk-based, and, when necessary, equipment is repaired. The use of underground components is minimised. When underground components are used and depending on the risks posed by the waste contained in those components in terms of soil and/or water contamination, secondary containment of underground components is put in place.	The concrete slab over the site will be placed over an HDPE liner to allow for leak detection via 1 No. leak detection pot. The 3 No. digesters will be constructed by Wolf (construction company) using a precast post tension wall construction with a cast in-situ slab. The digesters will sit slightly below the main containment slab due to the floor falls to aid in drainage to the secondary containment system sump to the south of the site. Given the tank is located below the bund slab a leak detection system has been incorporated Wolf to allow for leak detection of each tank. This system will be sealed to prevent leaks escaping into the lower HDPE membrane and or liquid flowing into the system from above. The 1 No. leak detection pots to HDPE layer (under concrete slab) and the 3 No. Digester leak detection pots to be inspected daily in accordance with Daily Checks **(HRCL-QUAL-Daily Checks-AQD 24-P1).** All other tanks will sit upon the base concrete slab of the site such that any leaks can be visually detected. Digestate liquor will be stored within a lined Storage Lagoon. There will be a leak detection pipe such that any liquid collecting within the liner can be checked for leaks and spills on a daily basis.

[10] Drainage Impact Assessment, Horse Close AD, GGP-29348-CD-DIA-08, GGP Consult, February 2025

BAT 19	**In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below.**	
		Underground pipework has been avoided where possible and with the exception of a small stretch of HDPE pipework beneath the farm track, transferring separated liquor digestate to the Digestate Lagoon. The lagoon pipework benefits from secondary containment and leak detection. Drainage pipework which will be made of suitable material e.g., Poly Vinyl Chloride (PVCu) and sealed, and pressure tested (water & air) prior to completion. All drainage within the containment system will be located above the 1.0mm HDPE membrane, with pipes, channels & chambers to have minimum 175mm concrete surround. The below ground Silage Effluent Tank will have a secondary liner under the full extent of the tank, carried up to the surface and sealed. A leak detection chamber will be provided between the tank and the liner which will be inspected daily in accordance with Daily Checks **(HRCL-QUAL-Daily Checks-AQD 24-P1).**
i	Appropriate buffer storage capacity is provided for waste water generated during other than normal operating conditions using a risk-based approach (e.g., taking into account the nature of the pollutants, the effects of downstream waste water treatment, and the receiving environment). The discharge of waste water from this buffer storage is only possible after appropriate measures are taken (e.g., monitor, treat, reuse).	In the case of abnormal excess water levels due to an extreme rainfall event clean water from the secondary containment system may be released to the wider environment following pre-determined checks detailed within the Discharge of Flood Water Procedure **(HRCL-QUAL-Draining Management and control-WI23-P1)**.

BAT 20 – not applicable (waste water treatment)

Emissions from Accidents and Incidents

BAT 21	**In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given below, as part of the accident management plan (see BAT 1)**	
a	Protection measures. These include measures such as: • protection of the plant against malevolent acts; fire and explosion protection system, containing equipment for prevention, detection, and extinction; and • accessibility and operability of relevant control equipment in emergency situations.	The site will benefit from: • *2.4m high anti-climb mesh fencing installed around the core site, in addition to a safety fence around the covered Digestate storage lagoon, Clean Water Lagoon and Dirty Water Lagoon.* • *Double leaf vehicle access gates and a pedestrian access gate.* • *CCTV installed and operational remote cameras. The site will be manned from 07:00 to 19:00 and the CCTV will be remotely monitored out of hours.* • *Main gate will be locked when the Site is not manned.* A DSEAR assessment **(HRCL-ABL-DSEAR Risk Assessment-H&S-P1)** will be carried out and recommendations actioned. All process elements of the plant can be operated remotely via telemetry.
b	Management of incidental/accidental emissions. Procedures are established and technical provisions are in place to manage (in terms of possible containment) emissions from accidents and incidents such as emissions from spillages, firefighting water, or safety valves	An Accident Management Plan Manual **(HRCL-ETL-AMP-RPT-P1)** and associated Emergency SOPs will be trained out to operational staff and include: • Procedure for Reporting Incidents & Accidents **(ABL-QUAL-INCIDENTS & ACCIDENTS-PRO-P1)** • Spill Control Procedure **(HRCL-QUAL-Spill control/Use of spill kits-WI24-P1)** • Control Panel Alarm Response **(HRCL-QUAL-Control Panel Alarm Response-WI07-P1)** • Fire & Explosion Response Procedure **(HRCL-QUAL-Fire & Explosion Response-WI08-P1)** • Biogas Leak Response Procedure **(HRCL-QUAL-Biogas Leak Response-WI09-P1)** • Foam Response Procedure **(HRCL-QUAL-Foam Response-WI04-P1)** • Main Power Outage Response Procedure **(HRCL-QUAL-Mains Power Outage Response WI05-P1)** • Safe Shutdown Procedure **(HRCL-QUAL-Safe Shutdown-WI06-P1)** • Flood Response Procedure **(HRCL-QUAL-Flood Response and discharge of flood water-WI10-P1)**

		• Reduced Gas Grid Demand Contingency Plan **(HRCL-QUAL-Reduced Gas Grid Demand Contingency plan-WI11-P1)** • Discharge of Flood Water Procedure **(HRCL-QUAL-Draining Management and control-WI23-P1)** Due to the proposed volume of flammable gases to be stored on site, the site is designated as a Lower Tier COMAH site, regulated by HSE as the competent authority and therefore there will also be a Major Incident Prevention Policy (MAPP) in place.
c	Incident/accident registration and assessment system. This includes techniques such as: • a log/diary to record all accidents, incidents, changes to procedures and the findings of inspections; and • procedures to identify, respond to and learn from such incidents and accidents.	In accordance with the Procedure for Reporting Incidents & Accidents **(ABL-QUAL-INCIDENTS & ACCIDENTS-PRO-P1**), it is the responsibility of the Site Manager to report any incidents to the EA incident hotline (0800 807060) as soon as practicably possible and in all cases within 12 hours of the incident or breach of permit to include: • *Damage or danger to the natural environment;* • *Pollution to water or land; and* • *Any incident which is causing or may cause significant pollution including breakdowns or failure of equipment or techniques and accidents*. It is the responsibility of the Site Manager to carry out the following steps after the incident: • *Use the Accident and Incident Report Form **(ABL-QUAL-Accident and Incident Report-AQD19-P1)** to record the details of the incident, the consequences (pollution/ damage/ breaches etc.), people involved and immediate response activities that were carried out.* • *Conduct an investigation using the Accident and Incident Report Form **(ABL-QUAL-Accident and Incident Report-AQD19-P1)** for incidents with an impact (or potential impact) on the environment finding the root cause(s) of the incident and identifying corrective action(s).* • *Ensure that a regular review of outstanding actions is undertaken, to ensure that the corrective actions are followed through to completion.* • *On completion of the corrective actions (where identified), update the form with completion dates and file the form for future reference.*

		• *Provide written confirmation to the EA of all pollution incidents and breaches of emissions within 24 hours, completing Part A of the Schedule 5 Notification form. Further details arising from further investigation into the incident are to be included within Part B of the Schedule 5 when available.* Corrective actions to be logged and tracked in the Non-conformance & Corrective Action Log **(ABL-QUAL-NCCAR-Log-R1**).

Material Efficiency

BAT 22	**In order to use materials efficiently, BAT is to substitute materials with waste.**	
a	Waste is used instead of other materials for the treatment of wastes (e.g., waste alkalis or waste acids are used for pH adjustment, fly ashes are used as binders).	There is limited use of raw materials. Raw material use is recorded and minimised where possible and options to replace raw materials with waste will be considered where appropriate.

Energy Efficiency

BAT 23	**In order to use energy efficiently, BAT is to use both of the techniques given below.**	
a	Energy efficiency plan. An energy efficiency plan entails defining and calculating the specific energy consumption of the activity (or activities), setting key performance indicators on an annual basis (for example, specific energy consumption expressed in kWh/tonne of waste processed) and planning periodic improvement targets and related actions. The plan is adapted to the specificities of the waste treatment in terms of process(es) carried out, waste stream(s) treated, etc.	Heat and electricity are provided by the CHP engines, (which are subject to a maintenance and service contract) except in the case of power failure. Power will then be provided by the emergency generator. If the CHPs are undergoing prolonged maintenance or in the case of periods of breakdown, the emergency boiler may be used to provide the shortfall in heat for the digesters and pasteurisers. Energy consumption is continuously monitored, and records are retained and reviewed to understand energy flows around the site. Records of primary energy used, energy generated, and energy exported, etc. are maintained and an annual return will be made to the EA in accordance with permit requirements under an Installation permit. An energy efficiency plan is being developed by ABL.
b	Energy balance record. An energy balance record provides a breakdown of the energy consumption and generation (including exportation) by the type of source (i.e., electricity, gas, conventional liquid fuels, conventional solid fuels, and waste). This includes: • information on energy consumption in terms of delivered energy; • information on energy exported from the installation; • energy flow information (e.g., Sankey diagrams or energy balances) showing how the energy is used throughout the process. The energy balance record is adapted to the specificities of the waste treatment in terms of	A Sankey diagram is being developed by ABL and a DRAFT of this document has been included with the application.

BAT 23	**In order to use energy efficiently, BAT is to use both of the techniques given below.**	
	process(es) carried out, waste stream(s) treated, etc.	

Waste Reduction

BAT 24	**In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1).**	
	Packaging (drums, containers, IBCs, pallets, etc.) is reused for containing waste, when it is in good condition and sufficiently clean, depending on a compatibility check between the substances contained (in consecutive uses). If necessary, packaging is sent for appropriate treatment prior to reuse (e.g., reconditioning, cleaning).	Packaged and containerised wastes are not received. The wastes treated on site (manure, slurries and potentially some limited liquid wastes) do not contain any residual waste and therefore there is no requirement for a Residues Management Plan. Powdered ferric hydroxide will be used to adjust H_2S and iron levels within the digesters, fed via the feed hoppers within a biodegradable paper bag. No packaging remains.

BAT 25-32 Not Applicable (mechanical treatment of waste when it is not combined with biological treatment)

General BAT conclusions for the biological treatment of waste

BAT 33	**In order to reduce odour emissions and to improve the overall environmental performance, BAT is to select the waste input.**	
	The technique consists of carrying out the pre-acceptance, acceptance and sorting of the waste input (see BAT 2) so as to ensure the suitability of the waste input for the waste treatment, e.g., in terms of nutrient balance, moisture or toxic compounds which may reduce the biological activity.	The EMS procedures for waste pre-acceptance and acceptance (see BAT 2) ensure that waste is only accepted at the facility if it is suitable for treatment within an anaerobic digester. The AD plant is fed in accordance with a daily feed recipe which is informed by feedstock supply planning, process monitoring and process management by balancing dry matter content and digestibility to maximise plant efficiency and reduce odour emissions from both the AD facility and the resulting digestate.

BAT 34	**In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds, including H_2S and NH_3, BAT is to use one or a combination of the techniques given below.**		
a	Adsorption	Air from the Manure reception building will be treated via a bespoke emissions abatement plant which comprises a double layer carbon filter as a final polishing step. There will impregnated carbon filters to treat: • *displaced air from the Liquid feedstock tank;* • *residual biogas from the Digestate storage lagoon; and* • *displaced air from the Digestate off-take points*	
b	Biofilter	Not applicable.	
c	Fabric filter	Not applicable.	
d	Thermal oxidation	Not applicable.	
e	Wet scrubbing	Air from the Manure Reception Building will be treated via a bespoke emissions abatement plant the first stage of which comprises a sulphuric acid scrubber to remove ammonia.	
BAT-associated emission levels (BAT-AELs) for channelled NH_3, odour, dust and TVOC emissions to air from the biological treatment of waste			
Ref	**Parameter**	**BAT-AEL (Average over the sampling period)**	
Table 6.7	NH_3 - mg/Nm^3	Not applicable	This BAT-AEL does not apply to the treatment of waste mainly composed of manure.
Table 6.7	Odour concentration - ou_E/Nm^3	Not applicable	This BAT-AEL does not apply to the treatment of waste mainly composed of manure.

BAT 35	**In order to reduce the generation of waste water and to reduce water usage, BAT is to use all of the techniques given below.**	
a	Segregation of water streams	This is detailed within the response to BAT 19.
b	Water recirculation	This is detailed within the response to BAT 19.
c	Minimisation of the generation of leachate	Silage leachate is produced from storage of silage. The leachate runs away from the silage stored within the clamps into drainage channels, then to an underground Silage Effluent Tank, from where it is pumped into the process water tanks and then used in the AD process. Manures are stored within a fully enclosed Manure Reception Building and are typically high dry matter. Any leachate from solid manures within the Manure Reception Building (maximum storage time 21 days) is captured within the sealed drainage system and used in the AD process as a feedstock.

BAT 36-37 Not Applicable (Aerobic treatment of waste)

BAT conclusions for the anaerobic treatment of waste

Process Monitoring

BAT 38	**In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.**	
	Implementation of a manual and/or automatic monitoring system to: • ensure stable digester operation, • minimise operational difficulties, such as foaming, which may lead to odour emissions, • provide sufficient early warning of system failures which may lead to a loss of containment and explosions. This includes monitoring and/or control of key waste and process parameters, e.g.: • pH and alkalinity of the digester feed; • digester operating temperature; • hydraulic and organic loading rates of the digester feed; • concentration of volatile fatty acids (VFA) and ammonia within the digester and digestate; • biogas quantity, composition (e.g., H_2S) and pressure; • liquid and foam levels in the digester.	The following process monitoring takes place: ***Continuous monitoring (recorded on SCADA):*** 1. Gas production 2. Gas pressure 3. Gas quality 4. Temperature ***Daily Process Monitoring:*** 5. Visual check on appearance and level of digesters (crust, foam, mixing speed) 6. Odour sniff test ***On-site testing:*** 7. FOS/TAC, pH and dry matter of substrate in the digesters on a daily basis 8. Feedstock dry matter content. ***Samples for laboratory testing:*** A sample will be taken routinely from each of the digesters in accordance with the Sampling and Analysis Procedure **(ABL-ENV-SAMPLING & ANALYSIS-PRO-P1)** and sent off to an Accredited laboratory for analysis including: 9. pH 10. FOS/TAC 11. Dry matter 12. Volatile fatty acids 13. Trace elements Feedstocks are sent for off-site testing including: 14. Biochemical methane potential (BMP) to inform the daily feed recipe. The frequency of testing is increased if required to enhance process monitoring around abnormal operation events or if monitoring results show any parameters changing. Process monitoring data will be used by the Site Manager to inform process decisions including the daily feed recipe, mixing regime and the addition of trace elements.

BAT 39-53 Not applicable (other waste treatment activities)

3. Conclusions and Recommendations

The BAT review has highlighted that the proposed site design and operations for Horse Close AD Plant are largely compliant with indicative BAT as stated in Best Available Techniques Reference Document for Waste Treatment.[1] The deviations from BAT identified through the assessment are detailed below.

BAT 14 stipulates measures to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour. BAT is to use an appropriate combination of the techniques including:

BAT 14a Minimising the number of potential diffuse emission sources: Straw will be stored in a dedicated Straw treatment building except for:

- *approximately 4,000 tonnes of straw will be stored within the silage clamps (when they are near or completely empty), following the cereal harvest for up to 10 weeks prior to the maize harvest when the silage clamps will be refilled; and*
- *moist extruded straw material will be set down within the external bunker prior to feeding into external feed hoppers.*

The risk of bioaerosol emissions arising from the external storage of straw has been assessed through a Site Specific Bioaerosol Risk Assessment (SSBRA) which is included as a supporting document to this permit application.[11] The SSBRA concludes:

> '*The results of the assessment indicate that the residual risk from all sources associated with the plant is low or very low. As such, it is concluded that no further control measures, other than those detailed in the assessment, are required in order to reduce the potential for impacts at sensitive locations in the vicinity of the site.'*

BAT 14d Containment, collection, and treatment of diffuse emissions:

- *The digestate separators and the separated fibre digestate are within a covered bunker. The bunker has a roof which forms a sealed join with the bunker base and a roller shutter door opening. The digestate fibre will be removed periodically by HGV and trailers during the day from site to destination field heaps. The front roller shutter door is only open for 20 minutes whilst loading and closed thereafter. This is carried out in accordance with the Digestate Handling Procedure (**HRCL-QUAL-Digestate Handling (Solid and liquid)-WI25-P1**).*

Air dispersion modelling has shown that:

- *In terms of air quality, the long-term and short-term impacts at all receptors can be screened out as not significant.*
- *The maximum odour impact at a receptor location is below the relevant benchmark of 3.0ouE/m^3 for "moderately offensive" odours. Therefore, the site operation is unlikely to cause an odour impact at human receptors.*[5]

[11] Bioaerosol Risk Assessment Horse Close Anaerobic Digestion Plant, 8876 r1, Redmore Environmental, February 2025

BAT 23 requires an energy efficiency plan which will be produced by ABL and an energy balance record which is also being produced by ABL, a DRAFT version of this document has been included with the application.

Appendix A – Process Flow Diagram

AS NOTED ON A1 FRAME

MAIN WATER SUPPLY

MAINS WATER BREAK TANK

17.1 WATER DISTRIBUTION SYSTEM - POWER RING I

17.2 WATER DISTRIBUTION SYSTEM - POWER RING II

17.3 WATER DISTRIBUTION SYSTEM - POWER DIGEST

FIRE WATER TANK

30.1 GAS FLARE

19.1 DESULPHURISATION OXYGEN GENERATOR

1.1 SOLID FEEDING SYSTEM 1 - 120m³

STRAW PRE-TREATMENT HALL

USED WATER

STERILISER

FILTER

1.4 LIQUID FEEDING SYSTEM 4-65m³

MANURE BUILDING

1.3 LIQUID FEEDING SYSTEM 3-65m³

1.2 SOLID FEEDING SYSTEM 2-120m³

4.1 5.1 POWER RING 1 45/26/9

(10mB To 12 mB)

4.2 5.2 POWER RING 2 45/26/9

(10mB To 12 mB)

3.1 PUMPING STATION 1

3.2 PUMPING STATION 2

DIGESTATE BUFFER TANK (BIOGEST SUPPLY)

WATER TANK 1 (BIOGEST SUPPLY)

WATER TANK 2 (BIOGEST SUPPLY)

LIQUID FEEDSTOCK TANK (BIOGEST SUPPLY)

24.3 SILAGE WATER SHAFT

21.1 GAS VALVE CHAMBER 1

21.2 CONDENSATE CHAMBER 1

CONDENSATE (BY CLIENT)

DOUBLE MEMBRANE GASHOLDER

12.1 POWER DIGEST 34/9

MDP 7mB

7.1 SEPARATOR

7.2 SEPARATOR

14.1 HYGIENIZED DIGESTATE TANK

32.1 HEAT DISTRIBUTION (AD HEATING)

37.1 HYGENISATION

32.2 HEAT DISTRIBUTION (HYGIENSATION)

10.1 CLEAN WATER LAGOON

DIRTY WATER LAGOON

10.2 LIQUID DIGESTATE LAGOON

24.1 SUMP PIT 1

24.2 SUMP PIT 2

BRIGHT UPGRADER

HEAT REMOVAL

(PR000136-104-PID05-80)

BIOGAS COOLING

(PR000136-104-PID04-60)

BIOGAS FILTRATION

(B0000-PID06-50-A)

DELIVERY

(PR000136-104-PID10-61)

BIOGAS UPGRADING

(PR000136-104-PID10-60)

COMPRESSING SYSTEM

(PR000136-104-PID08-65)

UTILITIES

(B0000-PID11-11)

UTILITIES

(PR000136-104-PID11-10)

CONTAINER ATEX

ATEX CONTROL ROOM (SAFE AREA)

SAFETY BLOW OFF

CO2 TO AIR

BRIGHT CO2 LIQUEFACTION

CO2 AIR COOLING

(C0000-PID09-30)

CO2 REFRIGERATION

(C0000-PID10-30)

CO2 COMPRESSING

(PR000136-104-PID05-30)

CO2 DRYING

(C0000-PID08-30)

CO2 STRIPPING

(PR000136-104-PID07-30)

CO2 FILTRATION

(C0000-PID04-35)

LIQUID CO2 STORAGE

(PR000136-104-PID08-23)

LIQUID CO2 TO TRUCK

GAS RETURN FROM TRUCK

UTILITIES

(PR000136-104-PID11-30)

WATER SUPPLY

VERIFICATION GAS

TRUCK SAMPLING

BIOGAS PRE-TREATMENT

GAS DEHUMIDIFIER & BOOSTER

CARBON FILTRATION

CONDENSATE POT

HEAT & POWER SERVICES

3000L BUFFER VESSEL (HPS)

(ACO-GEN-PID-001)

IMW CNG COMPRESSOR No.1

PROPITATORY PANEL

IMW CNG COMPRESSOR No.2

CNG GAS STORAGE

300Bar WORKING PRESSURE TOTAL STORED GAS @ 15°C 652m3

CNG GAS CHILLER

CNG TRAILER DISPENSER No.1 (SAFE)

CNG TRAILER DISPENSER No.2 (SAFE)

CNG VEHICLE FUELING DISPENSER (SAFE)

32.1 CHP No.1 (TEDOM)

32.2 CHP No.2 (TEDOM)

32.3 BIOGAS BOILER (560kW)

DN150 (SHL St.St.)

NOTES:-

KEY

- BIOGAS
- BIOMETHANE
- BIOMETHANE REJECT
- NATURAL GAS
- CARBON DIOXIDE
- CONDENSATE
- OXYGEN
- HOT WATER
- COLD WATER
- DIGESTATE
- LIQUID WASTE/SUBSTRATE
- FRESH WATER
- WASTE WATER
- SIGNAL CABLE

PIPE IDENTIFICATION

1	PIPE SIZE
2	MATERIAL
3	DESIGNATION
4	FLOW RATE

Rev	Date	Description
B	12/12/24	UPDATED
A	17/06/24	FIRST ISSUE

PRELIMINARY

acorn BIOENERGY

Job Title

AD Plant.
HORSE CLOSE

Drawing Title

PROCESS FLOW DIAGRAM
HORSE CLOSE

Status: PRELIMINARY

Scale: N.T.S.

Date: Jun '24

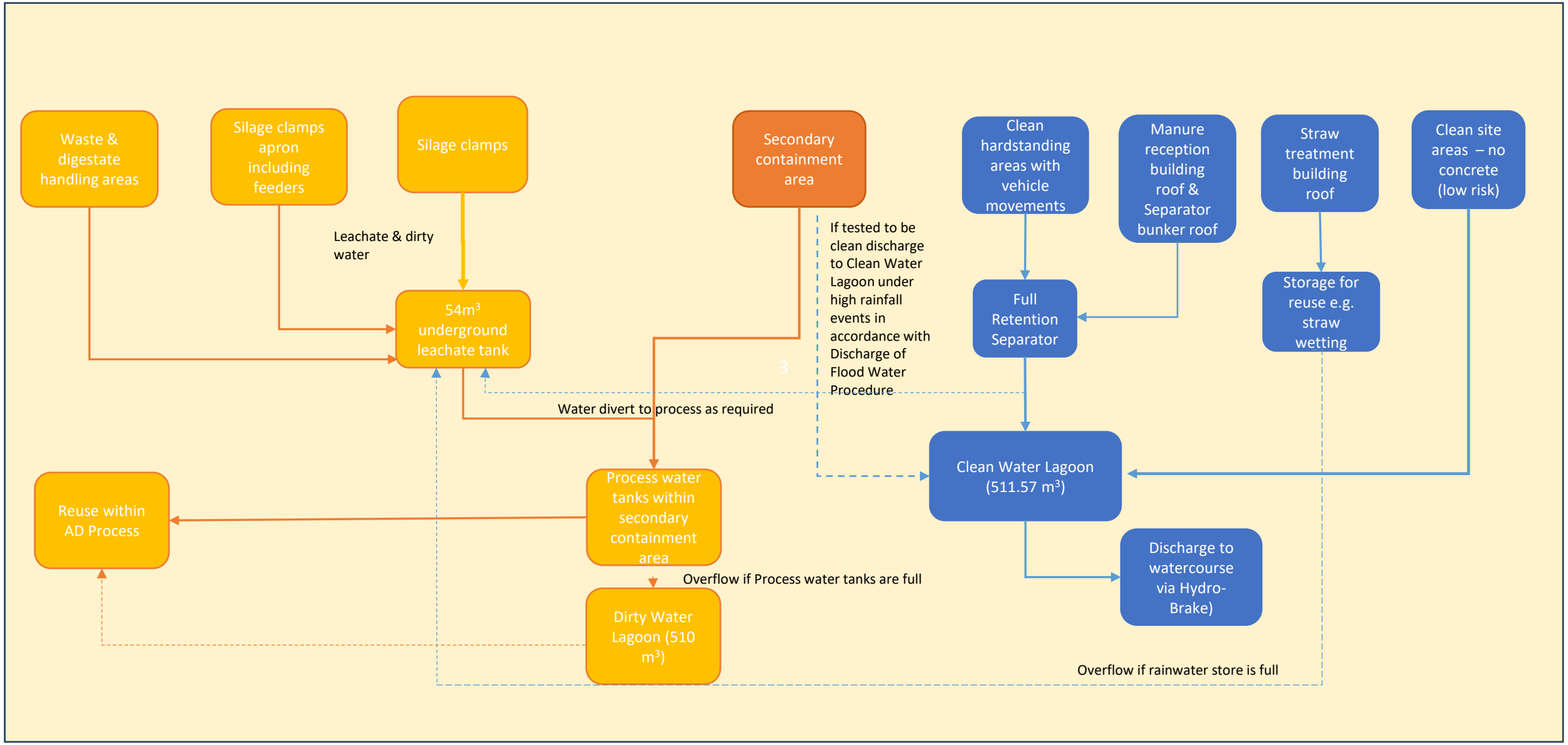
Drawn By: NDJ

Checked: – –

Drg. No.: HRCL-ABE-PFD-001 B

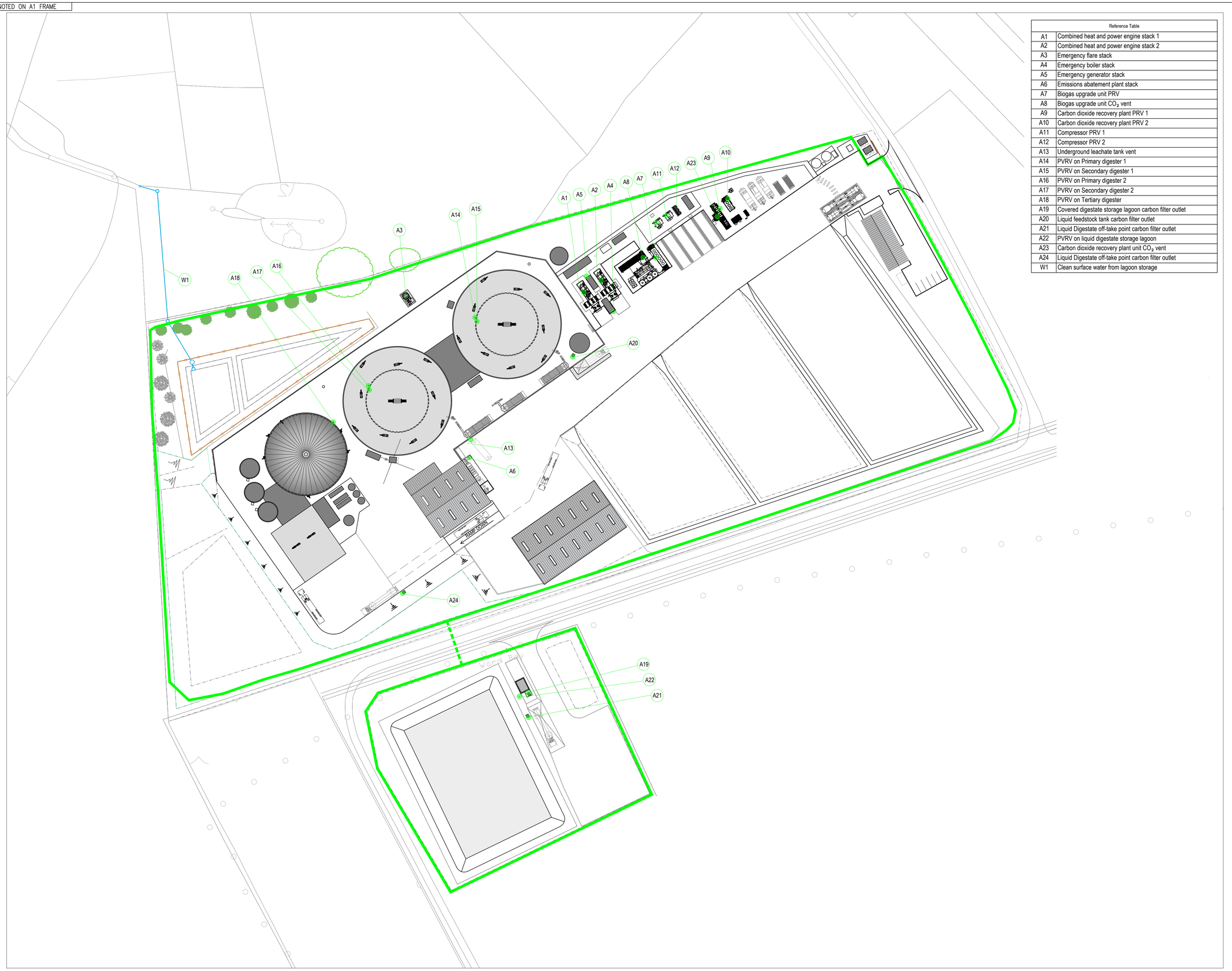
Appendix B – Drainage Process Flow Diagram

HRCL-ETL-Drainage Process-PFD-P1 Horse Close AD, Drainage Process Flow Diagram V1.0, February 2025



Appendix C - Emission Point Plan

AS NOTED ON A1 FRAME



Reference Table	
A1	Combined heat and power engine stack 1
A2	Combined heat and power engine stack 2
A3	Emergency flare stack
A4	Emergency boiler stack
A5	Emergency generator stack
A6	Emissions abatement plant stack
A7	Biogas upgrade unit PRV
A8	Biogas upgrade unit CO_2 vent
A9	Carbon dioxide recovery plant PRV 1
A10	Carbon dioxide recovery plant PRV 2
A11	Compressor PRV 1
A12	Compressor PRV 2
A13	Underground leachate tank vent
A14	PVRV on Primary digester 1
A15	PVRV on Secondary digester 1
A16	PVRV on Primary digester 2
A17	PVRV on Secondary digester 2
A18	PVRV on Tertiary digester
A19	Covered digestate storage lagoon carbon filter outlet
A20	Liquid feedstock tank carbon filter outlet
A21	Liquid Digestate off-take point carbon filter outlet
A22	PVRV on liquid digestate storage lagoon
A23	Carbon dioxide recovery plant unit CO_2 vent
A24	Liquid Digestate off-take point carbon filter outlet
W1	Clean surface water from lagoon storage

SITE PLAN
Scale: 1:750 @ A1

NOT FOR CONSTRUCTION

NOTES:-

Permitted Area Boundary (5.89ha)

Emission Release Location

Underground pipe conduit with leak detection

Rev	Date	Description	DR	CH
C	15/05/25	Issued For Approval	SJC	-
B	27/01/25	Issued For Approval	SJC	-
A	21/11/24	Issued For Approval	SJC	-

acorn BIOENERGY

Job Title
AD Plant.
Horse Close

Drawing Title
Site Emissions Plan.

Status
Approval

Scale
As Shown

Date
Nov '24

Drawn By
SJC

Checked
–

Approved
–

Drg. No.
HRCL-LAY-ABE-010

Rev
C